PREFACE

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THE BOAT (NAM LE) AND THE BEAUTIES OF POSTMODERN LITERATURE

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Abstract: *Nam Le is a Vietnamese-Australian writer. With the debut collection of short stories, The boat, the young writer has received a number of prestigious awards. Beyond the limitation of national literature, Nam Le has shown many qualities of an international writer. The characteristics of the postmodern style in his story collection are the factors contributing to such qualities as well as factors that create real excitement for reading.*

Keywords: *Nam Le, the boat, post-modern literature.*

1. Introduction

Nam Le is a Vietnamese-Australian writer. With a collection of stories called *The boat*, young writer has received many prestigious awards. However, up to now, Vietnamese readers do not seem to show a great interest in the author. Through the interpretation of some aspects of Nam Le's poetic short stories, especially two works related to Vietnam, we expect to receive the consensus from the readers about the beauty of postmodern style of this writer.

2. Contents

2.1. Introduction of the writer

Nam Le's real name is Le Huu Phuc Nam. He was born in 1978 in Rach Gia, Kien Giang province. At 3 months old, Nam Le and his family moved to Malaysia, and then settled in Australia. After graduating from the University of Melbourne with two Bachelor degrees in Literature and Laws, Nam Le became a young lawyer and quietly pursued a career in literature. In 2004, he received a master's degree in the field of literary art after attending a writing camp in Iowa (US). Nam Le also worked as an editor in the editorial office at *Harvard Review* - one of the most prestigious journal of literature and art in the US. In 2008, Nam Le returned to Australia and published a collection of short stories entitled *The boat*. The book quickly received many awards such as: *Dylan Thomas Prize* (2008), *U. S. National Book Foundation "5 under 35 Fiction Selection* (2008), *Sydney Morning Herald Best Young*

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Novelist Award (2009), *Australian Prime Minister's Literary Award* (2009), *PEN/Malamud Award for Excellence in the Short Story* (2010), etc. Currently, Nam Le is one of the most popular young writers in the US.

2.2. The beauties of postmodern literature in "The boat"

The collection of stories *The boat* by Nam Le published in Vietnam in 2011 by The Publishing House of Writers Association, was translated by Thien Nga and Thuan Thuc. It can be seen that the first factor contributing to the huge success of Nam Le's *The boat* is deep reflections of the writer about the difference between national literature and international literature. This makes literature become the subject of literature at the opening story of the collection: *Love and honor and pity and pride and compassion and sacrifice*. The questions often posed to the character named Nam, who has many autobiography characteristics of the writer, are: Why have I become a writer? What and how to write to become an international writer? The reason to become a writer was briefly explained: "*The Importance is in what you are able to write not in what no one can write*" [4, p.40], but the question of what to write is not easy to answer: "*deadline comes, I am really tired and I am trying to write. And then, in the long period between the deadlines, I return and face with an empty screen and my mind gradually becomes vague*. (…). *What a difficulty! This world always has something going on*" [4, p.18]. Thus, to Nam, the biggest challenge is not the problem of how to write, but the themes / topics / contents to be reflected. Although there have been a lot of suggestions like: "*Write a story about Vietnam*", or "*Ethnic literature's hot. And important too*", Nam even heard there was a Chinese woman who immigrated to America writing a collection of short stories about the process of Chinese immigrating to America and "*It was rumored that she was offered a six-digit contract to write two books*"..., but Nam was still in an intellectual impasse. As a writer who has a deep sense of his pen's mission, Nam felt insulted to write about something trivial or easy, which is a terrible insult. Nam also envisions a sense of sheer boredom that the writer brings to readers if he or she just writes about things that are familiar. Like many young people in Iowa, when he started writing, Nam recognized a number of limitations of ethnic literature. In the ebullient debates among them, the limitations have been indicated as: They keep describing foreign food; characters are always boring, general; poor language; stereotyped images ("*I imagine myself wearing a conical hats, standing in the rice paddy field, which is the way tobore my readers*"); using the trite and hollow stype, lacking the necessary actions to remove redundant words ("*Sometimes I still think about the number of words a way to think about the number of casualties*")... However, his final choice for the end work of the writing course is the story of the Vietnamese boat people - ethnic thing.

Like the character that carries his autobiography characteristics, in *The boat*, Nam Le wrote two stories for the ethnic theme. The Australian young writer aspired to be an international writer but not intend to deny his root. In other words, the qualities of an international writer which Nam Le desired did not conflict with his interest in the ethnic

subject or writing about ethnic. Even the writer who is living far from the homeland has been deeply concerned about the relationship between himself and the nation as a writer: "*I don't completely understand my relationship to Vietnam as a writer. This book is a testament to the fact that I'm becoming more and more okay with that*" [1]. "*Becoming more and more okay*" because through this collection, readers can see clearly how deep affection is the writer's for his country. Nam Le has placed two stories involving the ethnic theme on the most important positions in his collection: at the beginning and at the end. Both are related to the war in Vietnam before 1975: a story about the Vietnamese boat people left the country silently after the war (*The boat*) and a story about why he wrote about the boat people (*Love and honor and pity and pride and compassion and sacrifice*). Both of them are rich autobiography. Through those stories, readers visualize not only how the writer felt when he left, but also how he managed to live in a foreign country. What surprises the readers is that why a child leaving the country at 3 months old could write such as deep story about Vietnam. Furthermore, Nam Le has put in his works a huge amount of mother-tongue, including idioms, proverbs, dialects, pronouns, etc. that the translators have tried hard, yet failed to express them all. However, the most striking thing is that Nam Le wrote about his country in the international spirit. Both stories are not a trace of any political color. All reality materials illustrate the purpose of literature. Thus, war stories which lead to a series of bad consequences such as slaughter, betrayal, punishment, escaping, exile, etc. totally do not arouse the feelings of hatred, division and ending relationship. These horror obsessions of the devastating war just make people want to forget (*Love and honor and pity and pride and compassion and sacrifice*). The horror about a fragile life on the run just makes the people long to live (*The boat*). This means, as the writer said, it makes people vision something "*greater than resentment, more dangerous than memories*". Therefore, the writer's determination to choose a theme that has long been viewed as sensitive (the theme about the fate of the Vietnamese boat people) does not aim to raise people's awareness of things that would have been buried in the ashes of the past, but to remind people of a bloody lesson of war. This is never meaningless when the world we live in is still full of horrific murder weapons. This message makes the ethnic story not restricted in its framework. That is problem of humanity, story of eternality.

In search of the essence of existence, Nam Le aspires to go beyond all the space limits in his compositions. Except for two autobiographical stories which begin and end this collection related to ethnic theme, five remaining stories tell about five different places, at different unique times. It is a remote area of Australia - where a secondary school boy has to face the fear of challenge of rival that comes along with the approaching death of his mother (*Halflead bay*). It is a slum neighborhood in Colombia where a 14-year-old assassin boy lives among pure love and violence presenting everywhere. He was facing approaching death after having refused to perform the action to kill his childhood friend (*Cartangena*). It is a sweltering night in Tehran where an American lawyer was in psychological crisis, bewilderment by the drastic offs selection of her best girlfriend (*Tehran calling*). It was a clear morning, while Mayako was seeing a flash that was reminiscent to a camera lights in her old

memory, when the atomic bomb falls, claiming the lives of herself and many other innocent people (*Hiroshima*). That was a horror mood of old painter in New York before his death of hemorrhoids and the estrangement of his only daughter who had been separated for seventeen years (*Meeting Elise*). It is true that, with *The boat*, Nam Le is sobbing with the beauty and pain of many lands.

However, the international nature, humanity nature in this story collection does not only stop at the form aspect as themes or characters, spatial context or historical events influence to humanity, etc. but also in a very universal problem: problem of human destiny before the trials of existence. In life, people may have to face the completely individual situation, but behind the unique behavior of an independent individual, a writer always determines a living instinct. By a profound sympathy, thorough understanding and rare sophistication, Nam Le wrote the things that only he is capable of. Nam Le's works bring a very interesting sense that arouses readers to explore together and wish express deep feelings, the most discreet thoughts of the inner. In other words, the pen of Nam Le is making all boundaries of space and time become blurred and even disappear, leaving just the person with person. The young writer has suceeded in doing so by selecting the language for his characters which is capable of expressing almost absolute precision. May be, that is how "*To make the strange seem familiar and the familiar seem strange*" [6].

But postmodern style makes the readers, if you want to understand it, have a quite good literary understanding. Because the writers sometimes do not want to combine the expression and what is expressed. Postmodern thinking does not admit a type of power and universal discourse, so "no supernarrative spirit makes all peace". Allegory should appear so that inside the seemingly stable form hides the fluctuations constant, to "*forecast the depth can not capture the chaos and deep behind the structure of language*" [2]. The discourse of Nam Le usually piles with allegory. Each word, each sentence, each image contains connotations. They force the readers to constantly imagine, speculate, annotate, contact, patchwork, chaini, etc. so that the can open a door into the world of art that the writer creates. That is, turning to the position of the receiver, each reader instead of looking for the core meaning behind the text, has the right to obviously supply the works with their own significant/merits, and to expand and complement them.

In *Love and honor and pity and pride and compassion and sacrifice*, allegories such as the river, the bullet, the man and the burning gasoline container, Linda, the number 14, the exotic small head between pillows or above the aneurysm fur coat, etc. can help readers reach closer to the thoughts of the writer about the past stories related to the ethnic theme. Although no one can be certain of a unique significance of this discourse, they still have to accept that the use of allegory to convey the generation stories between exile Vietnamese, in this context, is entirely relevant. Because allegory has the characteristics of the era and current events. They establish continually new meanings which overlap the existing ones. This is also because allegory is based on a time misconception, "*added meaning is formed in a continuous way, it must structure and make the stable meaning, explicit or metaphors become minor*" [2].

This is a small example: "*In me nothing but hatred" he said, "but I was so bored with everyone now". He stopped after the word "hate" as a father for the first time says the word before his innocent child, testing knowledge of the child, checking what is the connotation of the word and something is experienced later"* [4, p.43]. With this style characteristics, although the amount of work is not large, the author is able to send various messages. This is what has been asserted by *The Times*: "*Stories always require read slowly and read more than once*" [4]. Therefore, it creates new spiritual excitements in receiving literature. It is here, we understand what the notion *Reading synonymous with creativity* means.

3. Conclusion

Although the writer has not written much, the special contours of a literature talent in Nam Le have been disclosed with *The boat*. Transcend the limits of national literature, Nam Le has shown many qualities of an international writer. The characteristic of the postmodern style in this collection of stories is one of the factors contributing to such qualities, as well as factors that create real excitement for reading activities.

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USING CHITOSAN AS COAGULANT IN DOMESTIC WASTEWATER TREATMENT PROCESS

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Received: 6 March 2017 / Accepted: 10 October 2017 / Published: November 2017

Abstract: *Alternative coagulants have been considered for wastewater treatment in which chitosan may be of great interest characterized by its treatment efficiency and environmentally friendly behavior. Chitosan was very effective in removing turbidity from raw domestic wastewater at natural pH. The removal efficiency reached 81.42%, and turbidity level was 0.013 (Abs) if 4 mg Chitosan/L used in coagulation. Along with turbidity removal, total organic carbon was also removed with the removal efficiency of 37.11%. However, the capacity of chitosan coagulant in total phosphorus and total nitrogen removal was low, with the removal efficiencies were 19.61% and 10.75% respectively.*

Keywords: *Domestic wastewater treatment, chitosan, coagulant.*

1. Introduction

Domestic (also called sanitary) wastewater is wastewater discharged from residences and from commercial, institutional, and similar facilities. It is handed by wastewater treatment plans and discharged into received water bodies (rivers, sea…). General terms used to describe different degrees of treatment are preliminary, primary, secondary, and tertiary and/or advanced wastewater treatment (FAO). Conventional wastewater treatment process includes physical, chemical, and biological processes, and is aimed to remove solids, organic matter and, nutrients from wastewater.

Primary treatment is intended to remove floating and settable materials from wastewater, usually by sedimentation [11]. Primary effluent then will be further treated by to achieve required criteria for specific wastewater reuse applications or discharge to receive water bodies.

Coagulation method is widely used in water and wastewater treatments, and well known for its capability of destabilizing and aggregating colloids [2]. The coagulants commonly used are metal salts such as polyaluminum chloride (PAC) which may have several environmental consequences: an increase in metal concentration in water and production of large volume of (toxic) sludge. Alternative coagulants have been considered for

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environmental applications in which chitosan may be of great interest characterized by its treatment efficiency and environmentally friendly behavior [8]. It is effective in the removal of suspended solids and the colloid materials while nutrients still remain in the coagulated supernatant [6], [10]. Chitosan possesses many outstanding characteristics as applied in the coagulation of wastewater treatment process. It was applied in treatment of milt factory wastewater, brewery factory wastewater, surimiwash water, and many other kinds of wastewater [13], [3], [4]. It is effective in the removal of suspended solids and the colloid materials while nutrients still remain in the coagulated supernatant [12]. Thus the remained nutrients can be utilized for the aim of water reuse such as irrigation for crops or microalgae cultivation. From this point of view, we study the capacity of chitosan coagulation in domestic wastewater treatment process.

2. Materials and methods

Raw wastewater samples were collected from the Koto Domestic Wastewater Treatment Plant (Okayama city, Japan). In every sampling, wastewater was taken at the influent to the primary sedimentation tank taken from 2014, July 4thuntil 2015, January 29th. The experiment was conducted at natural pH conditions of wastewater; pH is close to 7.

Chitosan stock solution (1 g/L) was prepared using commercial Chitosan (Chitosan500, 032-14412) from Wako (Japan). Chitosan powder (100 mg) was dissolved in 0.1N HCl solution and then diluted to the desired concentration using distilled water.

Coagulation was carried out in a four-spindle multiple stirrer unit (Water Cohesion Reaction Tester, Miyamoto Riken Ind. Co., Ltd., Japan). Wastewaters were divided into four beakers; each containing 500 mL. Each beaker was subjected to a rapid mixing step at 150 rpm for 5 minutes, a slow mixing step at 50 rpm for 15 minutes and then left to settle for 30 minutes. Different volumes of Chitosan were added to the beakers in the first step. All jar tests were conducted under temperature of 20^{o}C in an air-conditioned room. Samples were then collected in the upper part of the beakers to measure the various parameters of the treated effluents.

In order to determine the physical-chemical characteristics of the effluents and treated effluents, a large number of analyses based on Standard Methods for the Examination of Water and Wastewater (APHA, 2005) were conducted on each sample and the following parameters were measured: pH, Zeta Potential, Turbidity, Total Organic Carbon (TOC), Total Phosphorus (TP), Total Nitrogen (TN).

3. Results and discussion

Raw wastewater was taken from Koto Domestic Wastewater Treatment Plant, Okayama city, Japan. The characteristics of samples are shown in table 1.

Table 1. *Characteristics of raw wastewater*

Parameters	Average	Range
pH	6.93	6.46 - 7.2
Turbidity (Absorbance at 660nm)	0.10	0.031 - 0.18
Zeta potential	-17.95	-20.5 - -14.1
UV254	0.60	0.131- 1.087
Total Nitrogen (mgL^{-1})	26.10	11.83 - 37.60
Total Phosphorus (mgL^{-1})	5.22	1.19 - 11.19
Total Organic Carbon (mgL^{-1})	27.38	4.724 - 47.57

3.1. Effects of chitosan coagulation on pH, turbidity, zeta potential

Over the usual range of water pH (5-9), particles, which always carry a negative surface charge and because of this, are often colloidally stable and resistant to aggregation. Coagulants are then needed to destabilize the particles. Destabilization can be brought about by either increasing the ionic strength (giving some reduction inthe zeta potential and a decreased thickness of the diffuse part of the electrical double layer) or specifically absorbing counterions to neutralize the particle charge [8].

Chitosan is widely being used because of its particular macromolecular structures with a functional group, $-NH_2$ which can interact with contaminants [6]. Chitosan remove insoluble particles and dissolved pollutants by a charge neutralization associated to bridging effect mechanisms.

In this experiment, the capacity of chitosan in suspended solid or turbidity removal was studied under different chitosan dosage at natural pH of wastewater, neutral pH.

In the range of pH around 7, chitosan coagulation decreases turbidity of domestic wastewater from 0.11 to 0.02 absorbance at 4mg/L chitosan dose. Chitosan coagulation removed 74.03% of turbidity. The pH of wastewater unchanged in coagulation process.

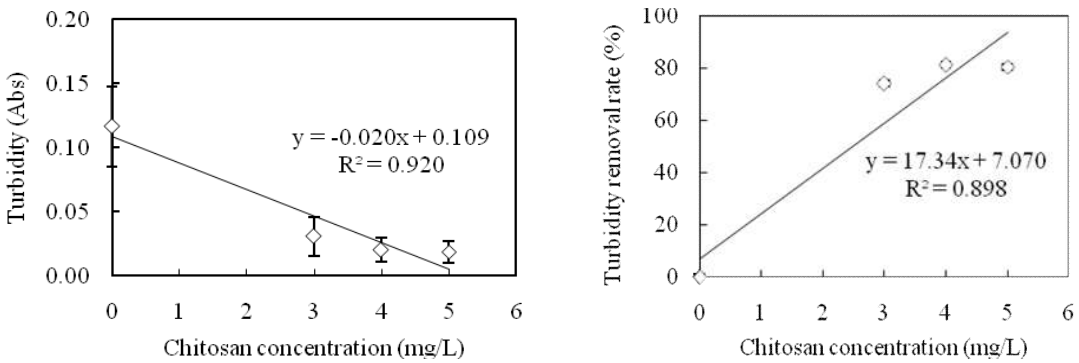

Figure 1. *Turbidity and turbidity removal ratio of coagulated wastewater at different chitosan doses at natural pH*

The capacity of chitosan coagulation in removal turbidity depend significantly on pH of wastewater and zeta potential of colloidal particles.

The pK_a of amine groups of chitosan is close to 6.5 for fully dissociated chitosan. This means that at pH of 5.0 or less, more than 90% of the amine groups are protonated [9]. This protonation gives chitosan ability to neutralize metal anionic, organic compounds. This number of protonated amine groups decrease with the increase of solution's pH.

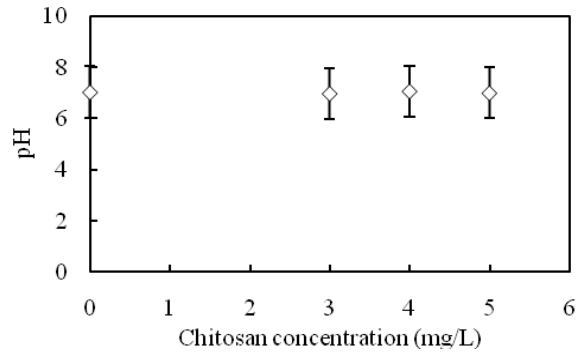

Figure 2. *pH of supernatants which coagulated at different chitosan doses*

In this study, the pH of wastewater was unaffected at different chitosan dosages. So the pH of solution did not effect on chitosan protonation, and not affect to turbidity removal of chitosan coagulation.

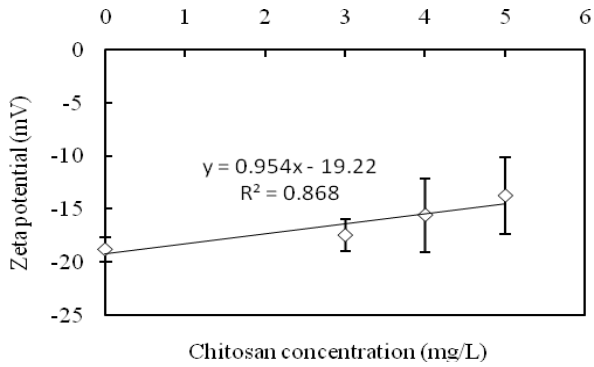

Figure 3. *Zeta potential of supernatants which coagulated at natural pH at different chitosan doses*

The zeta potential is a key indicator of the stability of colloidal dispersions. The magnitude of the zeta potential indicates the degree of electrostatic repulsion between adjacent, similarly charged particles in dispersion. Colloids with high zeta potential (negative or positive) are electrically stabilized while colloids with low zeta potentials tend to coagulate or flocculate.

In the neutral pH condition, the negative zeta potential of particles of wastewater decreases with the increasing of added positive-charged chitosan dosage. However, when the

chitosan coagulation reaches the highest efficiency, 4-5 mg chitosan/L dose, and the turbidity after Jar-test is lowest, the zeta potential of wastewater still does not reach the neutral point. In other words, the surface of particle still has negative charge. Chitosan as cationic polymer can destabilize the colloidal particles.

Moreover, the results shown in figure 4 point out that when chitosan dose excess optimum dose, the turbidity increases as chitosan dose increases. These results were similar to Chau's study.

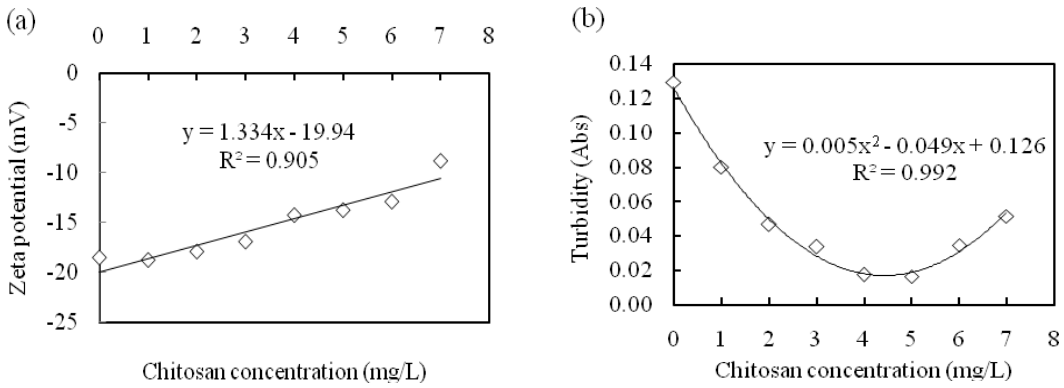

Figure 4. *The turbidity (a) and Zeta potential (b) of coagulated wastewaters at different chitosan doses at natural pH*

Those results confirm the double effect of chitosan in the process. At the neutral pH, both the coagulation (charge neutralization) and flocculation (colloid entrapment) mechanisms were involved in the removal of colloidal particles [9]. However, the major mechanism for chitosan to destabilize the colloid particles is the bridging flocculation [5].

3.2. Effect of chitosan coagulation on nutrient components

The removal of nutrients in wastewater of coagulation/flocculation may be related to removal colloidal particles process. The results of chitosan coagulation in total phosphorus removal at different chitosan doses are shown in Figure 5.

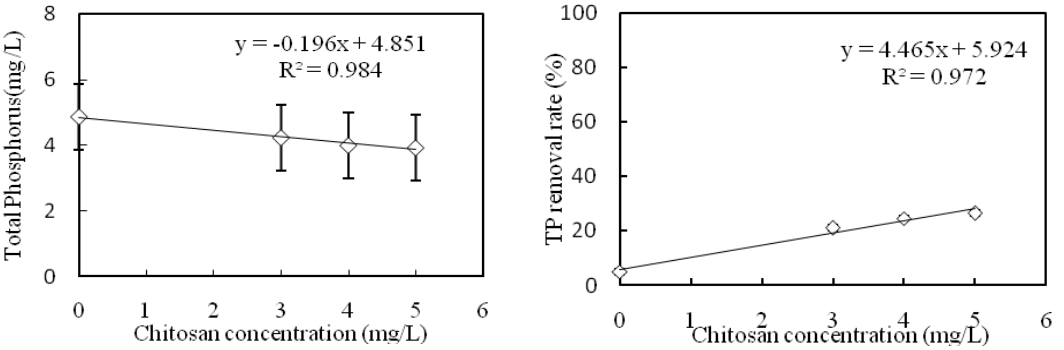

Figure 5. *Total phosphorus (a) and total phosphorous removal rate (b) of coagulated wastewater at different chitosan doses*

Phosphorus is a component which should be limited of wastewater effluent since it can cause eutrophication of surface water. In the coagulation-flocculation process, phosphorus is removed by being incorporated to solids in suspension and the reduction of these solids during the process including the removal of the phosphorus; or through the formation of phosphate precipitates with the metal salts used as coagulants [1]. In the case of chitosan coagulation, removal of phosphorus compound may be linked to the colloidal particles. Chitosan coagulation can remove 19.61% of total phosphorus and 10.75% of total nitrogen at 4mg/L of chitosan dose. Those values are rather low compare to metal-coagulants [12].

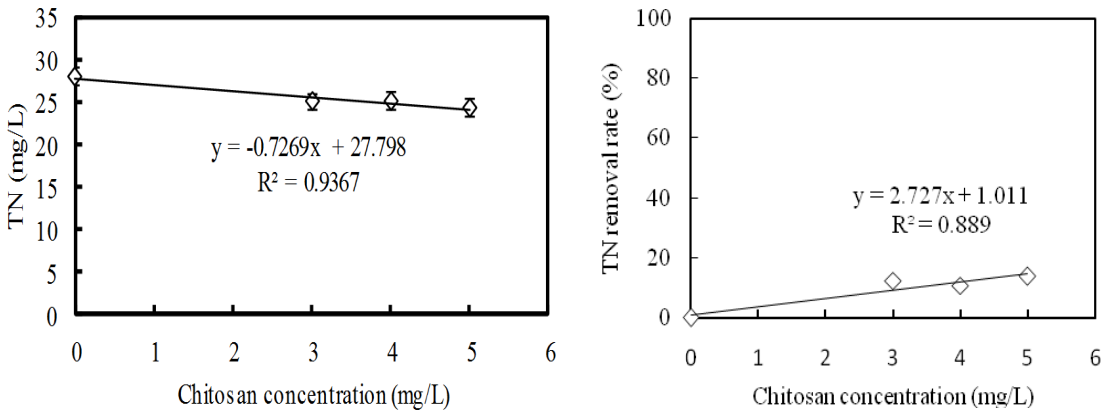

Figure 6. *Total nitrogen (a) and total nitrogen removal rate (b) of coagulated wastewater at different chitosan doses*

The compounds made of colloidal particles, which may contain nitrogen, are increasingly taken into account in water treatment processes due to the effects they may have on the environment. The nitrogen compounds in varied forms could reduce the levels of dissolved oxygen in the receiving water stimulate algae growth, assumed toxicity for some forms of water life.

The nitrogen compound in wastewater includes organic nitrogen, nitrate, nitrite and ammonium. The organic nitrogen represents nitrogen contained in natural compounds like proteins, peptides, nucleic acids, urea and a large number of synthetic organic compounds.

Nitrogen removal through the coagulation-flocculation process is related to the removal of colloidal matter [1].

3.3. Effect of chitosan coagulation on total organic carbon

The capacity of chitosan coagulation in total organic carbon removal is presented in figure 6. In this study, chitosan removed 37.13% of TOC and 38.50% of TOC at 4mg/L and 5mg/L chitosan, respectively. These results may be due to the condition of coagulation process, at pH = 7, instead of pH = 6.

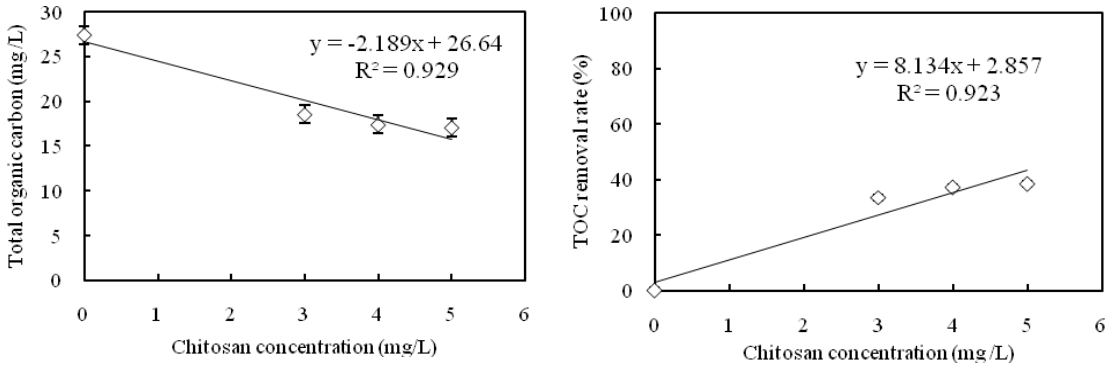

Figure 7. *Total organic carbon (a) and total organic carbon removal rate (b) in supernatant after coagulation by different chitosan doses*

The properties of wastewater after coagulation are shown in table 2.

Table 2. *Characteristics of coagulated wastewater*

Parameters	Average	Range	Removal rate (%)
pH	6.91	6.64 - 7.18	-
Turbidity (Absorbance at 660nm)	0.013	0.009 ≈ 0.045	81.42
Zeta potential	-15.55	-19.4 ≈ -1.61	-
UV254	0.31	0.083 ≈ 0.717	45.66
Total Nitrogen (mgL^{-1})	23.30	11.18 ≈ 36.03	10.75
Total Phosphorus (mgL^{-1})	3.76	0.56 ≈ 5.94	19.61
Total Organic Carbon (mgL^{-1})	19.12	1.83 ≈ 30.7	37.11

4. Conclusion

Chitosan is very effective in removing of turbidity when being used as coagulant in domestic wastewater treatment at natural pH. The removal efficiency reaches 81.42%, and turbidity level is 0.013 (Abs) if 4 mg Chitosan L^{-1} is used in coagulation. Total organic carbon was also removed with the removal efficiency was 37.11%. However, the capacity of chitosan coagulant in total phosphorus and total nitrogen removal is low, with the removal efficiencies of 19.61% and 10.75 % respectively.

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EVALUATION OF HEAVYMETAL POLLUTION AND PETROLEUM OF SEAWATER OF YANGSHAN PORT

Pham Thi Thanh Binh, Nguyen Thi Dung, Le Thi Lam

Received: 17 May 2016 / Accepted: 10 October 2017 / Published: November 2017

Abstract: *Analysis of samples which were taken at Yangshan port in China in 2011, 2012 to assess the level of heavy metal pollution of heavy metals and petroleum hydrocarbon with two main purposes; the first is to evaluate the main pollutants and their pollution level; the second is to evaluate the impact of operations on the port to environmental quality. The application of Grey clustering model to assess heavy metals and petroleum hydrocarbons shows that the heavy metals and petroleum hydrocarbons in sea water at Yangshan Port was at grade I.*

Keywords: *Heavy metal pollution, sea water pollution, petroleum pollution.*

1. Introduction

The development of a port is particularly important to each country's economic development. However, the activities of ships on the sea and other commercial ones on the seaport such as oil and fuel supply, ship repairing, shipbuilding are major causes of marine pollution. As a matter of fact, to achieve sustainable development, the environmental quality should be a primary concern. Therefore, it is necessary to have a database on the background status and trends in environmental quality as well as the main cause of pollution in order to maintain the port operation in the future. Among the numerous pollution factors, the heavy metals and petroleum hydrocarbons are two of the most dangerous agents. They directly affect human health and organisms. The accumulation of heavy metals can cause severe damage to human health such as cancer or cell destruction. Heavy metals go into food chain and accumulate in their bodies. Until the end of 2011, there has been no in-depth study on heavy metal pollution at Duong Son port. This will be the first on-going research to help environmental managers help the operation of Duong Son port to ensure sustainable development. From the reason, research on "Evaluation of heavy metals and petroleum hydrocarbon contamination in the sea water of Yangshan port in Shanghai, China" was conducted.

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2. Materials and method

2.1. Sampling

Concentration of 8 elements: Cu, Pb, Zn, Hg, As, Cr, Cd were checked in the samples. The samples in 17 stations were collected from 09/2011 to 12/2012 with three kinds of samples: a, b and c. For samples a and b, 6 samples were taken every month. For samples c, 05 samples were taken for twice a month. Samples were taken on the surface of water and put in plastic bottles.

2.2. The samples treatment and measurement method

2.2.1. Preservation method for the analysis of Hg, As, Cr

By using the fiber filter 0.45µ cellulose acetate membranes, the samples were filtered. They were preserved in the glasses bottle, then put H_2SO_4 into the bottles and shake the bottles.

2.2.2. Preservation method for the analysis of Cu, Pb, Cd, Zn

By using the filter paper 0.45µ cellulose acetate membranes, the samples were filtered. They were preserved in the plastic bottles, then HNO_3 into the bottles and to shake bottles.

2.2.3. Preservation method for the analysis of petroleum hydrocarbons

The samples were analyzed immediately after they were taken from the sea. Samples procedure and analytical method of samples used the Specification for Marine Monitoring of China (GB 17378.4-2007) [1]. The concentration of petroleum hydrocarbons was determined by the optical resolution fluorescence method by using the fluorescence spectrophotometer (F-4600).

2.2.4. Analytical method

Samples procedure and analytical method we used were based on the Specification for Marine Monitoring of China (GB 17378.4-2007).

The concentration of A**s** and Hg were determined by atomic fluorescence method by using the atomic fluorescence spectrometer (AFS-9130). Cu, Pb, Cd and Cr content were determined by atomic absorption spectrophotometer method without flame using the TAS-990 machine (Atomic Absorption Spectrophotometer). Zn content was determined by flame atomic absorption method with the GBC-932 machine.

2.3. Data analysis

Concentration of the samples were determined by

$$Pi = C_i/S_i$$

Where: Pi is concentration of each heavy metals and petroleum hydrocarbons, C_i is the actual concentration of heavy metals and petroleum hydrocarbons I (1=1; 2; 3;…;8), S_i is the value of standard concentration of each index i.

$$WQI= \Sigma P_i/Si$$

Where: WQI is the standard value; ΣP_i is total of P_i; Si is the value of standard concentration of each index i.

Gray clustering method was established in this experiment with 8 clustering objects, (Cu, Pb, Cd, Cr, Hg, As, Zn, petrolium) and 4 grey matter values.

3. Result and discussion

3.1. Concentration of heavy metals of seawater

The result from Figure 1 shows that the grade of heavy metals concentrations and petroleum hydrocarbons in Yangshan port were following this order Zn > petroleum hydrocarbons> Cu > Pb > As > Cr > Cd >Hg.

The concentration of heavy metals was changed with the same rules. From January to June, the concentration of heavy metals was high and the concentration of heavy metals began to decline from July to December. The concentration of Cu (45.69ug/L) and the concentration of Pb (34.9ug/L) was maximum value in March. The concentration of Cd and concentration of Zn (144), As (5.12), Hg (0.772) had highest value in January. There was the same situation with all of heavy metals and petroleum hydrocarbons that all of the concentration of heavy metal concentration and concentration of petroleum hydrocarbons in surface seawater were minimum value in December. The change of heavy mental concentration is explained by the cause of the change of sea level seasonly.

Table 1. *The average value of heavy metals and petroleum hydrocarbons concentration of Yangshan port*

(µg/L)	Cu	Pb	Cd	Zn	As	Hg	Cr	Petro
Highest	45.69	34.9	2.1	118.74	5.12	0.772	4.57	119.3
Lowest	1.91	0.49	0.1	42.81	0.49	0.136	0.69	12.78
Average	16.19	12.5	0.71	87.4	2.64	0.37	2.45	63.94

The annual average concentration of the substance is as follows: the concentration of Cu, Hg, Zn were higher than secondary standard but the value of difference was negligible. Concentrations of Cd, As, Cr were high. Concentration of Cd, As, and Cr were lower than the standard at grade I; concentration of petroleum hydrocarbons was higher than primary standards, but the value of difference was negligible with the difference in concentration compared to the standard level I was 13.94 µg / L. According to the actual results of the analysis, it is necessary to pay attention to the concentration of Pb (12.5µg/L). It was higher than grade III.

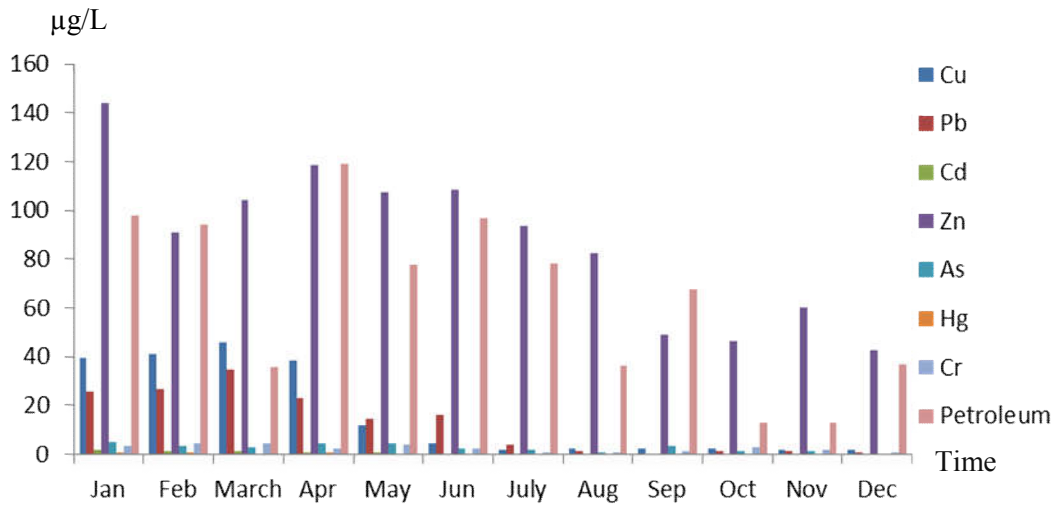

Figure 1. *The concentration of heavy metals and petroleum hydrocarbons in 2012*

Table 2 showed that the concentration of Cu, Pb, Zn, As, Cr in Yangshan was many times higher than other seas, especially the concentration of Cu and Zn.

Table 2. *Comparison of heavy metals of surface water in some sea areas*

Area	Cu	Pb	Cd	Zn	As	Hg	Cr
Yangshan port [this study]	16.19	12.5	0.71	87.4	2.64	0.37	2.45
Luoyan Bay [3]	0.27	0.83	0.31	15.3	2.5	/	/
Jinzhou Bay [4]	3.06	0.61	0.92	11.87	0.030	2.190	/
Tianjin Bohai Bay[5]	2.54	7.18	0.12	26.9	1.26	0.04	0.40
Lianyungang [6]	1.93	0.206	0.131	12.9	/	/	/
Liaodong Bay [7]	5.01	4.91	1.04	34.06	/	/	/

/: no data

All of concentration of heavy metals in Yangshan was higher than concentration of heavy metals in other areas. It's because of Yangshan is the very huge port. Yangshan is primarily industrial development and service area, like port services: import and export, export processing, bonded logistics, purchasing and distribution, and market transportation [8].

3.2. Evaluation of degree contamination of heavy metals and petroleum hydrocarbons of seawater

According to the Grey clustering method, the result from August to December 2011 (Table 3) showed that the water quality at Yangshan port was quite good. Result indicated that the water quality was good.

Table 3. *Clustering coefficient of heavy metal and petroleum hydrocarbons in 2011*

	Grade				
Month	**I**	**II**	**III**	**IV**	**Result**
September	0.52	0.22	0.00	0.49	I
October	0.54	0.00	0.00	0.58	IV
November	0.54	0.13	0.21	0.04	I
December	0.67		0.09	0.12	I

Table 4 also showed that the measured result in 2012 followed a gradual increase from January (0.62) and the highest value was in December (0.89). The data in 2011 year and 2012 year showed that water quality in Yangshan at all of 17 sampling stations belong to I grade. This result indicated that the surface water quality in Yangshan port was good in a whole, and the water was not polluted.

Table 4. *Clustering coefficient of heavy metal and petroleum hydrocarbons in 2012*

	Grade				
Month	**I**	**II**	**III**	**IV**	**Result**
January	0.62	0.10	0.23	0.20	I
February	0.65	0.08	0.23	0.18	I
March	0.68	0.01	0.24	0.22	I
April	0.65	0.08	0.23	0.17	I
May	0.67	0.10	0.12	0.13	I
June	0.77	0.15	0.14	0.03	I
July	0.79	0.20	0.08	0.00	I
August	0.83	0.15	0.07	0.00	I
September	0.86	0.18	0.00	0.00	I
October	0.84	0.18	0.03	0.00	I
November	0.83	0.07	0.16	0.00	I
December	0.89	0.14	0.00	0.00	I

These analyse showed that most of the values in the location a and b were higher than c positions. This may be due to different sampling locations. At a and b positions are close the anchorage area of the large ships to transport cargo handling to the place (Fig 1).

Table 5. *Clustering coefficient heavy metals and petroleum hydrocarbons according to the spatial distribution in 2011*

Grade					
Position of samples	**I**	**II**	**III**	**IV**	**Result**
S1a	0.54	0.05	0.27	0.31	I
S2a	0.54	0.15	0.20	0.30	I
S3a	0.54	0.19	0.15	0.32	I
S4a	0.54	0.02	0.03	0.41	I
S5a	0.54	0.03	0.16	0.38	I
S1c	0.69	0.16	0.09	0.01	I
S2c	0.69	0.11	0.13	0.01	I
S3c	0.65	0.07	0.05	0.13	I
S4c	0.69	0.02	0.19	0.03	I
S5c	0.69	0.00	0.05	0.13	I
S1b	0.56	0.22	0.11	0.24	I
S2b	0.54	0.18	0.16	0.29	I
S3b	0.54	0.04	0.15	0.41	I
S4b	0.54	0.22	0.15	0.31	I
S5b	0.54	0.02	0.16	0.42	I
b	0.54	0.17	0.20	0.38	I
a	0.54	0.10	0.25	0.38	I

Table 6. *Clustering coefficient of heavy metals and petroleum hydrocarbons according to the spatial distribution in 2012*

Grade					
Position of samples	**I**	**II**	**III**	**IV**	**Result**
S1a	0.67	0.28	0.11	0.00	I
S2a	0.67	0.17	0.22	0.00	I
S3a	0.71	0.19	0.13	0.01	I
S4a	0.67	0.24	0.12	0.00	I
S5a	0.67	0.24	0.13	0.01	I
S1c	0.68	0.23	0.12	0.02	I
S2c	0.72	0.26	0.09	0.00	I
S3c	0.67	0.2	0.15	0.07	I

S4c	0.67	0.22	0.14	0.05	I
S5c	0.68	0.2	0.15	0.01	I
S1b	0.68	0.22	0.15	0.00	I
S2b	0.68	0.19	0.17	0.00	I
S3b	0.68	0.07	0.16	0.1	I
S4b	0.68	0.12	0.24	0.04	I
S5b	0.67	0.14	0.25	0.04	I
b	0.67	0.06	0.2	0.12	I
a	0.67	0.08	0.19	0.13	I

4. Conclusion

(1) The order of heavy metals concentration and petroleum hydrocarbonsconcentrations was Zn > oil > Cu > Pb > As > Cr > Cd >Hg. The concentration of Cu, Hg, Zn was higher than grade II standard but the value of difference was negligible. Concentrations of Cd, As, Cr were good. They were smaller than the primary standard; the concentration of petroleum hydrocarbons was higher than primary standard, but the higher value was negligible. It was necessary to pay attention to the concentration of Pb. It was higher than grade III of standard.

(2) All of heavy metals had the same situation. All of heavy metals concentration at b positions was higher than positions a and positions c. For petroleum hydrocarbons, the concentration at positions a was higher than positions b and positions c.

(3) The application of Grey clustering model to assess of heavy metals and petroleum hydrocarbons in Yangshan port from August of 2011 year to 2012 year shows that the heavy metals and petroleum hydrocarbons in sea water at Yangshan port in 2011 and 2012 was at grade I. There was only the result in October 2011 was at IV grade. This means that the water quality at heavy metals and oil factor at the Yangshan port until 2012 year was quite good in a whole.

5. Recommendation and suggestion

5.1. Recommendation

In order to protect and improve the environmental quality of seaport operations, in the coming time, management agencies and port operators should set up the implementation of many solutions. Specifically, it is necessary to promote propaganda, dissemination and guidance to port owners, factories to build, repair, maintain and dismantle ships to strictly comply with regulations on environmental protection; organize the close inspection and supervision of activities of seaport enterprises and vessels when operating in seaport waters; To inspect the maritime safety of vehicles engaged in operation in the management area so as

to detect and promptly warn in order to eliminate potential dangers that may cause environmental pollution.

Besides, it is necessary to coordinate with other agencies and organizations to mobilize people and appropriate means to handle environmental incidents caused by the operation of sea-going ships. At the same time, it is necessary to regularly monitor the compliance of diary logs, the ability to ensure the operation and technical condition of installed equipment, tanks, valves, throat outlet. The potential or related factors to ensure the safety of environmental pollution or advoid environmental pollution from ships, special-use ships carrying petrol and oil, floating petroleum storage depots.

5.2. Suggestions

This research subject can be applied at Nghi Son port, Thanh Hoa province. However, due to natural conditions and climate different from Duong Son port in China, it is necessary to study the integration of criteria for water quality assessment according to Vietnamese standards which should include temperature, turbidity, N, P, K, heavy metals, biological indicators (DO, BOD, microorganism).

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SOME MAIN OCCURRENCES OF CROSSED MODULES

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Abstract: *In this paper, we describe in detail some main occurrences of crossed modules. These are the common classes of crossed modules in algebra and topology. For every class of crossed modules, we also look for the analogues and show their special property.*

Keywords: *Crossed modules, morphisms of crossed modules.*

1. Introduction

Crossed modules (over groups) were invented almost 70 years ago by J. H. C. Whitehead in his work on combinatorial homotopy theory [10]. Whitehead's ideas on crossed modules and their applications were developed and explained in the book by R. Brown, P. J. Higgins, R. Sivera [1]. Some generalisations of the idea of crossed module were explained in the paper of G. Janelidze [3]. Recently, N. T. Quang and his co-workers have obtained some interesting concerning to extending the notion of crossed modules and solving the group extension problems of the type of a crossed module regards to the results of categorical theory [5, 6, 7, 8].

One can say that crossed modules have found important roles in many areas of mathematics including homotopy theory, homology and cohomology of groups, algebraic *K*-theory, cyclic homology, combinatorial group theory, differential geometry, etc. Possibly crossed modules should be considered one of the fundamental algebraic structures. A crossed module is a quadruple (B,D,d,θ) satisfying two given conditions, where $d:B\to D$, $\theta:D\to \mathrm{Aut}B$ are group homomorphisms. Giving a homomorphism $\theta:D\to \mathrm{Aut}B$ means giving an action of *D* on *B*. In the works on crossed modules ([1, 2, 4]), the authors mention some examples of crossed modules, but they do not explain in detail the homomorphism $\theta:D\to \mathrm{Aut}B$ (the action of *D* on *B*), in which in many cases this homomorphism is built not-natural or in a flexible way.

In this article we give an account of some of the main occurrences and uses of crossed modules in algebra and in topology in particular we give a detailed description of the homomorphisms $d:B\to D$, $\theta:D\to \mathrm{Aut}B$. These are: inclusion crossed modules, crossed modules of a module over a group ring, automorphism crossed modules of a group, semi-direct product crossed modules, pullback crossed modules of a crossed module along a group homomorphism, crossed modules constructed from a pointed topological space. We also give the equivalent forms or properties of each class of crossed modules.

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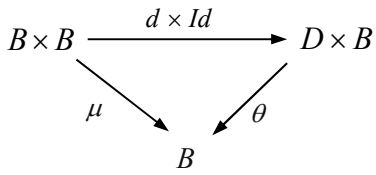
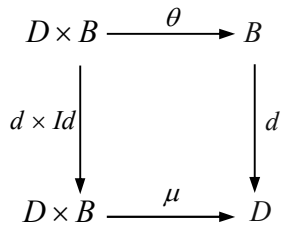
2. Crossed modules

Definition. [10] A *crossed module* is a quadruple (B,D,d,θ) in which $d:B\to D$, $\theta:D\to \mathrm{Aut}B$ are goup homomorphisms (the homomorphism θ we will conceive of as a map $\theta:D\times B\to B$, analogously to the adjoint action $\mu:G\times G\to G$ of a group on itself) such that the two following diagrams commute:





The two diagrams can be translated into equations, which may often be helpful.

$$\theta(d(b))(b') = \mu_b(b'),$$
$$d(\theta_x(b)) = \mu_x(d(b)),$$

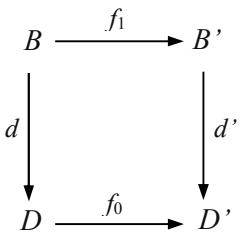
Where $x\in D, b, b'\in B$.

The second equation is known as the *Peiffer identity*.

If (B,D,d,θ), (B',D',d',θ') are crossed modules, a *morphism*,

$$(f_1,f_0):(B,D,d,\theta)\to(B',D',d',\theta')$$

of crossed modules consists of group homomorphisms $f_1:B\to B'$ and $f_0:D\to D'$ such that the following diagram (of group homomorphisms) commutes



and f_1 is an operator homomorphism, that is,

$$f_1(\theta_x b) = \theta'_{f_0(x)} f_1(b)$$

for all $x\in D, b\in B$.

Crossed modules and their morphisms form a category denoted by **Cross**.

For a fixed group *D*, there is a subcategory **Cross**$_D$ of **Cross** whose objects are those crossed modules with *D* as the "base", i.e., all crossed module (B,D,d,θ) for this fixed *D*,

whose morphisms are morphisms (f_1, f_0) from (B, D, d, θ) to (B', D, d', θ') just those (f_1, f_0) in **Cross** in which $f_0 : D \to D$ is the identity homomorphism on *D*.

Below, we give some well known situations of crossed modules.

3. Inclusion crossed modules

Let *B* be a normal subgroup of a group *D* and $i : B \to D$ the inclusion, then we will say (B, D, i) is a *normal subgroup pair*. The homomorphism $\theta^0 : D \to \mathrm{Aut}B$ is given by conjugation. Then, the quadruple (B, D, i, θ^0) is called a *inclusion crossed module* [4].

Conversely, it is easy to prove the following lemma.

Lemma 1. [4] *If* (B, D, d, θ) *is a crossed module,* $d(B)$ *is a normal subgroup of D.*

The inclusion crossed module plays an important role in the group extension problem of the type of a crossed module [7]. It together with the general crossed module makes a homomorphism of crossed modules which is a constraint of this group extension problem.

4. Crossed modules of a module over a group ring

Let's recall that if *D* is a group, the free abelian group *ZD* generated by the elements of *D* is a ring. We call *ZD* the *group ring* of *D*.

Suppose *D* is a group and B is a left ZD -module, let $\mathbf{0}: B \to D$ be the trivial map sending everything in *B* to the identity element of *D*, $\theta : D \to \mathrm{Aut}B$ is given by module action. Then, (B, D, d, θ) is called a *crossed module of a module over a group ring.*

Again conversely:

Lemma 2. [4] *If* (B, D, d, θ) *is a crossed module,* Ker*d is central in B and inherits a natural D-module from the D-action on B. Moreover,* Im*d acts trivially on* Ker*d, so* Ker*d has a natural* Coker*d-module structure*.

As these two examples suggest, general crossed modules lie between the two extremes of normal subgroups and modules. Their structure bears a certain resemblance to both - they are "external" normal subgroups but also are "twisted" modules.

5. Crossed modules of a surjective group homomorphism

Let $p : B \to D$ be a surjective group homomorphism whose kernel lies in the center of *B*, the homomorphism $\theta^0 : D \to \mathrm{Aut}B$ is given by conjugation. Then, the quadruple (B, D, p, θ^0) is called a *crossed module of a surjective group homomorphism.*

Equivalently, given any central extension of groups

$$0 \longrightarrow A \xrightarrow{i} B \xrightarrow{d} D \longrightarrow 1$$

that is, the above sequence is exact and A is in the center of B. Then, the surjective homomorphism $d : B \to D$ together with the action of D on B define a crossed module.

Thus, central extensions can be seen as special crossed modules. Conversely, a crossed module (B, D, d, θ) with the surjective boundary d defines a central extension. Because of this, one can use the results on crossed modules to solve the problems relating to central extensions.

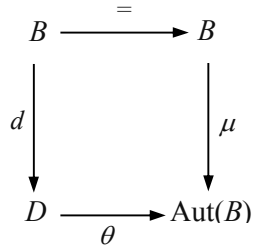
Analogously to the inclusion crossed module, the crossed module plays an important role in the group extension problem of the co-type of a crossed module [9]. It together with the general crossed module makes a homomorphism of crossed modules which is a constraint of this group extension problem.

6. Automorphism crossed modules of a group

Let B be a group, then, as usual, let Aut(B) denote the group of automorphisms of B. The homomorphism $\mu : B \to \mathrm{Aut}(B)$ sends an element $b \in B$ to the inner automorphism of the group B. Then, the tuple $(B, \mathrm{Aut}(B), \mu, id)$ is a crossed module, called the *automorphism crossed module of the group B and* its own notation **Aut**(B) [4].

More generally, if A is some type of algebra, $U(A)$ denotes the set of units of A, the homomorphism $\mu : A \to \mathrm{Aut}(A)$ sends a unit to the automorphism given by conjugation by it, then $(U(A), \mathrm{Aut}(A), \mu, id)$ is a crossed module.

This class of crossed modules has a very nice property with respect to general crossed modules. The homomorphism $\theta : D \to \mathrm{Aut}(B)$ of a general crossed module (B, D, d, θ) together with the homomorphism $\mu : B \to \mathrm{Aut}(B)$ gives a square:



We see that the first condition in the definition of a crossed module means the commutative square, i.e., the second condition in the definition of a morphism of crossed modules holds. Analogously, that the second condition in the definition of a crossed module means the second condition in the definition of a morphism of crossed modules holds. Thus, we do have a morphism of crossed modules $(id, \theta) : (B, D, d, \theta) \to (B, \mathrm{Aut}(B), \mu, id)$.

Moreover, in the group extension problem of the type of a crossed module [7], if we replace the general crossed module (B, D, d, θ) by the automorphism crossed module $(B, \mathrm{Aut}(B), \mu, id)$, we get the group extension problem as usual. Thus, the results of the group extension problem of the type of a crossed module cover those of the group extension problem.

7. Semi-direct product crossed modules

Let G be a group, $\alpha : M \to N$ be a morphism of left G-modules, and $N \rtimes G$ be the semi-direct product group. We define a homomorphism

$$d : M \to N \rtimes G \text{ by } d(m) = (\alpha(m), 1),$$

where 1 denotes the identity element of G. The homomorphism

$$\theta : N \rtimes G \to \mathrm{Aut}(M)$$

is defined via the projection from $N \rtimes G$ to G, that is,

$$\theta_{(n,g)}(m) = gm, \text{ for } n \in N, g \in G, m \in M.$$

Then, the quadruple is a crossed module.

In particular, if A and B are abelian groups, and B is considered to act trivially on A, the any homomorphism $f : A \to B$ gives a crossed module $(A, B, f, 0)$.

8. Pullback crossed modules of a crossed module along a group homomorphism

Suppose that we have a crossed module (B, D, d, θ), and a group homomorphism $\varphi : A \to D$, then we can form the "pullback group"

$$A \times_D B = \{(a, b) / \varphi(a) = d(b)\}$$

which is a subgroup of the product $A \times B$, where the multiplication in $A \times_D B$ is componentwise. The group homomorphism $d' : A \times_D B \to A$ is the restriction of the first projection morphism of the product, that is $d'(a, b) = a$.

The homomorphism $\theta' : A \to \mathrm{Aut}(A \times_D B)$ is defined by:

$$\theta'_{a'}(a, b) = (\mu_{a'}(a), \theta_{\phi(a')}(b)),$$

where $a' \in A, (a, b) \in A \times_D B$, μ is given by conjugation. Then, the tuple $(A \times_D B, A, d', \theta')$ is a crossed module. It is denoted by $\varphi^*(B, D, d, \theta)$ and called a *pullback crossed module of* (B, D, d, θ) *along* φ [4].

Moreover, there is a morphism of crossed module

$$(p, \varphi) : (A \times_D B, A, d', \theta') \to (B, D, d, \theta)$$

in which p is the second projection, i.e., $p : A \times_D B \to B, p(a, b) = b$.

In the above construction, if we replace groups by other algebraic structures, we obtain a class of pullback crossed modules of a given crossed module along a homomorphism.

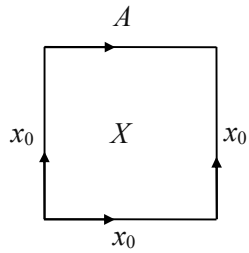
9. Crossed module constructed from a pointed topological space

Let X be a pointed topological space, that is a point x_0 has been chosen in X. Recall that *the fundamental group* $\pi_1(X, x_0)$ consists of all homotopy classes of continuous maps

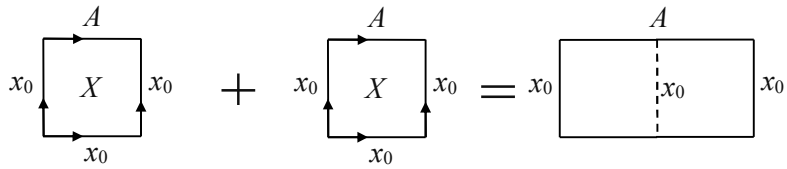
$f:[0,1]\to X$ with $f(0)=f(1)=x_0$. (Two such maps are *homotopic* if one can be continuously deformed into the other in such a way that the image of 0 and 1 remains x_0 throughout the deformation.) We think of these maps as paths in X beginning and ending at x_0.

The composition of paths yields a (not necessarily abelian) group structure on $\pi_1(X,x_0)$.

Now, if A is a subspace of X containing the point x_0 then we can consider *the second relative homotopy group* $\pi_2(X,A,x_0)$. This group consists of homotopy classes of continuous maps $g:[0,1]\times[0,1]\to X$ from the unit square into X which maps three edges of the square onto the point x_0 and the fourth edge into A. The appropriate picture of such a map g is



The juxtaposition of squares

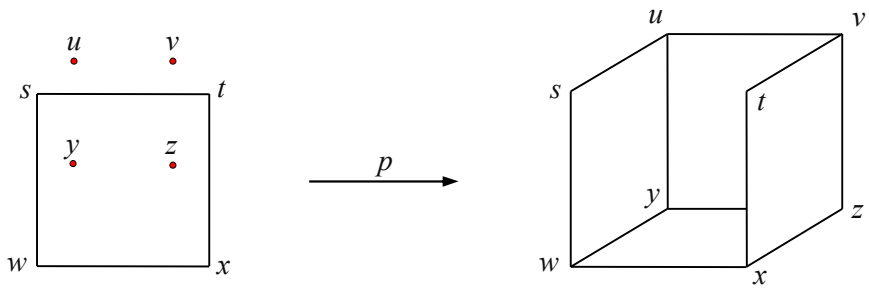


yields a (not necessarily abelian) group structure on $\pi_2(X,A,x_0)$.

By restricting to the fourth edge of the unit square we obtain a boundary homomorphism $\partial:\pi_2(X,A,x_0)\to\pi_1(A,x_0)$.

Moreover, we construct a homomorphism $\theta:\pi_1(A,x_0)\to \mathrm{Aut}(\pi_2(X,A,x_0))$ as follow.

First, there is a continuous map p from the unit square onto four faces of the unit cube:



Now, given a path $f:[0,1]\to A$ representing an element $[f]\in\pi_1(A,x_0)$, and a square $g:[0,1]\times[0,1]\to X$ representing an element $[g]\in\pi_2(X,A,x_0)$, we can construct a continuous map ${}^f g$ from the four faces of the unit cube to the space *X* by using g to map the face *uvyz* onto *X*, and mapping each horizontal line in the remaining three faces by *f* onto *A*. On composing ${}^f g$ with *p* we get a map which represents an element of $\pi_2(X,A,x_0)$. Thus, we have a homomorphism

$$\theta:\pi_1(A,x_0)\to \mathrm{Aut}(\pi_2(X,A,x_0)),\ \theta_{[f]}([g])=[{}^f g\circ p].$$

Therefore, the tuple $\left(\pi_2(X,A,x_0),\pi_1(A,x_0),\partial,\theta\right)$ is a crossed module. It is called a *fundamental crossed module* of the pair (X,A) [4].

Based on the fundamental crossed module of a pair of spaces, one can determine the second homotopy group of a CW-complex which is a free crossed module on 2-cells. Moreover, there is a functor from the category of pairs of pointed spaces to the category of crossed modules satisfying a form of the van Kampen theorem preserving the colimits.

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DETERMINED CONDITIONS OF LASER FIELD ON ACOUSTIC PHONON INCREASING IN SEMICONDUCTOR BLOCK

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Abstract: *In this paper, I have been established the kinetic equation for phonons in semiconductor block under intense laser field. Using this equation, we find expression for the rate coefficient for the case degenerate electron gas. The condition of the acoustic phonon increasing in semiconductor blocks is discussed.*

Keywords: *Acoustic phonon, semiconductor block, laser field.*

1. Introduction

Phonon amplification by absorption of laser field energy is a subject extensively investigated in different structures [1,2,3,4,8]. The main results of these papers are that by absorption of laser field energy, the interaction of the laser field with electron can lead to the excitation of higher harmonics and the amplification of phonon. With the development of modern experimental technology, the fabrications of low-dimensional structures are realizable. Naturally, phonon amplification by absorption of laser radiation in such confined structures should show the characterization of the electron-phonon interaction.

In this paper, we start from Hamiltonian of the electron-phonon system in Semiconductor Block (SB) under intense laser field; we derive a quantum kinetic equation for phonon in SB in the case of multiphoton absorption process. Then, we calculate the phonon excitation rate in the case of the electron gas is degenerative. Finally, we calculate the acoustic phonon excitation rate (APER) in a specific SB to illustrate the mechanism of the phonon amplification.

2. Quantum kinetic equation for phonon in a Semiconductor Block

We use a simple model for a SB, in which an electron gas is confined by SB potential along the z direction and electrons are free on the x-y plane. It is well known that its energy spectrum is quantized into discrete levels in the z direction. A laser field irradiates which is normal to the x-y plane, its polarization is along the x axis, and its strength is expressed as a vector potential $\vec{A}(t)$. The Hamiltonian for the system of the electrons and phonons in the case of the presence of the laser field is written as [8]:

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$$H(t)=\sum_{\vec{p}}\frac{1}{2m}\left(\vec{p}-\frac{e}{c}\vec{A}(t)\right)^2 a^+_{\vec{p}}a_{\vec{p}}+\sum_{\vec{q}}\varepsilon_{\vec{q}}b^+_{\vec{q}}b_{\vec{q}}+\sum_{\vec{p},\vec{q}}C_{\vec{q}}a^+_{\vec{p}+\vec{q}}a_{\vec{p}}(b_{\vec{q}}+b^+_{-\vec{q}}) \quad (1)$$

where $a^+_{\vec{p}}$ and $a_{\vec{p}}$ are the creation and annihilation operators of electron in SB, $b^+_{\vec{q}}$ and $b_{\vec{q}}$ are the creation and annihilation operators of phonon respectively, $\varepsilon_{\vec{q}}=\hbar\omega_{\vec{q}}$ is phonon energy for wave vector $\vec{q}$. $\vec{A}(t)$ is the potential vector, depending on the external field.

$$\vec{A}=\vec{e}_x A_0\cos\Omega t,\ A_0=cE_0/\Omega \quad (2)$$

Under intense laser field, the electron-phonon system is unbalanced, the phonon numbers change over time. The change over time of $N_{\vec{q}}(t)=\left\langle b^+_{\vec{q}}b_{\vec{q}}\right\rangle_t$ is described by the equation:

$$i\hbar\frac{\partial N_{\vec{q}}(t)}{\partial t}=\left\langle b^+_{\vec{q}}b_{\vec{q}},H(t)\right\rangle_t \quad (3)$$

We obtain the quantum kinetic equation for phonons in SB:

$$\begin{aligned}\frac{\partial N_{\vec{q}}(t)}{\partial t}=&\frac{1}{\hbar^2}\sum_{\vec{p}}|C_{\vec{q}}|^2\sum_{s,\ell=-\infty}^{+\infty}J_s\left(\frac{\Lambda}{\hbar\omega}\right)J_\ell\left(\frac{\Lambda}{\hbar\omega}\right)\exp[i(\ell-s)\omega t]\\&\times\int_{-\infty}^{t}dt'\Big\{\Big[[N_{\vec{q}}(t')+1]f(\vec{p}+\vec{q})[1-f(\vec{p})]-N_{\vec{q}}(t')f(\vec{p})[1-f(\vec{p}+\vec{q})]\Big]\\&\qquad\times\exp\left[\frac{i}{\hbar}\left(\varepsilon_{\vec{p}+\vec{q}}-\varepsilon_{\vec{p}}-\varepsilon_{\vec{q}}-\ell\hbar\omega\right)(t'-t)\right]\\&+\Big[[N_{\vec{q}}(t')+1]f(\vec{p})[1-f(\vec{p}-\vec{q})]-N_{\vec{q}}(t')f(\vec{p}-\vec{q})[1-f(\vec{p})]\Big]\\&\qquad\times\exp\left[-\frac{i}{\hbar}\left(\varepsilon_{\vec{p}}-\varepsilon_{\vec{p}-\vec{q}}-\varepsilon_{\vec{q}}-\ell\hbar\omega\right)(t'-t)\right]\Big\}\end{aligned} \quad (4)$$

Where $N_{\vec{q}}(t)=<b^+_{\vec{q}}b_{\vec{q}}>_t$, the symbol $<X>_t$ means the usual thermodynamic average of operator X, $J_\ell(z)$ is Bessel function, $f(\vec{p})=<a^+_{\vec{p}}a_{\vec{p}}>_t$, $\Lambda=e\hbar\vec{E}_0\vec{q}/(m\Omega)$.

3. Phonon excitation rate in a SB

Above results [4] allow one to introduce the kinetic equation for phonon number of the q mode:

$$\frac{\partial N_{\vec{q}}(t)}{\partial t}=\gamma_{\vec{q}}N_{\vec{q}}(t) \quad (5)$$

where $\gamma_{\vec{q}}$ is the parameter that determines the evolution of the phonon number $N_{\vec{q}}(t)$ in time due to the interaction with the electrons. If $\gamma_{\vec{q}}>0$ the phonon population grows with time, whereas for $\gamma_{\vec{q}}<0$ we have damping.

From (6), the phonon excitation rate becomes:

$$\frac{\partial N_{\vec{q}}(t)}{\partial t} = \frac{2\pi}{\hbar}\sum_{\vec{p}} |C_{\vec{q}}|^2 \sum_{\ell=-\infty}^{+\infty} J_\ell^2(\Lambda/\hbar\omega)\left[f(\vec{p}+\vec{q}) - f(\vec{p})\right]\delta(\varepsilon_{\vec{p}+\vec{q}} - \varepsilon_{\vec{p}} - \varepsilon_{\vec{q}} - \ell\hbar\omega) \quad (6)$$

In the strong-field limit, $\Lambda >> \hbar\Omega$ and the argument of the Bessel function in Eq. (6) is larger. For large values of argument, the Bessel function is small except when the order is equal to the argument. The sum over ℓ in Eq. (7) may then be written approximately:

$$\sum_{\ell=-\infty}^{\infty} J_\ell^2\left(\frac{\Lambda}{\hbar\Omega}\right)\delta(E - \ell\hbar\Omega) = \frac{1}{2}\left[\delta(E+\Lambda) + \delta(E-\Lambda)\right] \quad (7)$$

Here $E = \varepsilon_{\vec{p}+\vec{q}} - \varepsilon_{\vec{p}} - \varepsilon_{\vec{q}}$. The first Delta function corresponds to the absorption and the second one corresponds to the emission of $\Lambda/(\hbar\Omega)$ photons. In the strong-field limit only multiphoton processes are significant and the electron-phonon collision takes place with the emission and absorption of $\Lambda/(\hbar\Omega)$ photons. Substituting Eq. (7) into Eq. (6), the phonon excitation rate becomes $\gamma_{\vec{q}} = \gamma_{\vec{q}}^{(+)} + \gamma_{\vec{q}}^{(-)}$, where:

$$\gamma_{\vec{q}}^{(\pm)} = \frac{\pi}{\hbar}\sum_{\vec{p}} |C(\vec{q})|^2 \left[f(\vec{p}+\vec{q}) - f(\vec{p})\right]\delta\left(\varepsilon_{\vec{p}+\vec{q}} - \varepsilon_{\vec{p}} - \varepsilon_{\vec{q}} \pm \Lambda\right) \quad (8)$$

In the following, we will calculate for the case in which the electron gas is degenerative. In this case, we may simplify the carrier distribution function by using the Boltzmann distribution function:

$$f(\vec{p}) = \theta(\varepsilon_F - \varepsilon_{\vec{p}}) = \begin{cases} 0 & \text{khi } \varepsilon_F < \varepsilon_{\vec{p}} \\ 1 & \text{khi } \varepsilon_F > \varepsilon_{\vec{p}} \end{cases}.$$

I calculate the rate of acoustic phonon excitation. For acoustic phonon, we have $|C_{\vec{q}}|^2 = \frac{\hbar q \xi^2}{\rho v_a V}$ here V, ρ, v_a, and ξ are the volume, the density, the acoustic velocity and the deformation potential constant, respectively.

$$\gamma_{\vec{q}}^{(\pm)} = \frac{\omega_{\vec{q}} m^2 \xi^4}{16\hbar\pi\rho^2 v_a^2 V^2}\left(\pm\frac{eqE_0}{m\Omega} - \varepsilon_{\vec{q}}\right) \quad (9)$$

Analyzing Eq. (10) we can obtain the conditions for the phonon amplification. From the condition $\gamma_{\vec{q}}^{(\pm)} > 0$, we obtain $\left(\pm\frac{eE_o q}{m\Omega} - \varepsilon_q\right) > 0$. The condition which the laser field must satisfy is:

$$\Lambda = \frac{\hbar eqE_0}{m\Omega} > \hbar\omega_{\vec{q}} \quad (10)$$

in which:

$$\varepsilon_F > \frac{m}{2q^2}\left(\omega_o - \vec{q}\vec{v} - \frac{\hbar^2 q^2}{2m}\right)^2 ; \ \vec{v} = \frac{eE_o}{m\Omega}\vec{e}_x \qquad (11)$$

The condition (10) simply means that if the drift velocity of electron $\vec{q}.\vec{E}_0 / m\Omega$ under the intense laser field, excesses the phonon phase-velocity, a deformation potential for multiphonon excitation can be generated in the SB.

In next to the condition (10), in the case of degenerate electron gas must also satisfy the condition (11), so the increase acoustic phonons are more difficult. Note that the condition (11) is not indicated by other authors when studying this effect [6,8].

4. Conclusions

I have analytically investigated the possibility of phonon amplification by absorption of laser field energy in a SB in the case of multiphoton absorption process with non-degenerative electron system. Starting from bulk phonon assumption and Hamiltonian of the electron-phonon system in laser field we have derived a quantum kinetic equation for phonon in SB. However, an analytical solution to the equation can only be obtained within some limitations.

Using these limitations for simplicity, I have obtained expressions of the rate of acoustic phonon excitation in the case of multiphoton absorption process. Finally, the expressions are numerically calculated and plotted for a SB to show the mechanism of the phonon amplification. Similarly to the mechanism pointed out by several authors for deferent models, phonon amplification in a SB can occur under the conditions that the amplitude of the external laser field is higher than some threshold amplitude. This is the Cerenkov's condition [8].

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A STUDY OF INCUBATION PARAMETERS IN SIX BREEDS OF LOCAL CHICKENS

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Abstract: *In this study, we investigated the differences of incubation parameters traits in six breeds of Taiwanese chickens: Hua-Tung (HT), Hsin-Yi (HY), Ju-Chi (JC), Shek-Ki (SK), Nagoya (NG) and Quemoy (KM) breeds. The incubation traits, including loss of egg weight during storage (storeloss), 18 days in the setter (inculoss), 21 days of incubation (hatchloss), time to hatch, and hatchability were tested for the effect of breed, egg weight and storage period. The results showed that eggs weight, chick weight, and storeloss (%) in Generation 1 were higher than Generation 2, whereas, inculoss (%), hatchloss (%), and hatchability in Generation 2 were higher than Generation 1. The highest inculoss (%) and hatchloss (%) were found in Quemoy, while the lowest was Shek-Ki. The longest hatchtime was found in Quemoy and the shortest was Ju-Chi. The highest hatchability was found in Hua-Tung breed, while the lowest was Shek-Ki breed. Heritabilities estimated from regression of Generation 2 to Generation 1 were very high for egg weight and hatchtime while storeloss was nil. Furthermore, long egg storage time increases egg weight loss and incubation duration (hatch time), but reduces hatchability. When eggs were stored for one more day, egg weight loss increased 0.03 % during storage period, 0.03% during 18 days in the setter, and 0.07% for entire incubation period, increased the hatch time by 0.73 hr, but reduced hatchability by about 0.03%.*

Keywords: *Egg weight loss, incubation, hatchability.*

1. Introduction

The fate of chicks largely depends on the quality of hatching eggs. Various breeding practices and handling of eggs from egg laying to hatching, particularly pre-incubation storage condition, and incubation parameters have affected hatchability and quality of day old chicks (Tona et al., 2001). Hatching eggs are collected at breeding farm, stored for some time there, or directly transferred to the hatchery. Here, these are stored for a certain limit of time under

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specific environmental conditions. The main objective of holding period is to maintain the fertility of hatching eggs.

Hua-Tung, Hsin-Yi, Ju-Chi, Quemoy, Nagoya, and Shek-Ki are six breeds of local Taiwan chickens (Chen et al., 1994; Lee, 2006) kept at the research farm of National Chung Hsing University. During the annual reproduction period, their eggs were collected from farm and kept there for one to two weeks in storage before moved to the University for incubation. During this stage, there were many changes of egg's characteristics. Brake et al., (1997) reviewed the changes in eggs components associated with egg handling, storage and concluded that hatchability and chick quality varied by age of flock, age of egg, ambient temperature, strain and handling procedures. Better understanding of these details, the aim of this study, we investigate the differences of incubation parameters among six breeds of local chickens during the incubation period.

2. Material and methods

2.1. Animals and samples collection

1800 hatching eggs used in this study were obtained from six breeds of local chickens in research farm of National Chung Hsing University, Taichung, Taiwan: Hua-Tung (HT), Hsin-Yi (HY), Ju-Chi (JC), Shek-Ki (SK), Nagoya (NG) and Quemoy (KM) breeds. Hatching eggs were collected when hens were 59-60 and 29-30 weeks of age respectively for Generation 1 and 2.

2.2. Measurement of traits

2.2.1. Egg weight and storeloss

Eggs in each breed after laid were collected and were individually weighed and stored on farm every day to 12 days of experiment. Temperature and humidity in storage period were maintained at 18^0C, and 75 %. At day 12 after storage, they were reweighed to determine egg weight loss. Eggs weight loss in storage period were determined as follow:

$$Store loss\,(\%) = \left(\frac{Eggwt - Storewt}{Eggwt} \right) x100\%$$

Where, Eggwt is eggs weight on the day laid, Storewt is eggs weight to be measured in the farm at 12 days stored before moved to incubator.

2.2.2. Inculoss and hatchloss, hatch time and chicks weight

After reweighed at farm, eggs were moved to incubate in the campus of the university. All eggs were incubated for 18 days at 37.8^0C and relative humidity 50-55%. After 18 days of incubation, all eggs were removed from the incubator, individually weighed and transferred to the hatcher. The eggs were further incubated for an additional 4 days in hatcher at temperature 36.7^0 C and relative humidity 65-70%. The trays were designed to separate hatching chicks

and do not allow them to move from their places and mix. Hatched chicks were individually determined hatch time and weighed in 2 hours interval. Inculoss and hatchloss were determined as follow:

$$Inculoss\,(\%) = \left(\frac{Storewt - Wt18}{Storewt} \right) x100\%$$

$$Hatchloss\,(\%) = \left(\frac{Storewt - Chickwt}{Storewt} \right) x100\%$$

Where, *storewt* is eggs weight to be measured in the farm at 12 days stored before moved to incubator, Wt18 is eggs weights to be measured after 18 days of incubation. Chickwt is chicks to be weighted at hatched time.

2.3. Statistical analysis

1. Observation of incubation parameters of eggs laid by hens of six local breeds chicken for two generations were analyzed together using General Linear Models procedures of SAS Institute (version 9.3.1), based on the following statistical model:

$$Y_{ijkl} = \mu + G_i + B_j + (GB)_{ij} + e_{ijkl}$$

Where Y_{ijkl} is the observation of the *l*th egg laid by the *k*th hen in the *j*th breed of the *i*th generation, μ is the general mean. G_i is the fixed effect of the *i*th generation $i = 1, 2, \sum_{i=1}^{2} G_i = 0$. B_j is the fixed effect of the *j*th breed, $j = 1, 2, 3,.., 6, \sum_{j=1}^{6} B_j = 0$, and . $(GB)_{ij}$ is the fixed interaction between the *i*th generation and the *j*th breed $\sum_{i=1}^{6}\sum_{k=1}^{2}(\alpha\beta)_{ik} = 0$, and e_{ijkl} is the random error.

2. For the estimation of the effect of storage duration, egg weight, and egg shape on the hatching traits, following analysis of covariance statistical model was used:

$$Y_{ijk} = \mu + B_i + \beta X_{ijk} + \varepsilon_{ijk}$$

where, Y_{ijk} is the hatching trait observation of the *k*th hen egg laid by the *j*th hen in the *i*th breed. μ is the general means. β is the partial regression coefficient of the covariate. (X_{ij} , e.g., storage day, egg weight or egg shape of egg) on the hatching traits and ε_{ij} is the random error.

3. Results and discussions

3.1. Generations

The analysis of variance (Mean square) and least-square means of egg weight, egg weight loss, hatch time, chick weight at hatch, and hatchability are shown in Table 1. The significance of effects between two generations were found in egg weight, storeloss (%), hatchloss (%), inculoss (%), chick weight and hatchability ($P<0.05$), but not found in hatch time ($P<0.1$).

Egg weight and chick weight in Generation 1 were higher than Generation 2. The cause is hen's age. Egg weight increases with age (Anderson et al., 2004; Sukanya, 2007) and chick weight increases with egg weight increases (Alsobayel, 1992).

Egg weight loss (%) during storage period (storeloss) in Generation 1 was significantly ($P<0.01$) higher than Generation 2. However, hatchloss (%), inculoss (%) and hatchability in Generation 2 were significantly ($P<0.01$) higher than Generation 1 (Table 1). Eggs from older hens tended to lose more weight in grams but less in percentage than those from younger birds (Reis et al., 1997). The effect of breeds*generations interaction was highly significant ($P<0.01$) on the percentage of egg weight loss during 18 days in setter (inculoss) (Table 1).

3.2. Breeds

3.2.1. Egg weight and Chick weight

The heaviest chick weight was Hua-Tung breed, whereas the lightest was Quemoy (Table 1). Overall, day-old chick weights increased with the egg weights (Tona et al., 2003). The quality of newly hatched chick is a major factor in determining its livability, growth, and health. There was a highly significant correlation between egg weight and chick weight at hatched time. Thus, the heavier egg weight will produce the heavier chick weight.

3.2.2. Egg weight loss

The highest egg weight loss (%) during storage period was found in Nagoya breed, while the lowest was Hua-Tung breed (Table 1). The Ju-Chi and Quemoy breeds had the highest inculoss (%) while the lowest were found in Shek-Ki and Hua-Tung breeds ($P<0.01$). In hatchloss (%), however, the highest were found in Quemoy and Hsin-Yi breeds while the lowest were still Shek-Ki and Hua-Tung breeds. Reis et al., (1997) demonstrated that there is an inverse relationship between egg weight and hatchloss. Thus, egg which had smallest egg weight had largest hatchloss. This is the same as our results of eggs laid by Shek-Ki hens. The present results goes well with the observations obtained by Kirk et al., (1980), North and Bell (1990), and Roque and Soares (1994), who reported that proportional weight loss decreased slightly with flock age, probably because of the associated increase in egg weight. As larger eggs have less shell area per unit of interior egg weight than do smaller eggs. Another explanation of the breed's difference in inculoss might be caused by the shell difference.

3.2.3. Hatchtime

There were no difference in hatchtime between two generations, however, among six breeds, we found that the Hsin-Yi breed hatched earlier than other breeds (478.68 *h*) (Table 1), whereas the longest hatchtime was found in Quemoy and Shek-Ki breeds (492.02 and 491.82 *h,* respectively).

Although there had no significant effect between two generations, the effect of breeds*generations interaction was highly significant ($P<0.01$) on hatch time (Table 1). Hsin-Yi breed hatched earlier than other breeds in both Generations 1 and 2, whereas, Quemoy and Shek-Ki breeds hatched later than other breeds in both generations.

Table 1. *Analysis of variance (mean square) and least-square means of hatching traits in six breeds of local chickens*

Source of Variation	df	Egg weight (*g*)	Storeloss[1] (%)	Inculoss[2] (%)	Hatchloss[3] (%)	Hatch time[4] (*hr*)	Chick weight (*g*)	Hatchability (%)
Generation	1	2388.44 **	38.33 **	38.89 **	1006.72 **	216.92 +	2264.93 **	16.67 *
Breed	5	810.52 **	0.21	212.83 **	388.57 **	12741.81 **	589.91 **	16.77 *
Generation*breed	5	63.80 **	1.02	58.18 **	53.18 **	363.25 **	71.06 **	1.09
Error	3087	12.79	0.18	4.03	4.29	74.63	8.00	2.41
Generation 1		46.68 ± 0.10^{a}	0.46 ± 0.01^{a}	12.59 ± 0.06^{b}	27.89 ± 0.06^{b}	486.07 ± 0.24	33.52 ± 0.08^{a}	85.48 ± 0.45^{b}
Generation 2		44.87 ± 0.09^{b}	0.23 ± 0.01^{b}	12.83 ± 0.05^{a}	29.06 ± 0.05^{a}	486.62 ± 0.20	31.76 ± 0.07^{b}	87.52 ± 0.63^{a}
Hua-Tung		47.56 ± 0.16^{a}	0.32 ± 0.02	12.05 ± 0.09^{c}	27.86 ± 0.10^{d}	484.96 ± 0.39^{b}	34.22 ± 0.13^{a}	88.84 ± 0.95^{a}
Hsin-Yi		45.12 ± 0.15^{d}	0.35 ± 0.02	13.02 ± 0.08^{b}	29.00 ± 0.09^{b}	478.68 ± 0.35^{c}	31.93 ± 0.12^{d}	87.62 ± 0.95^{a}
Ju-Chi		46.90 ± 0.15^{b}	0.34 ± 0.02	13.29 ± 0.08^{a}	28.56 ± 0.08^{c}	484.90 ± 0.35^{b}	33.39 ± 0.12^{b}	88.48 ± 0.95^{a}
Quemoy		44.37 ± 0.16^{e}	0.36 ± 0.02	13.25 ± 0.09^{ab}	29.57 ± 0.09^{a}	492.02 ± 0.38^{a}	31.15 ± 0.13^{e}	83.59 ± 0.95^{b}
Nagoya		46.12 ± 0.17^{c}	0.38 ± 0.02	13.04 ± 0.09^{ab}	28.96 ± 0.10^{b}	485.72 ± 0.40^{b}	32.64 ± 0.13^{c}	87.40 ± 0.95^{a}
Shek-Ki		44.61 ± 0.19^{e}	0.33 ± 0.02	11.63 ± 0.10^{d}	26.90 ± 0.11^{e}	491.82 ± 0.45^{a}	32.52 ± 0.15^{c}	83.09 ± 0.95^{b}

$^{a\text{-}e}$ For each measure, means of different breeds without the same superscript are significantly different ($P<0.05$).

*$^{+}$ $P < 0.1$; * $P < 0.05$; ** $P < 0.01$.*

[1]Storeloss is loss of egg weight during storage period. 2Inculoss is loss of egg weight during 18 days of incubation. 3Hatchloss is loss of egg weight entire 21 days of incubation. 4Hatch time is number of hours required to hatch.

3.3. Effect of storage time on hatching traits

The partial regression coefficients of storage time on hatching traits in two generations were shown in Table 2. Long egg storage time increased storeloss (%), inculoss (%), hatchloss (%) and incubation duration (hatch time) but hatchability. In Generation 1, when eggs were stored for one more day, egg weight loss increased by 0.024% during storage period (storeloss %), 0.03% during 18 days in the setter (inculoss %), and 0.07% for entire incubation period (hatchloss %), increased the hatch time longer by 0.73hr, while hatchability decreased by 0.034%. In Generation 2, when eggs were stored for one more day, egg weight loss increased 0.034% during storage period (storeloss %), 0.017% during 18 days in the setter (inculoss %), and 0.037% for entire incubation period (hatchloss %), the hatch time was longer by 0.723 hr, but hatchability decreased by 0.026%. Reis et al. (1997) reported that eggs submitted to 1 day storage hatched about 3hrs earlier than eggs which were not stored. Yassin et al., (2008) showed that each day of storage up to 7 days reduced hatchability by 0.2%, whereas, further storage reduced hatchability by 0.5% daily. Theses suggest that the effect of pre-storage incubation on hatchability when storage time is prolonged depends on the developmental stage of the embryo after pre-storage incubation.

Table 2. *Estimates of partial regression coefficients of hatching traits in two generations*

Source of variation	**Storeloss[1] (%)**		**Inculoss[2] (%)**		**Hatchloss[3] (%)**		**Hatch time[4] (*hr*)**		**Hatchability (%)**	
Generation1										
Storage (*d*)	0.024	**	0.03	*	0.07	**	0.73	**	-0.034	*
Egg weight (*g*)	0.019	*	-0.09	*	-0.04	+	0.03	ns	0.17	+
Egg shape (*%*)	-0.003	ns	0.01	ns	0.03	ns	0.12	ns	-0.06	ns
Generation 2										
Storage (*d*)	0.034	**	0.017	*	0.037	**	0.723	**	-0.026	*
Egg weight (*g*)	-0.001	ns	-0.091	**	-0.005	ns	-0.162	ns	0.019	ns
Egg shape (*%*)	-0.003	ns	0.015	ns	-0.053	*	-0.088	ns	-0.043	ns

*(+ P < 0.1; * P < 0.05; ** P < 0.01; ns: none significant)*

[1]Storeloss is loss of egg weight during storage,

[2]Inculoss is loss of egg weight during 18 days in the setter,

[3]Hatchloss is loss of egg weight entire 21 days of incubation and

[4]Hatch time is number of hours required to hatch.

4. Conclusions

Eggs weight, chick weight, and storeloss (%) in Generation 1 were higher than Generation 2, whereas, inculoss (%), hatchloss (%), and hatchability in Generation 2 were higher than Generation 1.

The highest egg weight loss (%) was found in Quemoy breed, while the lowest was Shek-Ki breed. The highest hatchability was Hua-Tung breed, while the lowest was found in Shek-Ki breed. Long egg storage time increases egg weight loss, incubation duration (hatch time), and decreases hatchability. When eggs stored for one more day, egg weight loss increased by 0.03% during storage period, 0.03% during 18 days in the setter, and 0.07% for entire incubation period, and it also increased the hatch time by 0.73hr and decreased hatchability by about 0.03%.

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THE SITUATION OF AQUATIC AND MARINE PRODUCT EXPORT IN THANH HOA PROVINCE IN THE INTERNATIONAL INTEGRATION PERIOD

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Abstract: *In the international integration period, Thanh Hoa province determines to develop marine economy - including aquatic and marine products export development. It is one of the key missions of the province. There are many existing issues relating to aquatic and marine products export that need to be solved. The objective of this study is to evaluate the reality of quality and brand of aquatic and marine products; and, to recommend effective solutions for these issues. The study has three parts: Introduction is in part one; second part is the main part of this research - Research Content, includes the evaluation of the quality and brand of fishery products and the recommended solutions are introduced in part three.*

Keywords: *Aquatic and marine products export, international integration period, quality and brand, Thanh Hoa province.*

1. Introduction

Aquatic and marine products export under integration direction is one of the very important issues in developing agricultural and rural economy, particularly in coastal areas, which contribute to the economic structure shift, creating jobs and reducing poverty for a large number of people in Vietnam.

During the past years, aquatic and marine sector in Vietnam has gained important achievements with quick and stable growth, becoming one of the key sectors in export, bringing about considerable income for the country. At present, Vietnamese aquatic and marine products have been present in over 164 countries, generating an export ratio of more than 6.6 billion USD *(According to a report on Vietnam Fisheries production in 2015 of VASEP, Vietnam Association of Seafood Exporters and producers)*.

Thanh Hoa is the second largest province in Vietnam both in population and area. Statistics shows that Thanh Hoa has the coast of 102kms with 6 coastal towns and districts formed by 5 river mouths to the sea (*http://thanhhoa.gov.vn*). This province also has favorable

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conditions for economic development in general and aquatic and marine product export development in particular. Recently, Thanh Hoa has paid more attention to aquatic and marine products export.

Although the aquatic and marine products sector has been concerned and invested in recent years, new development needs particularly demands of integration into international economy with competitive, quality and branded products has posed urgent issues to the locality. In order to join the playground and integrate into international market and export, Thanh Hoa aquatic and marine products should not only invest in fishing and processing facilities and equipment but also have long-term strategies in branding products and productions to satisfy requirements of technical barriers as well as demands of customers in different countries.

2. Research Content

2.1. Reality of Thanh Hoa aquatic and marine products export in 2010 - 2015

The province has 76 enterprises specializing in processing, aquatic and marine products export business with total capacity of about 279,870 tons of aquatic and marine products per year. (*Report on the implementation of the 2015 plan for Fisheries and Aquaculture Development*). Total export value in 2010 reached USD 47.8 million (reaching 106.4% compared with the planning target of USD 45 million), 56 million in 2013, in 2015 it was estimated at USD 75 million, mainly export quota.

The main products are shrimp, frozen squid, fried fish. Product has not much added value. Raw materials for export processing is mainly products from fishing and brackish water aquaculture. Raw materials in the province only meet 20-30% of the capacity of the plant, so the raw materials are mainly purchased from other provinces such as Quang Nam, Quang Ngai and Thua Thien Hue.

Table 1. *Aquatic and marine products export turnover*

Year	Total aquatic and marine products export turnover of the country *(unit: Million USD)*	Aquatic and marine products export turnover of Thanh Hoa province *(unit: Million USD)*	Percentage compared to the whole country *(unit: %)*	Year	Total aquatic and marine products export turnover of the country *(unit: Million USD)*	Aquatic and marine products export turnover of Thanh Hoa province *(unit: Million USD)*	Percentage compared to the whole country *(unit: %)*
2000	1479	14.952	1.01	2008	4509	37.65	0.83
2001	1778	13.808	0.78	2009	4251	45.85	1.08

2002	2023	16.843	0.83	2010	5202	47.89	0.92
2003	2200	17.5	0.80	2011	6110	43.216	0.71
2004	2408	21.472	0.89	2012	6090	58.1	0.95
2005	2733	23.542	0.86	2013	6712	55.6	0.83
2006	3358	29.12	0.87	2014	7836	69	0.88
2007	3764	30.65	0.81	2015	6660	75	1.126

(Source: - Statistical Yearbook of Thanh Hoa province2014 year)
- The ThanhHoa Department of Agriculture and Rural Development
- The General Department of Customs and VASEP

**** Export market:***

Aquatic and marine production is increasing, aquatic and marine products export also brings about good results - aquatic and marine products export turnover increased significantly over the years.

Table 1 shows that the value of export turnover in 2000 reached USD 14,952 million, accounting for 1.01% compared to the whole country, by 2005 export reached USD 23,542 million, but it reduced compared to the country and just accounting for 0.86%; reaching USD 47.89 million in 2010 doubled compared to the year 2000, but the percentage compared to the whole country decreased 0.09%.

In 2011, the value of aquatic and marine products export increased but export turnover decreased more than compared to the year 2010. The reason is due to the inputs for production on the rise: electricity price increased by 18%, gasoline price soared, the currency market has large fluctuation in interest rates (interest rate is 15%/year, external loans is 20%), which makes great disadvantage for aquatic and marine products processing businesses as well as farmers and fishing in raising funds to invest in production. Besides, ThanhHoa as well as the whole country has trouble in export market - the modern technical barriers are being applied to aquatic and marine products of Vietnam.

However, by 2012, Thanh Hoa province has focused on upgrading and expanding a number of aquatic and marine products processing establishments for export, encourage private processing facilities to develop; some fisheries infrastructure such as Lach Bach fishing port, Lach Hoi etc,. invested to upgrade and meet the development requirement of fishing. Fishing capacity is increasing after the province has invested in a lot of resources to develop. Thus the value of export turnover reached USD 58.1 million, accounting for 0.95% of the whole country, up to 0.24% over 2011.

In the year 2013, the value of export turnover reached USD 55.6 million, a decrease of 0.12% compared to the year 2012, accounting for 0.83% of the whole country. The epidemics, storms, fuel prices and tight credit cause difficulties for aquatic and marine products processing enterprises for export.

By 2014, the value of export turnover reached USD 69 billion, an increase of 0.05%

compared to the year 2013, accounting for 0.88% of the whole country. In 2014, the aquatic and marine products sector of Thanh Hoa continues to face many difficulties and challenge of weather, disease, market and volatility in Bien Dong. But overall the sector has more advantages than the year 2013, because: flood situation occurred less, the domestic economy has been recovering, purchasing power rose in the country, many agricultural products in the market are well consumed.

In 2015, the value of national export turnover reached USD 6.660 million, of which export value of Thanh Hoa is USD 75 million, accounting for 1.126%. If comparing to other export commodities of the province, the aquatic and marine products for years remained at second position after the light industrial goods and handicraft, contributing greatly to the province's GDP growth. In the world, Thanh Hoa aquatic and marine products are increasingly selected by consumers thereby aquatic and marine product export market is expanded, the value of exports has increased.

2.2. The quality assurance in recent years

Requirement of major markets on standards of quality and food safety of marine and aquatic products is very high. The major markets (EU and the US) just import the products of Vietnam marine and aquatic products processing enterprises that have been issued certificate of standards of quality and hygiene. The stable quality assurance is one of the difficult problems for Vietnam marine and aquatic products processing enterprises today. Due to difficulties in purchasing raw material meeting quality standards as prescribed by Europe, although a lot of ponds, cages are in the harvest, creating instable quality of aquatic and marine products for export and facing problems on the international market.

So far, some shipments detected not to ensure food safety and hygiene have been returned, but Thanh Hoa has not had any marine and aquatic products belonging to that shipment. Most products of Thanh Hoa marine and aquatic processing enterprises have not met the standards of foreign markets, especially on the major markets. Currently, quota export of Thanh Hoa marine and aquatic products mainly concentrates in two businesses (Thanh Hoa Marine Products Import-Export Joint Stock Company and Long Hai Trading Transportation and Seafood Processing Joint Stock Company) with the main products: surimi, steamed clam, other seafood to market of Thailand, Korea, China, Japan and the EU countries.

2.3. Issues in Brand Building

For Thanh Hoa processed aquatic and marine products, most aquatic and marine product exports do not have their own brands, they are mainly consumed in foreign markets under the brands of the importers or distributors, supermarkets. This affects export prices, while the other competitors have been successful in building and promoting their brands. Current export method of Thanh Hoa province is mainly by informal way with simple purchases and procedures between enterprises, vessel owners with countries (particularly

China). Preserving techniques and technologies of the province are still poor, so long day offshore fishing boats usually sell to purchasers of other countries offshore. Thanh Hoa's majority of aquatic and marine enterprises are of small scale and they cannot meet the demands of formal orders in big quantity.

Values of quota and non-quota exports of Thanh Hoa aquatic and marine products are showed in Figure 1. In 2000 total export value was USD 14.952 million, including non-quota export value of USD 9.006 million, accounting for 60.23%, in 2005, non-quota export value of reached 70.83% with an increase of more than 10%, in 2020 this ratio was increased to 90.46% and in 2015 it was 80.05%.

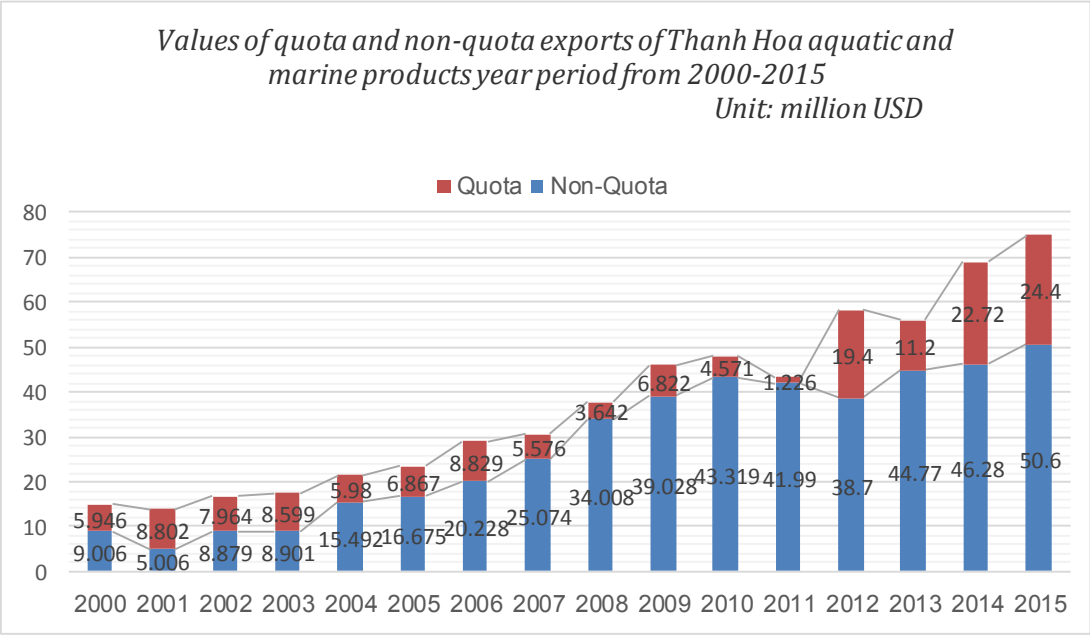

Figure 1. *Values of quota and non-quota exports of Thanh Hoa aquatic and marine products*

3. Some suggestions for developing aquatic and marine products

3.1. Solutions to improve product competitiveness

Thanh Hoa aquatic and marine products are determined for consumption in other provinces and for export. However, trend of regional and international economic integration generates increasingly fierce competition especially for imported goods. To overcome difficulties, stimulate production and development, market solutions should focus on the following issues:

Investing in improving market forecast capacity, especially medium and long-term forecasts of quantity, quality and type of goods that the market needs; the situation of supply-demand and price of each type of goods. Based on market information making investment and

production plans, and then chooses form and timing of market penetration for the highest effectiveness.

Stepping up trade promotion, market forecasts, encouraging and creating favorable conditions for businesses, scientists inside and outside the province in signing production and consumption contracts to expand and develop domestic market of aquatic and marine products and for export. They conduct the program "Link 4 sectors" to promote aquatic and marine products via contracts.

Investing in the construction of aquatic and marine product processing facilities to generate stable output markets, add value to aquatic and marine product.

Investing in development of market system, quickly forming exchange venues in rural areas for consumption of aquatic and marine products. In the immediate run, developing towns, townships and centers of "industrial - rural services", wholesale markets in association with main traffic routes and rural markets for consumption of aquatic and marine products to farmers, they encourage all economic sectors to participate. Guiding and creating conditions for cooperatives to ensure and cover outputs for aquatic and marine products.

3.2. Solutions to ensure quality standards in accordance with international market requirements

Solutions to improve quality of aquatic and marine products as required by international markets should be carried out from the phase of breeding, caring, exploitation, preservation and processing. It is necessary to boost fishing extension programs, investments of province for seed research and advanced processes to ensure food safety and hygiene. At the same time, it is required to support and encourage enterprises to build and manage product quality according to ISO, HACCP, etc.

Organizing regular activities of education and communication fishermen, farms, businesses and economic entities engaged in aquaculture, exploitation and processing of aquatic and marine products of the province by multiple channels such as radio, seminars, training, etc. on requirements of aquaculture, exploitation and processing of aquatic and marine products to ensure quality and food safety in accordance with requirements of international economic integration, the business knowledge in production, processing, consumption, etc.

Among the factors that affect the quality of aquatic and marine products for export, seed is considered as an important factor. To boost the efficiency of seeds, it is needed to make more investment in research and application of seed with high yield, quality and economic value and suitable with each locality and the tastes of consumers.

3.3. Brand development solutions

In the current context of integration, competition does not only limit at quantitative criteria such as price, quality, but also open to the intangible values such as reputation, image,

etc. of products. In recent years, Thanh Hoa aquatic and marine products have not created rightful position in domestic and international markets due to lack of its own brand. Therefore, building and developing brands for Thanh Hoa aquatic and marine products is very necessary and required from enterprises and the State.

For businesses

They should promote activities of establishing and advertising brands of aquatic and marine products in domestic and international markets. The branding for aquatic and marine products requires a coherent strategy from selection of seeds, farming, fishing, preservation and processing. When brands are available, it is important to pay attention to protection and preservation, promotion of brands a sustainable way. It is required to register protection of trademarks, product labels, brand at home and abroad so that consumers will be initially familiar with labels, brands and quality of aquatic and marine products of each enterprise and each locality. The key issue to ensure sustainable preservation and development of brands is to continuously improve product quality and developing sales network. At the same time, constantly investing in research and development creates new products to meet consumer demands.

For the province and the State

It is necessary to facilitate policies in management, support and create favorable conditions for enterprises to invest in building and developing brands. At the same time, it is also important to simplify legal procedures to create favorable conditions for enterprises to register trademark protection most quickly. Supporting enterprises in training, provision of information and advising enterprises on registering products trademark, commercial names, geographical guidelines, names and origin of goods in land and abroad. Preventing and protecting trademarks against acts of infringement, counterfeiting, imitation, infringement of intellectual property, etc. the authorities should speed up issuing detailed regulations guiding the implementation of the Law.

4. Conclusion

The issues in quality and brand of aquatic and marine products of Thanh Hoa province are analyzed. They obstruct the international economic integration of Thanh Hoa, especially when Vietnam was an official member of the WTO in 2007 - when low-cost imports extended to all goods. The Trans-Pacific Partnership (TPP) was signed, it means the challenge for Thanh Hoa's fishery products. Looking for the solutions for developing Thanh Hoa aquatic and marine products export are important. Business enterprises must have strategy to build up the brand, improve product competitiveness, ensure quality standards in accordance with international market requirements, etc. It is needed to implement such solutions synchronously since they have close relations and support each other.

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ANALYSIS OF THE IMPACT OF EXCHANGE RATE AND INTEREST RATE ON STOCK RETURN IN VIETNAM STOCK MARKET

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Abstract: *By using the multiple regression models we find out the impact of exchange rate and interest rate on stock return of 3 companies which present for 3 difference lines: technology - FPT Joint Stock Company (FPT), Construction trades Kinh Bac City Development Share Holding Corporation (KBC) and food industry - Viet Nam Dairy Products Joint Stock Company (VNM).*

Keywords: *Exchange rate, interest rate, stock return, Vietnam stock market.*

1. Introduction

Firstly being introduced since 1988, Vietnam stock market has experienced many periods of fluctuations. From 1988 until now, it has witnessed two important milestones of great significance. In spite of the fact that banking sector has dominated Vietnam economy market from then on, the stock market has still taken an important role. This was explained by the effect of stock market: once the stock market volatiles, it would entail a series of continuous consequences. Moreover, the emerging markets, including Vietnam, have been invested by the foreign cash flows since liberalization and globalization became popular. However, Vietnam stock market has still had to face with many risks such as poor infrastructure, loose legal framework and status of asymmetric information. This is a major concern for investors as well as Vietnam's economy. Therefore, it is important for economic entities participating in the Vietnam stock market to understand the principles of operation of the stock market, the factors affecting the stock market and the impact level of them.

The relationship between the stock price and financial variables has been the subject of numerous studies so far. However, they are often carried out in market, where the stock markets have been well-developed. Moreover, the studies of emerging markets like Vietnam are limited. Thus, this research aims to analyzing the impact of exchange rate and interest rate to the Vietnam stock market and applies APT model to analyze the impact of exchange rate and interest rate to stock return of VNM, FPT and KBC.

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2. Literature review

In reference to conventional economic reasoning, there is a negative relationship between the interest rate and stock market index. The higher the interest rate is, the more money is shifted from the high-risk instruments, for example: stocks and shares, to low risk ones which are savings or fixed deposit accounts. On the other hand, in case that the interest rate is too low, the money will no longer be kept in secure accounts, and the investors will draw them out to invest in stock market with the aim of gaining higher returns.

This theory is supported by many studies. Mahmudul and Gazi (2009) performed a research based on the monthly data in 5 years from stock markets of both developed countries such as Australia, Canada, Germany, Italy, Japan, etc. and developing countries such as Malaysia, Philippine and found that interest rate has a significantly negative impact on share price.

On the other hand, Kurihara and Nezu (2006) proved that in Japan, stock prices and interest rate, especially the domestic interest rate, had a quite blurred relationship.

By using an ordinary linear regression model, after studying the stock market capitalization and interest rate in Nigeria, Ologunde et. al. (2006) concluded that prevailing interest rate has a positive influence on stock market capitalization rate. Mueller (2006) said that the stock market could only be affected but dominated by the interest rate. The more the interest rate increased, the more difficult the borrowing was.

On the other hand, the stock market was not always expected to be affected negatively by the exchange rate. By a survey in Japan, Mukherjee and Naka (1995) have proved that exchange rate had positive impact on stock prices because of the export orientation of Japan, particularly, the more domestic currency was depreciated, the more exports and stock prices were promoted. However, in the study by Kurihara and Nezu (2006) which concluded that there is a "possibility that the industrial and economic structure have changed in Japan" and "stock prices in the United States (U.S.) do have significant impact on the stock prices in Japan, as U.S. is the largest trading partner of Japan".

By applying Kwiatkowski Philips, Schmidt and Shin coin testing techniques on 4 countries, Malaysia, Indonesia, Thailand and Singapore, Chong and Tan (2007) has conducted a research on the relationship between the macroeconomic factors such as interest rate, money supply, consumer price index, trade balance and composite indices and the fluctuations of exchange rate and concluded that this relationship was linearly in the same direction in the long term. It was suggested that the government and investors should "smooth the exchange rate variability and pursue economic policies that will give greater exchange rate stability" (Foo, 2009).

On the other hand, a study in China by Li and Huang (2008) indicated that Renminbi (RMB) nominal exchange rate was integrated of order one together with the stock returns. However, according to Engle - Granger test, exchange rate did not generate stock returns because there was no relationship between the two of them with the significant level of 5 percent in the long term (Foo, 2009).

In reference to Aydemir and Demirhan (2009), the exchange rate had both negative and positive and even mixed influence on all the stock market indicators in Turkey. However, Aydemir and Demirhan (2009) also indicated the only negative causal relationship between exchange rate and all the stock market indicators.

3. Methodology

The researcher will use the descriptive statistics and multiple regression models to analyze the data. The relationship between returns of three stocks and exchange rate (ER) and interest rate (IR) will be identified and verified using graphical and numerical methods. The models will be estimated to check for the significance of each independent variable in each model.

The data used on this study is the monthly basic. Besides the data of interest rate and exchange rate on the official sources such as Ministry's websites or General Statistical Office (GSO), the returns of three stocks VNM, KBC and FPT were collected in the Ho Chi Minh Stock Exchange. Interest rate is 6th Treasury bill rate and for exchange rate VND to USD rate is selected. The monthly data from 1/2010 to 6/2015 is selected for the analysis. The reason to select the three companies is that they are now operating well in the market with the dominating effect. Over the last few years, they have received a lot of attention from investors in the market.

4. Model Estimation

In this section, the researcher will estimate three models for three stocks where the dependent variables are returns; independent variables are interest rate and exchange rate. In each case, we explain the results, check for the suitability, check for the assumption of the models.

4.1. Model 1. Returns on the stock of VNM

Table 1. *Regression output of returns of VNM*

Dependent Variable: RETURN_1
Method: Least Squares
Date: 10/29/15 Time: 02:19
Sample: 1 66
Included observations: 66

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.387696	0.148138	2.617120	0.0111
IR	-0.036973	0.002326	-15.89438	0.0000
ER	5.17E-05	7.14E-06	7.246519	0.0000
R-squared	0.828860	Mean dependent var		1.105152
Adjusted R-squared	0.823427	S.D. dependent var		0.132633

S.E. of regression	0.055733	Akaike info criterion	-2.892092
Sum squared resid	0.195690	Schwarz criterion	-2.792562
Log likelihood	98.43903	Hannan-Quinn criter.	-2.852763
F-statistic	152.5596	Durbin-Watson stat	0.660949
Prob(F-statistic)	0.000000		

Table 1 above shows the regression results of the model estimating the relationship between the returns of stock of Vinamilk on interest rate and exchange rate. We can see that both of variables are significant in model by looking at the p-values in the output. It suggests that in the Vietnam stock market, in the case of VNM stock, interest rate and exchange rate really affect the return of an asset. In this case, the result shows that there is a positive relationship between two variables.

R^2 value of 0.83 means that about 83% of the variation in the return of VNM can be explained by the interest rate and exchange rate.

The value of F statistic and respective probability shows that the model estimation is significant with level of 5%

4.2. Model 2. Returns on the stock of KBC

Table 2. *Regression output of returns of KBC*

Dependent Variable: RETURN_2
Method: Least Squares
Date: 10/29/15 Time: 02:25
Sample: 166
Included observations: 66

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.243444	0.258953	0.940108	0.3508
IR	-0.054759	0.004074	-13.43994	0.0000
ER	6.29E-05	1.25E-05	5.026640	0.0000

R-squared	0.766867	Mean dependent var	1.021473
Adjusted R-squared	0.759347	S.D. dependent var	0.197596
S.E. of regression	0.096934	Akaike info criterion	-1.784526
Sum squared resid	0.582559	Schwarz criterion	-1.684170
Log likelihood	60.99711	Hannan-Quinn criter.	-1.744929
F-statistic	101.9713	Durbin-Watson stat	1.216692
Prob(F-statistic)	0.000000		

Interest rate has a negative effect on the returns of KBC but as in the case of VNM, exchange rate has a positive effect. Model explains for about 67% (R^2) of the variation in returns of KBC. Model is also significant under F test.

Checking for assumption, we can see that normality of error terms is valid under Jacque-Bera test (table 2) and there is no serial correlation using the LM test (p-value is larger than 0.05 - table 3). There is also no heteroscedasticity under White test (table 3).

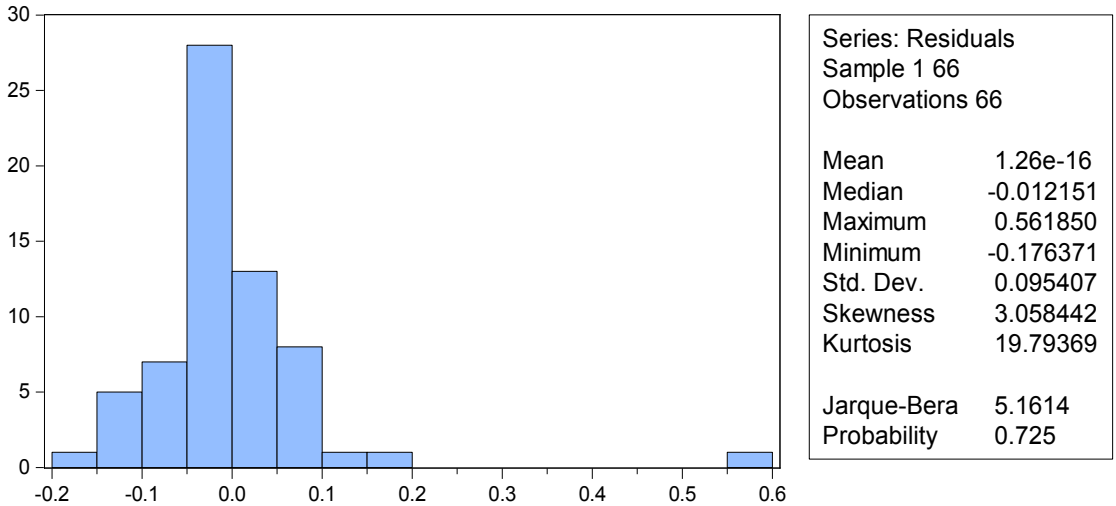

Figure 1. *Test output of normality of residuals for model of KBC*

Table 3. *Test output of serial correlation for model of KBC*

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.250403	Prob. F(2,60)	0.1279
Obs*R-squared	5.681484	Prob. Chi-Square(2)	0.1179

Table 4. *Test output of heteroscedasticity of for the model of KCB*

Heteroskedasticity Test: White

F-statistic	0.648823	Prob. F(5,59)	0.6635
Obs*R-squared	3.387747	Prob. Chi-Square(5)	0.6404
Scaled explained SS	28.96341	Prob. Chi-Square(5)	0.0000

4.3. Model 3. Returns on the stock of FPT

For the returns of FPT, estimation result shows that both interest rate and exchange rate are not significant with level of 5%, Model is also not significant. It may suggest that the returns of FPT (very big and attractive stock in the market) are not affected by the adjustment

of macro-economic factors like interest rate or exchange rate. This is also an interesting result as in the previous two cases of VNM and KBC, the two factors are well significant but it is not the case of FPT. It is recommended that depending on each asset, the effect of factors can be different in terms of both direction and magnitude.

Table 5. *Regression output of returns of FPT*

Dependent Variable: RETURN_3
Method: Least Squares
Date: 10/29/15 Time: 02:29
Sample: 1 66
Included observations: 66

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.098261	3.275837	-0.945792	0.3479
IR	-0.090745	0.051440	-1.764089	0.0826
ER	0.000252	0.000158	1.593901	0.1160

R-squared	0.082328	Mean dependent var	1.218859
Adjusted R-squared	0.053195	S.D. dependent var	1.266598
S.E. of regression	1.232449	Akaike info criterion	3.300272
Sum squared resid	95.69261	Schwarz criterion	3.399802
Log likelihood	-105.9090	Hannan-Quinn criter.	3.339601
F-statistic	2.825973	Durbin-Watson stat	2.090880
Prob(F-statistic)	0.066782		

5. Conclusion

5.1. Major findings

With three stocks selected, we found out that, on the Vietnam stock market, interest rate plays an important role and has effect (as theory) on the returns. However, exchange rate does not follow the theoretical background of impact in which the relationship is positive. That is an interesting result from the Vietnam market.

5.2. Recommendations

Interest rate will be used as the key factor to adjust the operation of stock market. Policy makers can consider the reduction in the basic interest rate, not only to facilitate the growth of economy but also promote the stock market.

To use the exchange rate as the tool for management, it should be carefully considered as the effect of exchange rate adjustment is sometimes not clear to the economy in general and on the stock market in particular. The adjustment of exchange rate should be placed in the context of many changing factors in the economy that make the impact of summarized factors could be clear and measured.

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USING SOFTWARE TO IMPROVE FIRST-YEAR ENGLISH MAJORS' PRONUNCIATION: AN ACTION RESEARCH AT HONG DUC UNIVERSITY

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Abstract: *This is an action research project conducted in a speaking course for first-year English majors at Hong Duc university. Realizing that freshmen' poor pronunciation hindered their performance in speaking classes, the teacher/researcher designed a new teaching program to supplement the current syllabus with the hope to improve their English pronunciation. The program involved using computer software to provide students with explicit instructions on English sounds, word stress, sentence stress, and intonation. The data were obtained from audio recording, classroom observation, and informal interview with students. The findings show that the intervention helps improve English pronunciation for first-year English majors at Hong Duc university.*

Keywords: *Software package, sounds, stress, intonation.*

1. Introduction

During the last decades, one of the ultimate goals of teaching foreign languages in general and English in particular has been helping learners use spoken language effectively to establish successful communication. That is why the magnitude of speaking and pronunciation teaching has been paid special attention to. A number of research studies have dealt with pronunciation teaching and problems students face in English pronunciation. The research findings have revealed that pronunciation frequently interferes with communication. Mispronunciation of sounds and misuse of prosodic features are responsible for the listeners' failure to comprehend and interpret what the speaker means (Kelly, 2000).

While intelligible pronunciation may suffice for non-English majors at other departments of Hong Duc university, English majors at Foreign Language Department must go far beyond the intelligibility to the point that they should sound as native-like as possible. This is because these students will become teachers of English and their pronunciation will

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affect many generations to come. However, my observation in speaking classes in the first week of the semester showed that my students made many mistakes in their pronunciation. I tried to correct some of them. However, these students seemed so solidly stuck to their initial pronunciation that right after the teacher's feedback, they returned to their mistakes. Therefore, I decided to provide them with proper training using the software package that is vivid enough to change their fossilized mistakes.

2. The study

2.1. Subjects

The students participating in the research were thirty first-year English majors of Foreign Language Department at Hong Duc University. They come from different districts in Thanh Hoa province and have learned English for at least seven years. Freshmen at Foreign Language Department were put in different groups based on their results in the placement test. Therefore, it can be assumed that the participants who are in the same group are homogeneous in their level of English proficiency.

2.2. Instruments

In order to help me see the effects of my intervention, three different instruments were used, namely classroom observation, informal interviews with the students and audio-recording.

Audio-recording

This is the main instrument to collect the needed information in my research which was administered to students at the second and final week of the semester. The purpose of the first audio-recording is to find out current situation of students' pronunciation regarding sounds, stress, and intonation. The second audio-recording is aimed at investigating the effectiveness of using software in teaching pronunciation.

Classroom observation

My observation during the intervention program fell on the following aspects: Students' accurate pronunciation of sounds, word stress, sentence stress, and intonation. My observation was noted down in my teaching journals after each lesson.

Informal interview with students

Throughout the whole term, I conducted informal interviews with my students during class breaks. My major concerns are their opinions of the new way of presenting the pronunciation using the software, and how useful they think it is. Information obtained from my students was also included into my teaching journals.

2.3. Procedures

At the beginning of the semester, a pretest was conducted to the students to investigate into the current situation of their pronunciation. Then the intervention was provided with

focus on the aspects of pronunciation that most students have trouble with. During the speaking classes, the teacher used the software package named *Pronunciation Power* to give the students explicit instructions on how to pronounce sounds, put stress on words or in sentences, and speak with the right intonation in English. Then the students practiced with the help of the software which provides a variety of exercises. At the end of the semester, a post-test was administered to these students to discover whether the intervention had any positive effect on their pronunciation.

Furthermore, from the very first lesson of the course, the teacher kept records of the students' pronunciation in speaking activities in her teaching journals, which lasted for the whole term. At the end of the term, records of teacher observation were analyzed. In the class breaks during the term, informal interviews with the students were carried out and also kept in the teacher's teaching journals.

2.4. The intervention

The whole program took place in eleven weeks of the semester excluding the first two weeks and the last one reserved for the researcher's preliminary investigation, pre-test, and post-test. The detailed intervention program involved teaching different aspects of pronunciation as shown in the following table.

Table 1. *Aspects of pronunciation to be taught using Pronunciation Power*

Week	Aspects of pronunciation
1	The researcher's preliminary investigation
2	Pre-test
3	Long and short vowel pairs
4	Vowels /æ/ vs. /e/ and /a:/ vs. /ʌ/
5	The consonants /θ/ and /ð/
6	The consonants /tʃ/, and /ʃ/
7	The consonants /dʒ/, and /ʒ/
8	Final consonants clusters
9	Word stress
10	Sentences stress
11	Intonation of statement
12	Intonation of wh-questions
13	Intonation of yes-no questions
14	Post-test

These aspects of pronunciation were taught by using *Pronunciation Power,* an interactive software program that focuses on developing students' individual sounds and basic

suprasegmental features. Three areas of study in the package are comprised of Lessons, Speech Analysis, and Exercises. The "Lessons" provides visual and auditory instructions for producing sounds. Audible sounds are accompanied by visual illustrations of real-time articulatory movements for the production of the sounds. A written description, and at times suggestions, for producing the sound is provided, which the user can access as an auditory clip. The "Speech Analysis" offers the users a look at graphic representations of the sound utterance as a waveform. The user is able to record their own production of the sounds, and then compare their waveform of the sounds with those of the instructor. The waveforms provide information concerning the amplitude and pitch of sounds, as well as duration. The "Exercises" includes a variety of exercises for students to practice.

2.5. Results and discussions

2.5.1. English sounds

In order to find out how students pronounced English sounds before and after the intervention, the researcher had her students read aloud a long passage which contains a variety of sounds. The audio script of this was used as the standard tool for the analysis of the students' pronunciation. The results are shown in the following table.

Table 2. *Students' mistakes in pronouncing English sounds*

Kind of Mistakes	Pretest		Posttest	
	No. of students	%	No. of students	%
1. Producing long and short vowel pairs identically	26	86.67%	8	26.67%
2. Pronouncing /æ/ like /e/ or /a:/	25	83.33%	14	46.67%
3. Omitting final consonant clusters	26	86.67%	13	43.33%
4. Producing /θ/ like 'th' and /ð/ like 'd'	24	80%	5	16.67%
5. Having wrong pronunciation with /tʃ/	20	66.67%	6	20%
6. Having wrong pronunciation with /ʃ/	17	56.67%	5	16.67%
7. Having wrong pronunciation with /dʒ/	16	53.33%	8	26.67%
8. Having wrong pronunciation with /ʒ/	16	53.33%	8	26.67%

The figures in the table show that the intervention has made some changes with fewer students making mistakes related to individual sounds. While 26 students (accounting for 86.67%) failed to distinguish long and short vowel pairs in the pretest, only 8 students (accounting for 26.67%) had this problem in the posttest. The sounds /θ/ and /ð/ also seem

manageable for the students when the number of students making mistakes with these sounds sharply decreases from 80% to 16.67%. Moreover, the sounds /tʃ / and /ʃ/ also witnessed a positive change in the students' pronunciation. 20% of the total number made mistakes with the sound /tʃ/ and 16.67% with the sound /ʃ/ in the posttest in comparison with 66.67% and 56.67% respectively in the pretest. Similarly, the sounds /dʒ/ and /ʒ/ also witnessed improvement. Among 16 students (53.33%) who made mistakes with these sounds in the pretest, 8 (26.67%) could make progress, and the other 8 (26.67%) kept their initial wrong pronunciation. It appears that the sound /æ/ is the most problematic for the students. After the intervention, 46.67% of the students could not make any improvement with this sound. Final consonant clusters are also a problematic issue. 43.33% of the students kept omitting final consonants when speaking.

In short, it can be concluded that the intervention has some positive effects on improving students' pronunciation of English sounds. Students made great progress with the distinction between long and short vowel pairs. Their pronunciation of the sound /θ/, /ð/, /tʃ/, /ʃ/, /dʒ/ and /ʒ/ also significantly improved. Nevertheless, little improvement is found for the pronunciation of the sound /æ/ and final consonant clusters.

2.5.2. Word stress and sentence stress

As regards word stress, students were required to read ten words with different stress patterns. The detailed results are shown in table 3 below.

Table 3. *Students' performance of word stress*

Word No.	**Pattern (*A small 'o' represents a syllable, the big 'O' represents the stressed syllable)***	**Pretest**		**Posttest**	
		No. of correct responses	**%**	**No. of correct responses**	**%**
1	Oo	10	33.33%	23	76.67%
2	oO	7	23.33%	20	66.67%
3	oOo	9	30%	24	80%
4	Ooo	11	36.67%	20	66.67%
5	ooO	12	40%	18	60%
6	ooOo	11	36.67%	17	56.67%
7	ooOo	7	23.33%	16	53.33%
8	ooOo	9	30%	19	63.33%
9	ooOoo	6	20%	18	60%
10	oooOo	8	26.67%	16	53.33%

The results in the table show that after the intervention, the number of students who put stress on the right syllable of the word increased although the rising rate was not as significant as the researcher had expected. It seems that the words with fewer syllables are easier for students than those with more syllables. The first four words with two or three syllables received more correct answers than the others in both the pretest and the posttest. Word No. 3 which has 3 syllables with stress on the middle syllable had the most correct answers (up to 80%) in the posttest.

In terms of sentence stress, students were required to read seven sentences with stress put on important words. To pronounce these sentences correctly, students have to identify both stressed words of the sentence and stressed syllable of each of these important words. The findings from the study are shown in table 4 below.

Table 4. *Students' performance on sentence stress*

Sentence No.	**Pattern** (***A small 'o' represents a word in a sentence, a big 'O' represents a stressed word)***	**Pretest**		**Posttest**	
		No. of correct responses	**%**	**No. of correct responses**	**%**
1	OoOo	9	30%	22	73.33%
2	oOoOo	8	26.67%	19	63.33%
3	OooOo	7	23.33%	17	56.67%
4	oOoooO	6	20%	18	60%
5	oOooOoOoo	4	13.33%	17	56.67%
6	ooOoooOoOo	5	16.67%	16	53.33%
7	oooOOooOooO	6	20%	16	53.33%

The figures in table 4 show that, in the pretest, the number of students who put the right stress on the right important words in the pretest was not high. Sentence 1 received the most correct responses from students with 9 correct answers (accounting for 30%). The longer the sentences are, the fewer correct responses there are. Sentences 8, 9 and 10, which are the longest sentences, received the least correct answers, only 13.33%, for sentence 8, 16.67% for sentence 6 and 20% for sentence 7. In the posttest, the number of students who had correct responses increased significantly. Sentence 1 also received the most correct responses in the post test (73.33%). The next highest number is for sentence 2 which had 63.33% of correct responses. Sentence 5 and 6 witnessed the least correct responses (only 53.33%). Whatever, the number of correct responses in the posttest increased considerably in comparison with that in the pretest.

2.5.3. Intonation

As for intonation of statements, yes-no questions, and wh-questions, the results are shown in the table below.

Table 5. *Students' intonation of statements, yes-no questions, wh-questions*

Sentence		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pattern		↘	↘	↗	↗	↗	↘	↗
Pre-test	**No. of correct patterns**	25	20	16	16	11	19	14
	%	83.33%	66.67%	53.33%	53.33%	36.67%	63.33%	46.67%
Post-test	**No. of correct patterns**	30	27	25	26	22	27	26
	%	100%	90%	83.33%	86.67%	73.33%	90%	86.67%

As can be seen from the table, 25 students, which accounts for 83% of the total 30 students, could produce a statement - sentence 1 with the right patterns in the pretest. It means that most of these students did not have much trouble with the intonation of statements. However, when it comes to yes-no questions and wh-questions, the number of right patterns fell down. Only 11 students (36.67%) could produce the right pattern for sentence 5, a yes-no question. My informal interview with these students revealed that many of them knew the intonation pattern of yes-no questions but they could not put it into real speaking. The fact is that they produced yes-no questions with a flat intonation or with a rising tune but in an unnatural way.

As the researcher had expected, the students performed strikingly well after the intervention. 30 students (100%) could produce sentence 1, which is a statement, with the right pattern. This is explainable because up to 25 students (83%) could pronounce a statement correctly in the pretest. Futhermore, sentences 2 and 6, which are wh-questions both received 27 correct patterns which made up 90%. For yes-no question - sentences 3, and 7, the students also made progress with 25 correct patterns for the former and 26 for the latter in comparison with 16 and 14 respectively in the pretest. All in all, the students' intonation of statements, yes-no questions, wh-questions, has greatly improved at the end of the research program.

It can be concluded that, as a result of the intervention, the students' pronunciation has considerably improved. The results of the study support the view by Stenson, Downing, Smith, & Smith (1992) that the use of software with visual displays of language learner speech and the opportunity to visually and aurally compare output to that of a native speaker can improve target language pronunciation. Furthermore, the findings of this study fairly correspond with the assumption Derwing, Munrol and Wiebe (1998) have made, that is, explicit instruction is essential in teaching pronunciation. Explicitly teaching learners about the features of pronunciation will help them master the features faster than letting them pick up the features through exposure to the language, particularly in a foreign language context.

Therefore, it is necessary for ESL teachers to draw learners' awareness to these features and to provide them with explicit training. On the other hand, the results of the study are also consistent with the findings in my related investigations (Levis, 2005; Saito, 2007) that segmental should be taught prior to suprasegmental features. This result does not mean that students do not have the ability to perceive the suprasegmental features at the initial stage, but that they need to have basic understanding of sounds before moving into the more complicated issue of prosody.

2.5.4. Further findings from the teacher's class observation and informal interviews with the students

Further findings from the teacher' observation during class hours and informal interviews with the students during breaks are as follows.

Firstly, the students held the new way of teaching pronunciation in high regard. They acknowledged that the use of software in teaching and learning pronunciation did a great help in improving their pronunciation. Secondly, during the class hour with the exploitation of software, the students were highly-motivated. They took part in the lesson actively and enthusiastically. All the students held a positive attitude towards using software in pronunciation lessons. The informal interviews with the students revealed that the reasons for their high motivation consisted of their interest in vivid images and sounds.

On the other hand, using the software *Pronunciation Power* in teaching pronunciation also reveals some disadvantages. At the beginning of the project, the students complained about some difficulties which are mainly related to technical issues such as being unfamiliar with some computer functions, or being unable to run the software. However, these problems were easily solved by the teacher's instructions.

3. Conclusion

An action research project was conducted in a speaking course in the first semester for thirty first-year English majors of Foreign Language Department at Hong Duc university. The project involved exploiting the computer software entitled *Pronunciation Power* to provide students with explicit instructions on English sounds, word stress, sentence stress and intonation and relevant exercises for them to practice. The instruments used for obtaining the data consisted of audio recording, classroom observations, and informal interviews with students. The researcher's initial investigation and the pretest results showed that the students' difficulties concerns long and short vowel pair distinction, and the sounds that do not exist in Vietnamese such as /æ/, /θ/, /ð/, /tʃ/, /ʃ/, /dʒ/, and /ʒ/. Furthermore, stress and intonation are also the students' weaknesses. The intervention took place from week 3 to week 14 of the semester. The findings from the posttest results, teacher's observation and informal interview with students showed that the intervention helps improve English pronunciation for first-year English majors at Hong Duc university.

The findings of the study implicate that software packages should be integrated in teaching and learning English pronunciation in order to increase the quality of EFL education in general and English pronunciation in particular.

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GENERATION STABLE CELL LINE USED FOR PROTEIN EXPRESSION SYSTEM

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Abstract: *The ecdysone inducible system was generated for checking the the toxicity of the target gene which was transfected into the cells. The retinoid X receptor (RXR) was transfected into HEK293FT to generate an inducible stable cell line pVgRXR-HEK293FT. For checking the function, the cells transfected with pIND-GFP and induced by 1μM ponasteron A for GFP expression. The fluorescence signals were detected in the transfected and induced cells informed the success of experiment.*

Keywords: *Ecdysone inducible system, ecdysone receptor, pVG-RXR, HEK293FT.*

1. Introduction

In order to generate the target proteins for scientific work, cellular protein expression systems are widely utilized. However, besides other influences, the success of protein expression experiments can be limited due to a toxic side effect of overexpression of target protein. In order to overcome this limitation, inducible expression systems like the glucocorticoid inducible mouse mammary tumor virus (MMTV) system, ecdysone-inducible *Drosophila* analog promoter/receptor (EcP) system and the tetracycline-dependent system (Tet) are commonly used (Meyer-Ficca et al, 2004).

The ecdysone inducible system displays a low basal activity, high inductivity and fast response. And the most important feature is its switch on or off ability depending on certain requirements (Padidam et al, 2003; Meyer-Ficca et al, 2004). In addition, due to the natural lipophilic form, ecdysones are able to penetrate into all tissues and have a short half-live which allow precise and potent inductions (No et al, 1996; Oehme et al, 2005). Moreover, ecdysteroids are not toxic and are not known to affect mammalian physiology (No et al, 1996). Based on these perspectives, the ecdysone inducible promoter system was utilized to induce the expression of different subunits of AChR in this study.

Belonging to ecdysteroid family, ecdysone is the insect molting steroid hormone triggering metamorphosis in insects, for example *Drosophila melanogaster*. An increase of ecdysone concentration in *Drosophila* leads to the expression of genes coding for proteins that are necessary for larva development. The synthesized ecdysone inducible system bases on two

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plasmids. One is a receptor expression plasmid, pVg-RXR containing the modified ecdysone receptor (VgEcR) with the ecdysone binding domain and the retinoid X receptor (RXR). Another is a plasmid containing the ecdysone- responsive IND promoter which is a fusion of the ecdysone responsive elements and minimal heat shock promoter. In general, the binding of ecdysone or its synthesis analog (ponasteron A, munisterone A) to ecdysone binding domain of VgEcR promotes the dimerization of modified ecdyson receptor (VgEcR) and the retinoid X receptor (RXR). The heterodimer afterwards binds to the ecdysone responsible elements in the synthesis ecdysone responsive IND promoter. (Lueers et al, 2000). The interaction results in the activation transcription of target gene fused downstream to minimal heat shock promoter. The principle is shown in Figure 1.

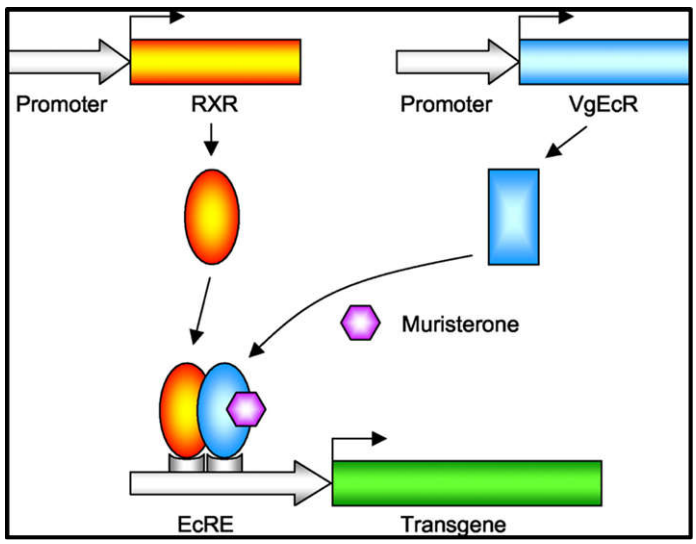

Figure 1. *Schematic diagram of ecdysone-inducible gene expression system*

The inducer (Munisterone) binds to the ecdysone binding domain on the modified ecdysone receptor (VgEcR). This interaction will lead to the hetero-dimerization with retinoid X receptor (RXR). The receptor complex then interacts with the ecdysone responsible elements (EcRE) and acts as the transcription factor and consequently resulting in the activation transcription gene of interest (Figure taken from Luisa Barzon et al, 2004).

However, the requirement to introduce two vectors into the experimental cell system could be the disadvantage of this system. After integration into the genome, transcriptional activity of both constructs could be affected from the flanking genomic sequence resulting in system non- function (Lueers et al, 2000).

2. Materials and Methods

2.1. Materials

HEK293FT cells (Life Technology), pVG- RXR ((Invitrogen), pIND- GFP (Addgene).

The chemicals used in this research were of high quality of Merck (Germany), Sigma - Aldrich (Germany), Invitrogen (USA), Carl Roth (Germany), Fermentas (Germany), VWR (Germany).

2.2. Methods

2.2.1. Cell culture

HEK293FT cells were cultivated in Dulbecco's Modified Eagle Medium (D- MEM) supplemented with 10% fetal bovine serum (FBS), 2mM L- Alanyl - L- Glutamine, 1% non-essential amino acid, 1mM sodium pyruvate and antibiotic G418 (50µg/ ml). The experiments were performed according to Lab manual and SOPs Molecular Cell biology (Kuepper, 2009).

2.2.2. Lipofectamin™ 2000 Transfection

Lipofectamin™ 2000 reagent is a cationic liposome formulation complex with nucleic acid molecule via the ionic interaction. The DNA-Lipofectamin complex overcomes the electrostatic repulsion of the cell membrane and transports into nucleus of the cells (Dalby et al 2004). The procedures were performed according to manual of Lipofectamin™ 2000 reagent (Invitrogen).

Because the HEK293FT cells are not tightly attached to the conventional surface of the cell culture flasks as well as the well plates, the cells were transfected as suspension. The cell seeding number depends on the used plate format. Lipofectamin™ 2000 and DNA were diluted in a serum free medium (table 1). The diluted Lipofectamin was incubated for 5 mins at room temperature (RT) before mixing with the diluted plasmid DNA. The mixture was incubated for 25 mins at RT. The DNA-Lipofectamin complex was subsequently added dropwise in the cells.

Table 1. *Experimental set up for the transfection with Lipofectamin™ 2000*

Plate format	Cell number	Plasmid DNA (µg)	Volume of Lipofectamin (µl)	Volume of serum free medium (µl)
96 well plates	$2x10^4$	0.2	0.5	2x 25
24 well plates	$2x\ 10^5$	0.8	2.0	2x 50

2.2.3. Generation stable cell line pVgRXR HEK293FT

The receptor expression plasmid pVgRXR was transfected into HEK293FT cells by Lipofectamin™ 2000 reagent in 24 well plates. One day after transfection, the cells were harvested by trypsinizion. Thereafter, the cells were transferred into the 10cms cell culture dishes at three different cell number (10^4, $5x10^4$, 10^5 cells/dish). The cells were then supplemented with 200µg/ml Zeocin for selection. Transfected cells were cultivated

for the clone formation for three weeks. HEK293FT cell culture medium containing Zeocin (200 µg/ml) was changed two times per week. The dishes containing more than 50 colonies were discarded.

2.2.4. Isolation pVgRXR- HEK293FT colonies

The plates containing below 50 colonies were washed one time by 1X PBS. The cloning discs were first incubated on 1X Trypsin/ EDTA for 5 mins at RT and then placed on each clone. The incubation was performed at 37^0C for 10 mins. After that, cloning dishes were transferred to 24 well plates containing HEK293FT cell culture medium supplemented with 200µg/ml Zeocin. Cells were cultured until reaching 80-90% confluence and then harvested by trypsinizion. The cells were seeded into 96 well plates to test their function. The rest of cells were transferred into 25cms T flasks for continuing cultivation.

3. Results

HEK293FT cells were transfected with pVgRXR plasmid in 24 well plates. 24 hours following incubation, the cells were trypsinized and transferred to the 10 cm cell culture dishes at three cell densities including 10^4, $5x10^4$, 10^5 cells/dish, three-time replications. The cells were selected by 200µg/ml Zeocin for three weeks. The dishes containing more than 50 clones were discarded.

Finally, 21 clones were picked (data not shown). In order to check the function, the cells were transfected with pIND-GFP in 96 well plates by using Lipofectamin™ 2000. 24 hours after incubation, the target gene expression was induced by 1µM ponasteron A. The induction was performed during five days. In addition, HEK293FT cells served as the control. The pVgRXR-HEK293FT cells transfected with pIND-GFP without ponasteron A induction and non-transfected pVGRXRHEK293FT cells with ponasteron A treatment, were utilized as the additional controls. Six out of 21 clones showed fluorescence signal after transfection with pIND-GFP and induction with 1µM ponasteron A. Representing for all positive clones, the results for clone 11 and 16 are shown in figure 2.

Moreover, HEK293FT cells transfected with pIND-GFP either with and without ponasteron A induction showed very weak fluorescence signal (IA, IB). As expected, no signal was seen in non-transfected HEK293FT cells with ponasteron A induction (IC). In the case of pVgRXR-HEK293FT cells, a strong green fluorescence signal was seen in the cells transfected with pIND-GFP and induced by 1µM ponasteron A (IIA, IIIA). The cells transfected with pIND- GFP and without ponasteron A induction, no signal was detectable in two out of six clones (clone 11-II and clone 17- data not shown) (IIB). In contrast, a few signals were detectable in other four clones (clone 16 -IIIB). Surprisingly, a few signals were also seen in several non-transfected pVgRXR-HEK293FT cells with 1µM ponasteron A induction (IIC, IIIC).

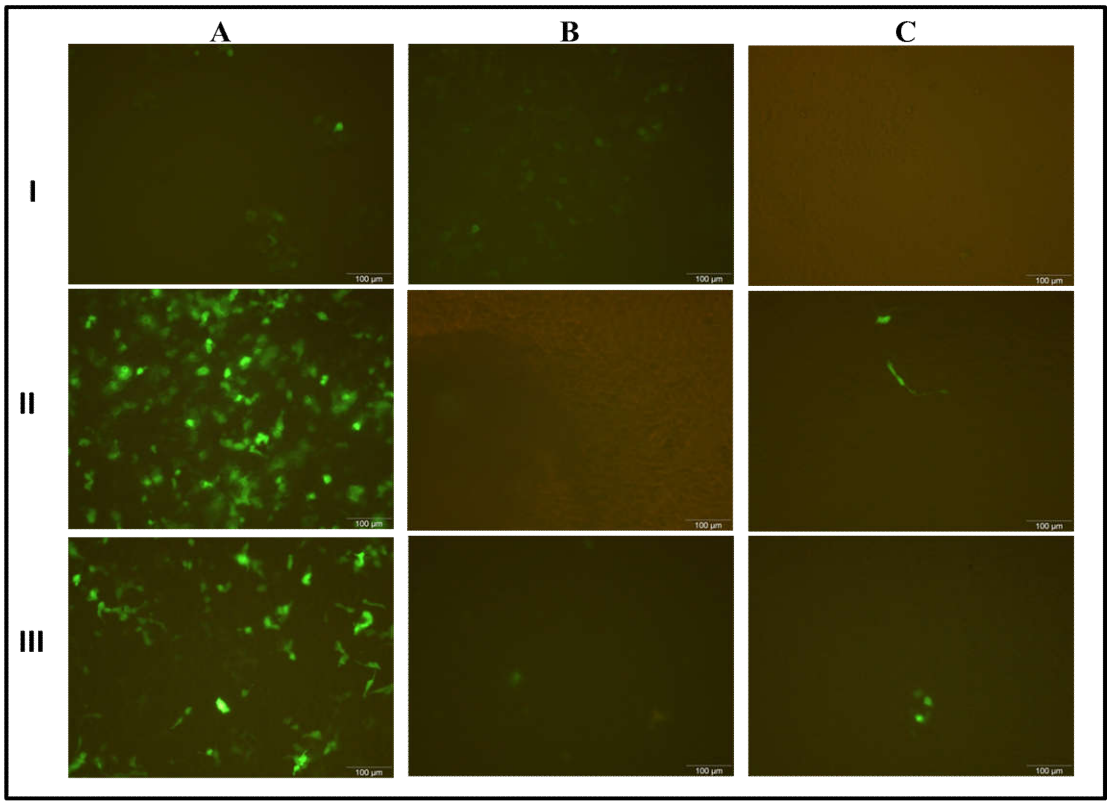

Figure 2. *Characterization the function of stable expressing receptor cell line, pVGRXR HEK293FT*

The HEK293FT cells were suspension transfected with pVgRXR in 24 well plates using Lipofectamin™ 2000. Following 24 hours after transfection, the cells were trypsinzed and transferred into the 10 cms cell culture dishes at three cell concentrations including 10^4, 5x 10^4, 10^5 cells/ dish. The cells were selected by 200µg/ml zeocin. Cells were incubated for clone formation for three weeks. 21 pVGRXR-HEK293FT clones were selected (data not shown). Their function was analyzed by transfecting with pIND-GFP in 96 well plates by Nanofectin (chapter 4.6.2). The cells were incubated for 24 hours and then induced with 1µM ponasteron A. The GFP expression was analyzed 24 hours after post induction.

Lane I: HEK 293FT cell, Lane II: pVgRXR HEK293 FT clone 11, Lane III: pVgRXR HEK293FT clone 16. Lane A: the cells transfected with pIND-GFP with ponasteron A induction, Lane B: the cells transfected with pIND-GFP without 1µM ponasteron A induction. Lane C: the non- transfected with 1µM ponasteron A induction.

The GFP expression was weak in the transfected HEK293FT cells with (IA) and without (IB) ponasteron induction. No signal was detected in non- transfected HEK293FT cell with ponasteron A induction (IC). pVGRXR HEK293FT clone 11 (IIA) and clone 16 (IIIA) were strong in GFP expression. Transfected cells without ponasteron induction showed no GFP expression in case of clone 11 (IIB) or very weak GFP expression in case of clone 16

(IIIB). pVgRXR HEK293FT cells without pIND-GFP but with ponasteron A showed surprisingly some GFP positive cells (IIC, IIIC). Pictures were taken at fluorescence microscope CKX41; Scale bar: 100 µm; Expose time: 2.0s. fluorescence microscope CKX41 48hours after induction. Expose time: 2.0 s. Scale bar: 100 µm.

4. Discussion

HEK293FT cell line (human embryo kidney) is a fast-growing, highly transfected clonal isolate derived from human embryo kidney cells and transformed with the SV40 large T antigen. Expression of the SV40 large T antigen is controlled by the human *cytomegalo virus* (CMV) promoter (Thomas et al, 2004). Special characteristic of HEK293FT cells is not tightly attached to the conventional surface of the cell culture flasks as well as the well plates. At 90% cell confluence, the cells are detached and floated in the cell culture medium.

In order to analyse the cell transfected efficiency, cells were harvested after 48hrs post-transfection, washed, and then resuspended to PBS containing 0.02% EGTA and 1 µg/ml propidium iodide to identify the nonviable cells through propidium iodide fluorescence. Afterwards, the cells were sorted by flow cytometry, evaluated with the Cellquest software to determine the proportion of fluorescent cells. However, the main purpose of project was only generalize inducible cell line to over come the limitation of target protein's overexpression, this step was skipped.

To select a stable cell line pVgRXR-HEK293FT, the cells were treated with 200µg/ml Zeocin for selection. After three weeks cultivation, 21 clones (named 1-21) were isolated in which six clones (2, 11, 14, 16, 17, 21) showed fluorescence signal after transfection with pIND-GFP and induction with 1µM ponasteron A. This matched with the finding of Lueers et al (2000). They transfected pVG-RXR and pER-EGFP into CHO (Chinese hamster ovary) cells and incubated for clone formation and selected by 100µg/ml Zeocin. The isolated clone showed fluorescence signal of GFP after induction with 1µM ponasteron A.

At the begining, the cells were cultivated at three cell densities including 10^4, $5x10^4$, 10^5 cells/dish, repeated three times and after three week cultivation, six functional clones were isolated. Assuming that at the ideal model, each clone was formed from one transfected cell, cloning efficiency was 0.00125%. However, due to the special characteristic of HEK cells, these clones could be also formed by the gathering of floating cells. In this case, cloning efficiency could not be calculated.

The protein expression level was estimated through the GFP signal at the treatment of transfection with pIND-GFP and induction with 1µM ponasteron A. Fluorescence signal indicated that protein expression of clone 11 and 17 was about 85%, clone 14 and 16 was about 50% and clone 2 and 21 was about 30%.

A few cells with weak fluorescence signal were seen in the HEK293FT cells transfected with pIND-GFP either with or without ponasteron A induction. This result demonstrated the GFP expression under normal condition. In addition, four out of six clones showed a very

weak fluorescence signal after transfection with pIND-GFP but without ponasteron A induction (see figure 2). The result indicated the leakiness of this inducible system. Even very small amounts of target gene is expressed could result in exponential increase after certain replication cycles. Due to this fact, these clones were eliminated. Other two clones which did not show the signal after transfection with pIND-GFP without 1μM ponasteron A induction were selected for further investigation. The result suggested that the ecdysone inducible system was the useful tool for controlling the target gene expression.

5. Conclusion

An inducible stable cell line was successful generated. For further research, two clones were selected to re-check the functions and use for gene of interest expression.

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BUILDING MODEL FOR DETERMINANT OF BUSINESS SUCCESS OF SMALL AND MEDIUM AGRO EXPORT ENTERPRISES IN VIETNAM

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Abstract: *Exports have created the growth and the development opportunities for companies to expand their access to foreign markets, and these companies can reach a higher level of production, higher profit and market share. Experts believe that finding out determining factors of business success of export firms is important for both the export companies and countries in the competitive markets in order to improve export performance. This research conducted with the aim of identifying and summarizing the factors effecting business success of small and medium enterprises (SMEs) in the agro exporting sector. The research reviews previous studies on business success of export firms and business success of export firms models to identify the determinant of business success. Twelve managers of agro export SMEs and 5 export experts were interviewed to get more detail on building research model. Findings show that at least eight factors are determining the business success of agro export firms as follows: Manager's capability, product and service, finance resource, export human resource, export marketing strategy, linkage, customer and market, government support and policies.*

Keywords: *Determinant, business success, agro-exporting, SMEs.*

1. Introduction

Many countries considered exports as an important solution to enable local firms to quickly access and integrate into the world economy. Exports also helps local businesses improve the value of their products and maximize regional, price and resource competitiveness. In addition, it creates opportunities for businesses to learn and advance capility. According to the analysis of 41 countries during 1963 to 1985 by the World Bank has showed that economic performance of countries with extroverted economy was better than countries with introverted economy in all aspects. Each country has its own advantages in terms of natural and geographic conditions, thus creating outstanding products that can participate in international exchange to bring the highest value to a host nation (Elahe Kinai

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Harchegani & Abolfazl Solati, 2015). In Vietnam, agricultural products are considered strengths with advantages such as good quality, high yield and low cost. However, the number of products exported is not proportional to its potential. Over the past years, the government has provided many incentives to import and export firms through the support policies to access capital, information, and trade promotion. Therefore, the participation of agro exporting enterprises are increasing and has led to an increase in total export output. However, because of the small size, limited capital and resources, exports SMEs are dificult to directly access the international market but through intermediary exporters. Therefore, the benefits are divided equally in the supply chain, the actual value that export SMEs recieved is very low. Practical research of the agro exporting SMEs in Vietnam detected that in the same dynamic business environment and industry but there is a big gap in business performance among these firms. Many firms with the same size, capital, and market have different business results. Even companies with plentiful capital remain unsuccessful in international business. In contrast, numerous small companies can directly export agricultural products to difficulty markets such as Japan, Korea, USA and France. So, the questions are what the main causes here are; which factors decice the business success of agro export enterprises. From the practical requirement, this research aims to build a model "determinants" of the business success of agricultural exporting SMEs, thereby enabling SMEs to be more proactive in developing strategies, preparing resources and successful access the world market in international business.

2. Theoretical background of the study

The theoretical background of the determinant of business success of agro exporting firms is limited. Therefore, to build a vivid model for agro exporting SMEs, this research will review both relevant literature about the determinant of business success of SMEs and relevant literature about the determinant of business success of exporting SMEs.

2.1. Theoretical issue of determinant of business success of SME

To date, there are a lot of scientific research projects on factors affecting the operations of SMEs. Each document has different approaches and different factors affecting business success of SMEs. For the study in the field of the success of SMEs, Nurul Indarti & Marja Langenberg, (2005) pointed out that two most important elements affecting the success of an enterprise is the characteristic of entrepreneurs and characteristics of SMEs. There is a close relationships between managerial skills and success of SMEs in service sectors in Malaysia such as budgeting skills, human relations skills, business operating skills, skills to obtain shares from market, management expertise skills, skills to offer special services, skills to focus on quality and design of product and services, organizational structuring skills, marketing strategy skills (Yahha at el, 2011). Saleem (2012) investigated some socioeconomic

factors like age, education, experience, skills on the success of small business. He found investment, business profile; entrepreneur experience and culture are significant for the success.

According to the research on SMEs in Bangladesh, service products of enterprises, methods of management and external business environment are important factors deciding business success of firms (Md. Aminul Islam & Muhammad Hasmat Ali, 2008). Relationship between market and enterprises is the important factors affect business activity of SMEs (Pelham, 2005). Factors affect the existence of 227 high-tech enterprises in Japan are managers and capital (Swanthep, 1998), internal factors (capital, technology, human resource and brand name) significantly impacts on success of 152 enterprises in Singapore and 164 enterprises in Australia (Gosh and Kawan, 1996). Marketing factors decide success of import-export enterprises in Malaysia (Summania, 2008). The most important thing for the expansion and development of small and medium enterprises is a serious shortage of necessary funds (Chowdhury, 2007). Human resources are associated with the level of education and their experience (Chowdhury, Amin, 2011); Shapero, Sokol (1982); Gnyawali, Fogel (1994) reported that SMEs in developing countries may encounter numerous obstacles such as lack of training facilities, lack the skills necessary to start and manage medium and small businesses. SMEs have highly skilled workers who have experience with higher education may be more effective (Hewitt, Wield, 1992; Batra an Tan 2003). Other studies (Lee, 2001, Yousuf, 2003, Camp, Anderson, 2000) found that low technological capabilities are a major constraint in the development of small and medium enterprises. H. Khan Jahangir, Abdul Kader Nazmul, Md. Farooque Hossain, Munsura Rahmatullah (2012) present a model to study the factors affecting the development of enterprises including: Entrepreneurship, financial support, appropriate policies and institutions, the linker, appropriate technology, and the relationship market/demand for the product. It is clear from the research that some reform is needed to support the development of SMEs in Bangladesh. The research of (Dr Nazrul Islam & Dewan Muktadir - Al Mukit, 2014) about factors determining the success of SMEs in Bangladesh points out that eight factors such as entrepreneur's authority on business and market strategy followed, natural and type of business and financial support, management know-how, use of modern technology, market accessibility, network, government policy and support, external environment and owner's personal qualities have most effecting on business success of SMEs. Philip (2010) found that the most significant factors that affect the business success of SMEs in Bangladesh are product and service, social network, government support, the way of doing business, management know-how (networking), and external environment. He said that, the more product and service improve, the better result the company has; social network can help company reduce the risks and transaction cost, improve access to business ideas, capital and knowledge (Philip, 2010). A study in Thailand on the success of SMEs identified that the understanding of the business continuity can lead the business success. Both firm's internal and external factors can affect its success. Product and service are the key strategic dimension in business success of Thailand. External factors such as social network, government support are the key strategic dimension in business success. Cooperate also may enable the SMEs to

improve its strategic position, focus on its core business, enter international market, reduce transaction cost, learn new skills and cope positively with the rapid technology change (Chittithaworn, 2011). Another research of Helen Bewley John Forth and Catherine Robinson (2011) on the Evaluation methodology: measurement of drivers of business success and failure launch in Department for Business Innovation and Skills book stated that the input such as financial capital, physical capital, highly-skilled workforce; internal factor in terms of firm size, market diversification, management practices, internationalization and innovation; external factors such alliances, network, product market structure and product market and labor market regulations. In the recent international growth literature, regulations have been identified as one of a number of factors that is likely to assist or hinder the successful implementation of new technology. All factors can be summary in this table as flowing:

Table 1. *Factors affecting on business success of SMEs*

Factors	**Author**	**Independent variables**
Political (government support, government policies)	Md. Farooque Hossain, Munsura Rahmatullah (2012), H. Khan Jahangir, Abdul Kader Nazmul, Md. Farooque Hossain, Munsura Rahmatullah (2012), Dr Nazrul Islam & Dewan Muktadir - Al Mukit (2014), Philip (2010), (Chittithaworn, 2011)	*Government support*
Capabilities (finance access, finance resource)	Swanthep (1998), H. Khan Jahangir, Abdul Kader Nazmul (2012), Chowdhury (2007), Md. Farooque Hossain, Munsura Rahmatullah (2012), Lee, 2001, Yousuf (2003), Camp & Anderson (2000), (Helen Bewley John Forth and CatherineRobinson, (2011)	*Capital access/Capital resource*
Internal factors (human finance, culture, product & service, market)	Pelham (2005), Swanthep (1998), Chowdhury & Amin (2011), Philip (2010), Munsura Rahmatullah (2012), (Helen Bewley John Forth and CatherineRobinson, (2011)	*Product and service*
Manager (personal characteristics, skills, experience)	Marja Langenberg (2005), Muhamat Alat Ali (2008), H. Khan Jahangir, Abdul Kader Nazmul, Md. Farooque Hossain, Munsura Rahmatullah (2012), Hewitt, Wield (1992); Batra, Tan (2003), Dr Nazrul Islam & Dewan Muktadir - Al Mukit, 2014	*Manager characteristics*
Relationship to business (linkage, network)	H. Khan Jahangir, Abdul Kader Nazmul, Md. Farooque Hossain, Munsura Rahmatullah (2012), Philip (2010), (Chittithaworn, 2011), Dr Nazrul Islam & Dewan Muktadir - Al Mukit (2014), Munsura Rahmatullah (2012),	*Social Network and linkage*

Marketing factor (marketing strategy)	Summania (2008), Pelham (2005), Swanthep (1998), Chowdhury & Amin (2011), Dr Nazrul Islam & Dewan Muktadir - Al Mukit (2014), Munsura Rahmatullah (2012), Helen Bewley John Forth and CatherineRobinson, (2011), McMahon, (2001)	*Marketing strategy*
Human resource (employee's skills, knowledge and experience)	Chowdhury, Amin (2011); Shapero, Sokol (1982); Gnyawali, Fogel (1994), Hewitt, Wield (1992), Batra & Tan (2003), Dr Nazrul Islam & Dewan Muktadir - Al Mukit, 2014	*Human resource*

(Source: Author's collection)

2.2. Relevant literature about determinant of business success of (aggro) exporting SME

From reading and finding, the author reveals that determinant of business success and business performance of exporting SMEs are little missing in the literature. However, it can be presented in some edges of factors affecting business success and performance of firms or factors causing/supporting business success of exporting firm.

Elahe Kinai Harchegani & Abolfazl Solati (2015) research about factors affecting on SME's export performance of sports equipment in Tehran point out that environmental factors, managers' commitment to export, managers' marketing strategy, export incentives, objective have a strong affection on business performance of exporting SMEs. According to the research of O Maldifassi on export success factors of SMEs in Chile, the firm level, international quality assurance, workers, local alliances, strategy affecting exporting SME's business success (O Maldifassi Jose' at el, 2014). Export performance is determined by the environment and strategy, firm characteristics and competencies (Aaby & Slater, 1989). The export success of an SMEs comes from its source and capital. Theses determinants can be classified into four categories such as firm characteristics, export oriented management, dynamic and export committed manager, technology resource. Exported product is a key component of the firm's identify and activity, its nature and it will be sold are thus essential in the determination of export performance (O Maldifassi Jose' at el, 2014).

Export marketing strategy can be defined as the means by which a firm responds to the interplay of internal and external forces to meet the objectives of export performance (Cavusgil S and Zou, 1994). Marketing factors decides success of import-export enterprises in Malaysia (Summania, 2008). In another research, they studied the impact of strategies on export performance through the opposition standardization vs adaptation strategy. Product adaptation strategy is the process of setting up coherent planned activities in order to meet the customer's needs (Cavusgil S and Zou, 1994). In the research of Craig Julian and Aron O'Cass, Griffith University-Gold Coast (2002) find out that export marketing strategy is the means by which an export firm responds to market forces to meet its objectives is the key determining factor affecting marketing strategy is the decision to standardize or adapt to the

conditions of the foreign market. Strategy involves all aspects of the marketing product, pricing, promotion and distribution, and in international marketing, the key determining factor affecting marketing strategy is the decision to standardise or adapt to the conditions of the foreign market (Cavusgil and Zou, 1994; Douglas, 2000).

Characteristics of managers also do play a role in the export success of SMEs. When analyzing export performance of firms, one must consider another component of the management are the decision maker (Carole Maurel, 2009). His attitudes, perception and characteristic do play a role in the export success of SMEs (Counders and Remaud, 2003). The education and the age of the manager are two features to consider. The education level and international experience of manager are positive factors of business export performance (Bellaaj and Akrout, 2005). A research Export Experience of Managers and the Internationalization of Firms find that productivity and fixed costs associated to exporting are not the sole determinants of the selection of firms into international markets, but "managerial inputs" are as important (Davide Sala and Erdal Yalcin, 2012). Manager's experience and expertise are also positive role in export performance. It can be explained by the fact that the manager has a great experience, has built a network around him, has necessarily useful knowledge to decide what to do to get on and conquer new market and able to face the obstacles with success (Favre Bonte and Gianellioni, 2007). Gumede and Rasmussen (2002) found that SMF export that have better access to information, business linkages, and intermediaries in the country of destination perform better than those who do not possess those capabilities. According to the Prochile (2005), the following factors can be considered a basis for success for small and medium export firms: competitive prices, strategy, optimal product quality, and financial capital of firm. In an other study by Mai Van Nam (2013) researched factors affected the effectiveness of business performance of small and medium sized enterprises (SMEs) in Can Tho city, Vietnam. Descriptive analysis and regression analysis have been used in this research. The results of the study showed that factors of success are due to governmental supporting policies, years in schooling of businessmen, scale of company, social relations, and revenue impacted the effectiveness of business activities of SMEs in Can Tho city. In the research by Nguyen Thi Loan (2016) on the business environment of small and medium enterprises in agro exporting sector in Thanh Hoa province Viet Nam has showed that government support policy, market, infrastructure, human resource are the main factors affecting SME's development and performance. Ngo Thi My (2016) researched on factors affecting the export of agricultural products of Vietnamese enterprises has identified 11 factors, including 5 macroeconomic factors such as exchange rate, inflation, openness of economy GDP, GDP of the country of export and GDP of the country of importation. 6 factors of the enterprise such as products, marketing policies, quality of personnel, linkages, factors of the characteristics of export enterprises. The study also suggested that the government should support agricultural exporters in terms of accessing capital, technology and information to enhance their competitive advantage.

Table 2. *Determinant of business success of exporting SMEs*

Factors	Author point out	Independent variables
Manager's capability	Elahe Kinai Harchegani at el (2015), (Counders and Remaud, 2003), (Bellaaj and Akrout (2005), (Davide Sala and Erdal Yalcin, 2012), Favre Bonte and Gianellioni (2007), Rutherford & Oswald, 2000; Kristiansen, Furuholt, Wahid, 2003, Ngo Thi My (2016)	*Manager's capability*
Export human resource	O Maldifassi Jose' at el (2014), Nguyen Thi Loan (2016),	*Export human resource*
Finance resource	Gumede and Rasmussen (2002), Prochile (2005), Mai Van Nam (2013), (Nurul Indarti & Marja Langenberg, 2005) (Chittithaworn, 2011)	*Finance resource*
Product and service	O. Maldifassi (2014), Prochile (2005), (Chittithaworn, 2011)	*Product and service*
Marketing strategy	Elahe Kinai Harchegani at el (2015), O Maldifassi Jose' at el (2014), Aaby and Slater (1989), (Cavusgil S and Zou (1994), Summania (2008), Craig Julian and Aron O'Cass, Griffith University-Gold Coast (2002), (Nurul Indarti & Marja Langenberg, 2005)	*Export marketing strategy*
Linkage/network	Gumede and Rasmussen (2002), Prochile (2005), Mai Van Nam (2013), (Nurul Indarti & Marja Langenberg, 2005), Ngo Thi My (2016)	*Linkage among business (social capital)*
Government policies	O Maldifassi Jose' at el (2014), Prochile (2005), Mai Van Nam (2013), Nguyen Thi Loan (2016), Ngo Thi My (2016)	*Government support*
Firm characteristics	O Maldifassi Jose' at el (2014), Aaby and Slater (1989), Mai Van Nam (2013), Nguyen Thi Loan (2016), Kristiansen, Furuholt, Wahid (2003), Ngo Thi My (2016)	*Firm characteristics*

3. Research methodology

This research is developed and applied based on its purpose and according to the method of gathering information, it is qualitative. The research sample is top export entrepreneurs in the field of agro export, decision making and entrepreneurs. As this study is aiming to understand the current status of performance of agro export SMEs and investigate the factors which affect the performance of the agro export SMEs, interviews are selected as

the important source of the primary data required for this research, supplementing the survey data. First, selecting companies, twelve agro exporting SMEs were selected for investigation. After the selection of the companies, establish the contact with the right people who can provide the most relevant data in the companies that are going to be used in the analysis, both e-mails and phones were used as means to communicate. For the next step, an e-mail was formed outlining the purpose of the research and was sent to the authorized people who are responsible for arranging the necessary meetings within the companies. For this study, we used one-to-one interviews, both face-to-face and telephone interview. Face-to-face interviews to four managers were conducted in a natural conversation style between two people, interviewer (a member in the data-collection team) and a department manager. The interviews and telephone conversations were carried out with eight others. The content of the interviews was later written-down in Vietnamese. Total of twelve interviews from twelve agro export SMEs were conducted. Each interview average lasted for 30 minutes for face-to-face interview and lasted for 10-15 minutes for interview via phone. The position of the interviewees, date of interviews, types of interviews, and locations of interviews can be found.

4. Analysis and finding

Based on the results of deep interviews with twelve managers combined with previous research reviewing it is found that, the determinant of business success of SMEs in the agro export sector includes eight factors: Manager's capability, human resources, exporting products, finance resource, government support and policies, marketing strategy, linkage, market and customers are factors strongly affect business success of agro export SMEs. From these remarks, the author forms researching factor and model as follows:

Table 3. *Factors Affecting Business Success for Agro exporting SMEs*

Variables	Scale of concept/ items	Source/manager' s agreement
Manager's capability		
MC1	Enterprise executive have good leadership skills	P1, P2,P3,P6,P7,P10, P11
MC2	Enterprise executives have good management skills	
MC3	Enterprise executives have good communication skills	
MC4	Enterprise executives are always ready to innovate	
MC5	Enterprise executives have high professional knowledge	
Finance resource		
FN1	The enterprise has abundant financial resources	P1,P3, P4,P6,P7,P8,P10, P11, P12
FN2	If necessary, the enterprise is easily access to loans	
FN3	Current capital of the enterprise is long-term capital	
FN4	Our business loan is long-term	

Product and service		
PS1	The products of the enterprise have better quality than the same products	P1, P2,P3, P4,P6,P7,P8,P9, P12
PS2	Products are unique	
PS3	Products meet the technical requirements by importing countries	
PS4	The amount of products is abundant enough to serve all customer needs	
Exporting Human resource		
HR1	Skilled employees perform in export activities proficiently	P1, P2,P3, P4, P5,P6,P7,P8,P9, P12
HR2	Employees have wide knowledge and good understanding of export activities	
HR3	Employees with proficient foreign language skills to find customers and markets	
HR4	Employees are very loyal to the enterprise	
HR5	Employees are very active and creative in their work	
Export marketing strategy		
MS1	The product export channel system spreads widely	P1, P2,P3, P4, P5,P6,P7,P8,P9, P12
MS2	Many export promotion strategies are implemented	
MS3	Frequently perform product promotion activities online	
MS4	Product price strategy is appropriate and effective	
MS5	The export marketing strategies are long-term	
Linkage		
LK1	Has a broad business relationship	P2,P3, P4, P5,P7,P9, P10, P12
LK2	There are many partners who support the export	
LK3	Participate in many professional associations	
LK4	Participate in religious organizations	
Customer/Market		
CM1	The enterprise has a wide export market	P1, P3, P4,P,5P8,P9, P11
CM2	Export markets have similar consumption characteristics to the Vietnamese market	
CM3	Export markets with close geographical proximity (Southeast Asia, Asia)	
Government support		
GS1	Government support to my business is satisfactory	P2, P4,P6,P8,P9, P10, P11, P12
GS2	I got business permit and other permits easily and quickly	
GS3	When running the business, I have no problems of contacting with government	

Regarding factors influencing business success of agro export SMEs, each research focused on specific factors. Most of them examined the factors in the context of developing countries, therefore, in general this is suitable with the research finding. In the context of this research we based on the finding of study in the same field of Thailand, Indonesia, Phillipines the countries have similar economic and resource condition to Vietnam while taking suggestions from the qualitative study into account. Specifically, eight factors were selected, including: Manager's capability, human resources, exporting products, finance resource, government support and policies, marketing strategy, linkage, market and customers which are independents variable and strongly affecting business success of agro exporting SMEs.

The research model for this study is presented in Figure 1.

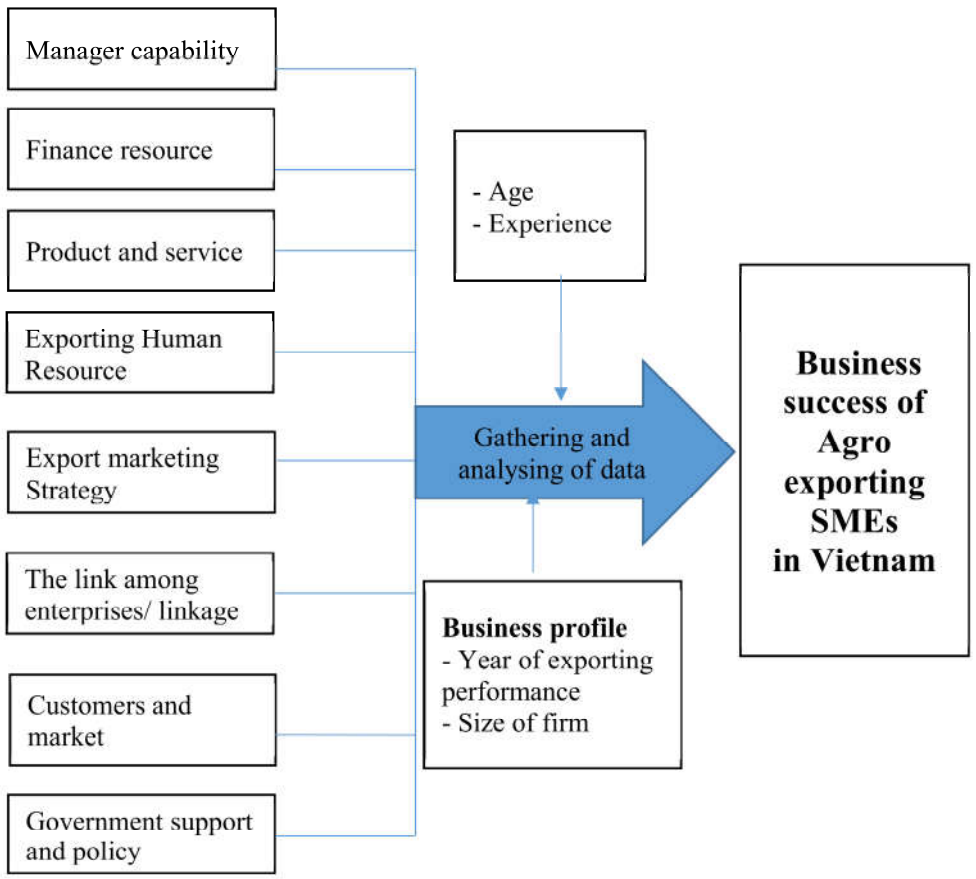

Figure 1. *Research model*

Dependence variable: Business success of Agro exporting SMEs.

Independent variables: Manager's capability, Human resource, Exporting product, Finance resource, Government support and policies, Marketing strategy, Linkage, Market and customer.

Mediating variable: Year of exporting performance; Size of firm or Age and Experience.

The research model was built based on inheriting and expanding previous research in combination with local practical analyzing. In addition to basic factors such as finance, products, markets, government support policy, this research suggest further factors as social network (linkage), export marketing strategies, exporting human resources. These factors have a strong impact on the success of agro exporters. Specifically, many SMEs have abundant financial resources, good products but people lack of knowledge, skills and foreign language competence to participate in the international market; many firms do not care about the strategy of promoting export products on the media and cannot reach the potential international market. From this, exporters should focus on both finance resource and humance resource and marketing method to get better result on international trading. From this, exporters should focus on both finance resource, human resource and marketing method to get better results in international trading.

5. Limitations and suggestions for the future research

The research has built the model to analyze the deteminant of business success of agro exporting SMEs. However, the sample size is small and focus on one industry, agro exporting. Some macro factors are not considered there.

This study is associated with one area to obtain conclusive results about business success of SMEs we suggest that future studies including a variety of sectors will be investigated; For future studies, other factors like technology, social, nature and cultural ones should be considered.

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STUDY BOLTZMAN DISTRIBUTION FUNCTION FOR IDEAL GAS SYSTEM

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Abstract: *Consider an ideal gas system consisting of a large number of particles. The nature of the macroscopic system could not be described in detail. It could only be described in terms of averages, i.e. only the mean values of the thermodynamic quantities characteristic of the medium of the macro system. The average values of the thermodynamic quantities characterizing the macroscopic state of the system such as state equation, free energy, the internal energy, etc. could be calculated by Boltzman distribution function.*

Keywords: *Ideal gas, distribution function, the average quantities, Boltzman distribution function.*

1. Introduction

An ideal gas system consisting of an extremely large number of particles could not be mechanically studied but could only be studied by statistical methods. The gas system here is considered as a homogeneous particle system. The Boltzmann distribution function is derived based on the application of the Gibss distribution function to the homogeneous particle system, through that it could describe the average nature of the ideal gas system.

2. Establishing Boltzman function

Consider a quantum macroscopic system consisting of a very large number of particles
Physical description
The wave function describes the system

$$\psi = \psi_{k_1, k_2, k_3, \ldots, k_N}(q_1, q_2, \ldots, q_N)$$

(k_i is a full set of quantum numbers of particle i[th])

The energy of the system: $E = \sum_{ka} \varepsilon_{ka}$

Schrodinger equation for single particle:

$$\hat{H}(q_a, p_a)\psi_{ka} = \varepsilon_{ka}\psi_{ka} \quad (1)$$

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Because the system is a homogeneous particle system, Hamilton operator for a particle is the same for all particles in the system. Hence, Schrodinger equation for each particle energy spectrum will be the same for all particles.

Because the system is a homogeneous particle system, should energy spectrum of the particles are identical, we do not need and cannot indicate the state ψ_{ka}, which particles occupy in the state ψ_{ka}, that we only can say how many particles in the state corresponde to the wave function ψ_{ka}.

Then the full set of quantum numbers $(k_1, k_2 ... k_n)$ is replaced by the filling set of number $(n_1, n_2 ... n_k)$.

With a system of a large number of particles that the full set of quantum number is random, so the fill set of number also is the random and can get many different values (values: 0,1,2,3...) and the particles are non - negative integers, so we just calculated the average value of $\overline{n}_k$

$$\begin{array}{lccccc} n_k = & 0, & 1, & 2, & 3,....., N \to \infty \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ \omega_{nk} & \omega_0 & \omega_1 & \omega_2 & \omega_3 \end{array}$$

ω_{nk} is the probability that the particles appear n_k or probability that state ψ_k has n_k particles. Base on probability theory rules:

$$\overline{n_k} = \sum_{n=0}^{\infty} n_k \omega_{nk} = 0.\omega_0 + 1.\omega_1 + 2.\omega_2 + ...$$

Which satisfies the normalizing conditions of probability function [1]:

$$\sum_{n=0}^{\infty} \omega_{nk} = 1$$

* Consider: + A subsystem that all particles occupy in a state of 01 particle described by $\psi_{k'}$.

Another subsystems that all particles do not locate in the state $\psi_{k'}$.

These two subsystems and other subsystems can still exchange particles, so the number of particles in the subsystem n_k is fluctuant, leading to the fluctuation of energy E_{n_N}. Therefore, the considered subsystem is a system that the number of particles and energy are fluctuant. Hence, we apply generalized Gibbs distribution for those subsystems.

The probability that the system has N particles and quantum numbers are in thermodynamic equilibrium at temperature T is [1-3]:

$$\omega_{nN} = \exp\left(\frac{\Omega_k + \mu.N - E_{nN}}{T}\right)$$

Because $N = n_k, E_{nN} = n_k \varepsilon_K \Rightarrow \omega_{n_N}$ depends on n_k. so we denote $\omega_{nN} = \omega_{nk}$

Thus, the probability that the system has a number of particles n_k staying in state $\psi_{k'}$:

$$\omega_{nk} = \exp\left(\frac{\Omega_k + n_k\left(\mu - \varepsilon_k\right)}{T}\right)$$

Note that in this paper we consider the dilute ideal gas, in which the interaction between the particles is weak, so the number of particles occupying a given state is slight. Thus, the average number of particles in a certain state is $\overline{n_k} \langle\langle 1$

then

$$\omega_0 = \exp\left(\frac{\Omega_k + 0\left(\mu - \varepsilon_k\right)}{T}\right) = \exp\frac{\Omega_k}{T} \approx 1$$

$$\omega_1 = \exp\frac{\Omega_k}{T}.\exp\left(\frac{\mu - \varepsilon_k}{T}\right) = \exp\left(\frac{\mu - \varepsilon_k}{T}\right) \qquad (<1)$$

$$\omega_2 = \exp\frac{\Omega_k}{T}.\left[\exp\left(\frac{\mu - \varepsilon_k}{T}\right)\right]^2$$

$\omega_3, \omega_4, ... \to 0$ rapidly

In calculating later, infinitesimal levels increse rapidly, so it takes the infinitesimal level 1st

$$\overline{n_k} = 0.\omega_0 + 1.\omega_1 + 2.\omega_2 + ... = 1.\omega_1 = \exp\left(\frac{\mu - \varepsilon_k}{T}\right)$$

Therefore, the average number of particles occupies quantum state of a particle is

$$\overline{n_k} = 1.\omega_k = \exp\left(\frac{\mu - \varepsilon_k}{T}\right)$$

This result is the same with the previous calculation [1], [3]

We see that ε_k increases, the number of particles decreases that means the particles tend to occupy lower - energy states and the speed of reduction depends on the temperature T.

3. In classical Boltzman Distribution

Considering the classical ideal gas which all degrees of freedom characterizing the gas particles are classical degrees of freedom.

Degrees of freedom of the gas molecules include: The first is the degree of freedom involved in translational motion; the second is intrinsic freedom: Related to the rotation of molecules and the motion of atoms inside molecules.

We temporarily considered intrinsic degrees of freedom as quantum degrees of freedom while the degrees of freedom relating to translational motion is classical degrees of freedom.

The status of a particle is characterized by coordinates and generalized momentum and they are measured simultaneously (because of classical particles)

Particle (molecule) = (q,p)

r is a degree of freedom of a molecule.

We have an average number of particles in the volume element dqdp surrounding the phase point (q,p) equal to average particle density $n(q,p)$ multiplying by the number of states corresponding to volume $dq.dp$

$$dN = n(q,p)d\Gamma$$

$d\Gamma = \dfrac{dq.dp}{(2\pi\hbar)^r}$ is the number of states corresponding to volume $dq.dp$

Each state occupies a volume $(2\pi\hbar)^r$ in the phase space.

$n(q,p) = \exp\left(\dfrac{\mu - \varepsilon(q,p)}{T}\right)$; $\varepsilon(q,p)$ is energy of a particle.

The energy of a particle

In the Cartesian coordinate system: $\varepsilon(q,p) = K(p) + U(q)$ = Kinetic + Potential

Meanwhile the distribution of particles is presented by the composition of 2 factorials

A factorial determines the change the average number of particles according to momentum

Another factorial determines the change of the average number of particles according to coordinates

Considering the distribution of the average number of particles according to momentum.

Supposing that the system is not in the external field $U(q) = 0$ (homogeneous in space)

Then particle density is constant: $\dfrac{N}{V} = const$

Distribution of particles according to the momentum:

$$dN_{\vec{P}} = const.e^{\frac{-P^2}{2.m.T}}.d\vec{p} \rightarrow \int dN_{\vec{P}} = \frac{N}{V} \Leftrightarrow \int const.e^{\frac{-\left(P_x^2+P_y^2+P_z^2\right)}{2.m.T}}.dp_x.dp_y dp_z = \frac{N}{V}$$

Using Poatxong formula:

$$\int_{-\infty}^{+\infty} e^{-\alpha.p_x^2} dp_x = \int_{-\infty}^{+\infty} e^{-\alpha.p_y^2} dp_y = \int_{-\infty}^{+\infty} e^{-\alpha.p_z^2} dp_z = \sqrt{\frac{\pi}{\alpha}}$$

$$\Rightarrow dN_{\vec{p}} = \frac{N}{V\left(2\pi m.T\right)^{\frac{3}{2}}} e^{\frac{-\left(P_x^2+P_y^2+P_z^2\right)}{2.m.T}}.dp_x.dp_y dp_z$$

Replacing $\vec{p} = m.\vec{v}$ we have the formula of velocity distribution:

$$dN_{\vec{v}} = \frac{N}{V}\left(\frac{m}{2\pi.T}\right)^{\frac{3}{2}} e^{\frac{-m\left(v_x^2+v_y^2+v_z^2\right)}{2.T}}.dv_x.dv_y dv_z$$

When $\vec{v}$ increases, the particle density will decrease considering the distribution of particles according to coordinates:

Assuming that the system is placed in the external field has the potential energy $U = U(\vec{r}) = U\left(x, y, z\right)$

At that the average density depends on coordinates as below:

$$n(\vec{r}) = const.e^{\frac{-U(\vec{r})}{T}} = U_0 e^{\frac{-U(\vec{r})}{T}}$$

$U_0 = U(\vec{r} = 0)$ they are the average particle density at point $\vec{r} = 0$

In the external field is the Earth's gravitational field, we have:

$$U = U(\vec{r}) = U\left(z\right) = m.g.z$$

$\Rightarrow U_z = U_0 e^{\frac{-m.g.z}{T}}$ (Barometric formula)

4. Hemholtz free energy for Boltzman ideal gases

The free energy of the system are:

$$F = -T.\ln Z$$

Where, Z is the statistical total of the system

If the system is quantum macroscopic system, the quantum statistical total is: $Z = \sum_n e^{\frac{-E_n}{T}}$.

Applying to the ideal gas Boltzman:

$$Z = \frac{1}{N!}\sum\nolimits_{k_1,k_2...k_N} e^{-\left(\frac{\varepsilon_{k_1}+\varepsilon_{k_2}+...\varepsilon_{k_N}}{T}\right)} = \frac{1}{N!}\sum\nolimits_{k_1,k_2...k_N} e^{-(\frac{\varepsilon_{k_1}}{T})} e^{-(\frac{\varepsilon_{k_2}}{T})} ... e^{-(\frac{\varepsilon_{k_N}}{T})}$$

Because the considered gas here is dilute, so $\overline{n_k} \langle\langle 1$

With n_k is large, the probability ratio of infinitesimal levels increases, so we just take infinitesimal level 1st: $\overline{n_k} = 0.\omega_0 + 1.\omega_1 + 0... = 0.\omega_0 + 1.\omega_1$

$\Rightarrow n_k = 0,1$. That means in a state there are not any particles or there is only a single particle, so the number of particles N need to distribute how in order that each state only contains a maximum of one particle that the full set of numbers of different particles is different.

Thus, the system with (a - 1) particles is different from the system with (a '- 1) particles.

$$\Rightarrow k_1 \neq k_2 \neq k_3 \neq k_a \neq ...k_N$$

Therefore the factorials $\varepsilon^{\frac{-\varepsilon_i}{T}}$ are different.

$$Z = \frac{1}{N!}\sum_{k_1} e^{-(\frac{\varepsilon_{k_1}}{T})}\sum_{k_2} e^{-(\frac{\varepsilon_{k_2}}{T})}\sum_{k_N} e^{-(\frac{\varepsilon_{k_N}}{T})}$$

Because the particle system is a homogeneous system, the single totals are the same although the full set $k_1 \neq k_2 \neq k_3 \neq k_a \neq ...k_N$ so: $Z = \frac{1}{N!}\left(\sum_k e^{-\left(\frac{\varepsilon_k}{T}\right)}\right)^N$

And

$$F = -T.\ln Z_{1hat} + T.\ln N!$$

Using formula: $\ln N! = N.\ln\frac{N}{e}$

$$F = -T.\ln Z_{1hat} + TN\left(\ln N - \ln e\right) = -N.T.\ln\left(\frac{e}{N}Z_{1hat}\right)$$

Therefore, the energy in quantum statistics for macroscopic system with N particles becomes the statistical total for each particle.

5. State equation of an ideal gas

Considering Boltzman ideal gas in zero electro- magnetic field, the movement of the molecules includes 3 types of motion: (i): the translational motion of its center of mass; (ii): the rotation of the molecule; (iii): internal molecular motions

In these three types of motion:

The first movement is a classical motion because atoms can have translational motion in a volume of container. Degrees of freedom of this motion is classical degrees of freedom.

The 02 left degrees of freedom are two quantum degrees of freedom

=> Therefore we consider the system has both classical degrees of freedom and quantum degrees of freedom.

The energy of a molecule: $\varepsilon = \varepsilon_k\left(\vec{r},\vec{p}\right)$

(k is the quantum degrees of freedom by fully set characterizing the rotation and internal molecular motion)

$\varepsilon = \varepsilon_k\left(\vec{r},\vec{p}\right) = \varepsilon\left(\vec{r},\vec{p}\right) + \varepsilon'_k$ = Energy for Classical degrees of freedom + Energy for quantum degrees of freedom

Consider the case of the closed system in zero filed:

$$\varepsilon\left(\vec{r},\vec{p}\right) = \varepsilon\left(\vec{p}\right) = \frac{p^2}{2.m} \Rightarrow \varepsilon = \varepsilon\left(\vec{p}\right) + \varepsilon'_k$$

Replacing it into the formula of statistical total for 01 particle:

$$Z_{1hat} = \sum_k \int \frac{dV.d\vec{p}}{(2\pi\hbar)^3} e^{\frac{-\varepsilon(\vec{r},\vec{p})}{T}} = \frac{V}{(2\pi\hbar)^3}\left(\sum_k e^{\frac{-\varepsilon'_k}{T}} \int d\vec{p}.e^{\frac{p^2}{2.m.T}}\right) = V\left(\frac{m.T}{2\pi\hbar^2}\right)^{\frac{3}{2}} \sum_k e^{\frac{-\varepsilon'_k}{T}}$$

Replacing it into the formula of free energy:

$$F = -N.T.\ln\left(\frac{e}{N}Z_{1hat}\right) = -N.T.\ln\left[\frac{e.V}{N}\left(\frac{m.T}{2\pi\hbar^2}\right)^{\frac{3}{2}} \sum_k e^{\frac{-\varepsilon'_k}{T}}\right] \Rightarrow F \in (N,T,V) \qquad [2, 3]$$

we can deduce other thermodynamic quantities:

Pressure P: $P = \frac{\partial F}{\partial V} = \frac{N.T}{V} \Leftarrow P.V = N.T$ (Equation of state of an ideal gas)

Entropy S : The changing speed of F and T: $S = \frac{\partial F}{\partial T} = N.\ln\frac{e.V}{N} - N.f'(T)$

$$\Phi = F + P.V = -N.\ln\frac{e.V}{N} + N.f(T) + P.V = N.T.\ln P + N\left[f(T) - T\ln T\right] \qquad [2, 3, 4]$$

$$W = N\left[f(T) - Tf'(T) + T\right]$$

$$C_V = \left(\frac{\partial E}{\partial T}\right)_V = N\left[-T.f''(T)\right] = N.c_V$$

$$C_P = \left(\frac{\partial W}{\partial T}\right)_P = N\left[-T.f''(T) + 1\right] = N.c_P$$

=> For 1 molecule is: $c_P - c_V = 1$. This result is the same with previous calculation [3-4].

6. Conclusion

Through Boltzman distribution function, we can determine the average value of the thermodynamic quantities characterizing for states of an ideal gas state system. In this article, the Boltzman distribution function has been caculated in a more complete way than in previous caculation. The results in the article are consistent with previous calculations.

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A COMPARATIVE DISCOURSE ANALYSIS OF CINDERELLA VERSIONS

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Abstract: *This paper uses Systemic Functional Linguistics to interpret ending texts of four Cinderella versions. The interpretation compares and highlights the ways how experiential and interpersonal meanings are shaped in these texts. As a result, it reveals the similarities and differences in cultural values embedded in the fairy tales. Convincing cultural and historical explanations for contemporary controversies about the different Cinderella versions in Vietnam are also provided.*

Keywords: *Fairy tales, Cinderella, Systematic Functional Linguistics, experiential meanings, interpersonal meanings.*

1. Introduction

This paper uses Systemic Functional Linguistics - a theory initially developed by Halliday (1985) to interpret ending texts of four Cinderella versions (one German, one French and two Vietnamese versions). The interpretation highlights different ways how meanings are shaped in the texts. This way, it is expected to further provide convincing cultural and historical explanations for the current controversies about this fairy tale.

Fairy tales are one of the most important discourse genres in traditional literature (Jones, 2011). They have significant contributions to the general knowledge, the social and moral development of generations. They are sites for the construction of appropriate gendered behaviours, are an integral part of the complex layering of cultural stories. However, some authors have negative appraisals on several fairy tales and raise controversies about their values. "Tam Cam" - a Vietnamese Cinderella version is one of the examples. With different endings among many versions of Cinderella around the world, the moral lessons and values of "Tam Cam" fairy tale have created controversies in Vietnam. The fairy tale has been examined in different aspects to explain and prove their "appropriate" views in the controversies.

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2. Fairy tales and Cinderella versions

2.1 Fairy tales and their functions

Fairy tales have been thought by most folklorists to belong to wonder tales. Jarrar (2011, p. 13) states that wonder tales are the "spoken traditional narratives" that are meant to be told not read. From the Marxist viewpoint, at that time, wonder tales are tools to reflect social issues and "ideological concerns". Moreover, in societies dominated by class struggles, they were used to express messages about desires and beliefs of the working classes. This is a "subversive potential" for Good to over win Evil (Jarrar 2011, p.13). The writers such as Charles Perrault (17th century), the Brothers Grimm (19th century) collected, edited and recorded wonder tales to serve purposes such as socialisation and acculturation. Then, they had become what are called as fairy tales today.

Fairy tales are materials providing "a clear picture of the effects that present behaviours will have on the future of our societies" (Doyle & Doyle, 2001). Reading them, children obtain ideological messages and then behave in the ways to address expectations of society. This is a way fairy tales serve the functions of socialising and acculturating. They are also called historical documents (Darnton, 1999), cultural barometers (Paul, 1998), and cultural artefacts (Gilbert, 1992) of which influence is still alive and important today.

In Vietnam, the very first function of fairy tales is "educational target of morals and normal standards" (Dang 2010, p.45). There are always messages, moral lessons and principles hiding in the struggles in Vietnamese fairy tales: class struggles; struggles between "Good" and "Evil"; struggles between Vietnam and invading countries. They are lessons of being optimistic, being patient, and showing solidarity.

2.2. Cinderella and its versions

Cinderella is the most famous fairy tale in the world (Iona & Opie, 1974). There have been more than 700 versions of it across all countries. In Europe, the first written Cinderella-type tale was published in 1634 in Italy under the name of "La Gatta Cenerentola" by Basile (Cashdan 1999, p.87). This story then appeared in English from the translation of "Cendrillon" in "Histories oucontes du temps" in 1697 by Charles Perrault (Iona & Opie, 1974). Many Western versions of Cinderella are typical examples for motifs of fairy tales (Tran, 2012). They are a story of a good, sweet and beautiful girl living with a wicked stepmother and two vain and selfish stepsisters. This girl has to withstand hardships and sit down under a stream of abuse by her stepmother and stepsisters. At the end, a fairy godmother magically helps her to become a Prince's wife. In Vietnam, Cinderella version is "Tấm Cám". It has two parts. In the first part, the title character - Tấm - an orphaned hardworking girl faces her stepmother and stepsister's jealousy, and ultimately regains her position as bride of the King. In the second part, Tấm keeps being a victim of "Evil", being murdered many times and then passing through many incarnations. At the end, she indirectly killed her stepsister and

stepmother. This ending separates "Tấm Cám" from other versions of Cinderella and raises a question: Can Tam with an action of killing Cam and her stepmother be a representative of "Good"?

The answer to that question can partly be found in this paper through analysing endings of four Cinderella versions. The 1st one (Text 1) is a German version recorded by Brothers Grimm (1857) which is very common in many countries. The 2nd one (Text 2) is from an early record of Cinderella in French by Perrault (1697). They are two significant examples of Western Cinderella. The third one (Text 3) is the ending of Tam Cam by Nguyen (1982) - the very first written form of Vietnamese Cinderella. The last text (Text 4) is also a Vietnamese one edited from Nguyen's version and used in Grade 10 literature text-books. All these four texts are translated into English before analysing. They are forwards named Text 1, Text 2, Text 3 and Text 4.

3. Systemic Functional Linguistics approach

Systemic Functional Linguistics (SFL) explores how language is used in social contexts to achieve particular goals. In terms of data, it looks at the discourses an interlocutor produces, and the contexts of the production of these texts. In other words, it places importance on language function rather than on language structure.

SFL introduces three simultaneous metafunctions of language. They are to represent experiences of the world (the ideational/experiential function), to negotiate relationships with others (the interpersonal function) and to organise the representation and negotiation as a meaningful text (the textual function). Each of these metafunctions is created from the choices and organisation of a certain grammatical system. Experiential meanings are construed through the system of transitivity which includes three aspects: Process, participants and Circumstances (Eggins, 1994, p.229). Modality (an intermediate range between extreme positive and negative) and Mood (roles of interlocutor and addressee) are often used to represent interpersonal meanings. Textual meanings are mostly expressed through Theme system and the development of Theme and Rheme.

Because this paper focuses on the experiential and interpersonal meanings of texts which can reveal social and cultural aspects in fairy tales clearly, the SFL theory of transitivity, modality and mood will be employed as a key guiding tool for the analysis.

4. Data analysis

4.1 Experiential meanings

Experiential meanings focus on the "content" of discourse: what kinds of activities are undertaken, and how participants in these activities are described, how they are classified and what are they composed of (Martin & Rose, 2003, p.66). These meanings of the four chosen

texts is analysed through looking closely at the participants and processes they employ. Results of an examination on process types is summarised in Table 1.

Table 1. *Process types in four texts*

	Text 1		Text 2		Text 3		Text 4	
	QTY.	%	QTY.	%	QTY.	%	QTY.	%
Material	10	77	9	56	11	37	4	20
Mental	1	8	5	32	8	27	7	38
Relational	2	15	1	6	7	23	3	16
Verbal	0	0	1	6	3	10	5	26
Behavioural	0	0	0	0	0	0	0	0
Existential	0	0	0	0	1	3	0	0
Total	13	100	16	100	30	100	19	100

Texts 1 and 2 mostly use material process (77% and 56%). The world in these texts is revealed in terms of actions and doing. The stories thus are the reality of "the real world". In contrast, there are four types of dominant processes in Texts 3 and 4: material, mental, relational and verbal processes. Hence, the Vietnamese fairy tales create a world of not only things that are happening but also what people are thinking and feeling, listening and talking. As a result, roles of participants in these texts are totally different (see Table 2).

Table 2. *Frequency of participant types in four texts*

Roles of participants	Text 1		Text 2		Text 3		Text 4	
	QTY.	%	QTY.	%	QTY.	%	QTY.	%
Actor	7	40	10	29	4	10	3	10
Goal	5	28	8	23	3	8	3	10
Beneficiary	1	5	2	6	1	2	0	0
Carrier	2	11	1	3	7	18	3	10
Attribute	2	11	1	3	7	18	3	10
Senser	1	5	5	15	4	10	5	18
Phenomenon	0	0	4	12	5	12	3	10
Sayer	0	0	0	0	2	5	4	14
Receiver	0	0	0	0	4	10	5	18
Verbiage	0	0	1	3	2	5	0	0
Behaver	0	0	1	3	0	0	0	0
Behaviour	0	0	1	3	0	0	0	0

Existent	0	0	0	0	1	2	0	0
Total	18	100	34	100	39	100	29	100

Dominant roles of participants in these texts are actor (40% in Text 1; 29% in Text 2) and goal (28% in Text 1, 23 % in Text 2). Roles of participants in Texts 3 and 4 are more various than those in Texts 1 and 2. They include carrier, attribute, senser, receiver, sayer, phenomenon, actor and goal. Their usage percentage is moderately equal, from 10% to 18%. The difference in employment of these types of processes and participants can be seen as a result of differences in cultures. For example, in general, in Vietnamese culture, thoughts and feelings are expected to create vivid pictures of the real world. In contrast, western cultures place an emphasis on fact rather than feelings and opinions in revealing the world.

Significantly, although these texts convey and share the same field, they leave different messages and reveal different aspects in life. These differences can be examined in frequency of common participants in these texts, their activity consequences and taxonomic relation (see Table 3a, 3b, 3c, 3d).

Table 3a. *Frequency of common participants in Text 1*

Roles of participants	The pigeons	Step-sisters
Actor	2	6
Goal	0	1
Carrier	0	2
Senser	0	1
Total	2	10

Table 3b. *Frequency of common participants in Text 2*

Roles of participants	Cinderella	Step - sisters
Actor	2	2
Senser	2	2
Phenomenon	2	2
Goal	3	2
Carrier	1	0
Behaver	1	0
Behaviour	0	1
Beneficiary	0	1
Total	11	10

Table 3c. *Frequency of common participants in Text 3*

Roles of participants	Tam	Cam	Step - mother

Actor	1	1	2
Goal	1	2	0
Carrier	1	2	1
Beneficiary	0	0	1
Senser	0	0	2
Phenomenon	1	1	1
Receiver	1	0	1
Sayer	1	2	0
Attribute	1	0	0
Total	7	8	8

Table 3d. *Frequency of common participants in Text 4*

Roles of participants	**Tam**	**Cam**	**Step - mother**
Actor	2	0	0
Senser	0	4	2
Phenomenon	1	0	0
Sayer	2	1	0
Carrier	1	2	0
Receiver	1	2	0
Total	7	9	2

Table 3a shows that the most common participant of Text 1 is the two stepsisters with ten appearances. The participant appears with a sequence of activities such as “came”, “wanting to gain”, “to share”, “walked” and “punished”. This activity sequence focuses on describing an ending scene of the story and emphasizes on a punishment. “The pigeons” appears only twice, but plays an important role - a power to punish “Evil”. They are the doer of the repeated activities “pecked out the eyes of the step-sisters”. In terms of taxonomic relation, repetitions are exploited (false - falsehood; the older sister - the older one, the younger - the younger one, the pigeons - the pigeons) to keep track of participants through the text. Antonyms (false - good; fortune - punish; younger - older) are employed to reveal the opposite sides of “Good” and “Evil” with endings of forever happiness and punishment. Furthermore, synonyms (pecked out the eye - blindness) and hyponyms (two false sisters - the older one + the younger one) are also used to build the field of the story and show the equal treatment to each class member in the group. In summary, these ways, experiential meanings of Text 1 reveal the opposite of “Good” and “Evil” and place an emphasis on the indispensable punishment on “Evil”.

In Text 2, there is a parallel of employment of two main participants Cinderella and step-sisters (see Table 3b). The roles of the participants are varied and equally disposed. This makes the ending of the story resolve smoothly. In addition, these participants interact together in two main sequences of activities. The step-sisters are an agency of remorseful activities for their ill treatment with Cinderella such as "threw themselves at her feet" and "beg pardon". Cinderella is a doer of forgiven activities such as, "embraced them", "forgave them", and "matched them with two great lords in the court". Therefore, the experiential picture in this text is remorse and forgiving.

Like Text 1, Texts 3 and 4 also place an emphasis on "Evil" and punishment. However, the significant difference between them is employment of key participants which represents different agency of punishment. Three main participants of Text 3 and 4 are Tam (Cinderella), Cam (stepsister) and the step-mother (See Tables 3c and 3d). They have sequences of struggling activities which explain how events in the story occur. The preceding events are conditions for the next events. For example, Tam's coming back with much more beauty and Cam's being curious and jealous explains for the next events: Cam's asking Tam the way to become more beautiful, following what she said and then dying. This way, Tam - the representative of "Good" is the doer of killing Cam, and then played the main role in the step-mother's death. She therefore becomes agency of punishment. Focusing on the harsh punishment, the activity consequences in these texts reveal violent aspects. Some examples of activities include: "jumped into boiling water", "died", "was cut" and "died of shock". These activities are the key elements to distinguish between the endings of the Vietnamese Cinderella and the Western versions.

4.2 Interpersonal meanings

When conducting any piece of language, encoders not only convey experiential meanings but also make interaction with each other. The interaction is revealed in interpersonal function of language. This function is chiefly encoded in systems of appraisal and negotiation. There are three aspects of appraisal: attitudes, amplification, and source. Summary of analysis on these aspects in the four texts is illustrated in Table 4.

Table 4. *Appraisal in texts*

	Attitude			**Amplification**	**Source**
	Affect	**Judgement**	**Appreciation**		
Text 1	Wanting	False; Favour Wickedness; Falseness	Good fortune		
Text 2	Wanted ; Took up; Embrace;	Fine; Beautiful;	Ill	More …than; No less … than;	Her two sister found; They had

	Forgave; With all her heart; Love	Young; Charming; Good; Beautiful; Great		Very	made; Cinderella…said; He thought
Text 3	Wanted; Enjoyed; Shock	Beautiful; Curious; Jealous; Beautiful; Angry	Delicious; Delicious; So delicious	Much more… than; So..; More…than; So…	(Cam) seeing Tam came back; She asked Tam; Tam told her; The mother thought; A crow… told; The mother …told
Text 4	Loved ; Was afraid of; Neglected; Want; Agreed; Died of shock	Beautiful Dearest White and beautiful		Still; As ever; As you; Immediately	Cam released that … ; She asked Tam; Tam responded; Tam then asked

Text 1 is more about people than things. Hence, in terms of attitudes, affect (people's feelings) and judgment (people's character) is naturally expected to be foregrounded than appreciation (the value of things). However, affect is expressed only once in the verb "wanting". The domain aspect of attitudes in Text 1 is judgment. Three negative judgments in this text (false, wickedness, falseness) are used to judge the stepsisters. In contrast, the other positive one (favour) is used to characterize Cinderella. Significantly, amplifications and sources of the attitudes are not expressed in the language of Text 1. It means the evaluations come from the narrator but the characters. To sum up, in terms of interpersonal meanings, Text 1 distinguishes "Good" and "Evil" by negotiating positive and negative judgements on them. However, the focus on these judgements are directly criticising the stepsisters as "Evil". This interpersonal meaning goes well with the experiential meaning of "Evil" and punishment discussed above.

Similarly, Text 2 is dominant in affect and judgement rather than in appreciation because it is more about people than things. However, attitudes in this text are conveyed in a wide range of aspects and with amplifications and sources. All the affects in Text 2 are used to reveal Cinderella's beauty in her behaviours, her soul and her heart. This way, "Good" in Cinderella is represented. Additionally, while most of judgments in Text 1 are negative on the stepsisters, those in Text 2 (fine, beautiful, charming, good) are used to evaluate Cinderella's characters. The sources of these attitudes are also introduced. They are stepsisters (Her two sisters found), Cinderella (Cinderella …said) and the Prince (he thought). This means the attitudes and judgements are affirmed by different voices, even "Evil" - stepsisters. Stepsisters" positive attitudes towards Cinderella illustrate their remorse, and then are reasons

for Cinderella's forgiving. Furthermore, the scale intensifiers such as "more … than", "no less … than" and "very" are exploited to make the attitudes and judgements stronger. They additionally emphasise Cinderella's beauty and nature of "Good". In summary, differently from Text 1, Text 2 focuses on the perfect of "Good" with the beauty in both appearance and personality and the remorse of "Evil" with the positive attitudes on "Good".

Text 3 employs both negative and positive affects and judgements. The negative ones such as "curious", "jealous" and "angry" appraise Cam and stepmother. Oppositely, the positive ones, especially the repetition of judgements "beautiful" are used to describe Tam. Text 3, like Text 1, produces negative attitudes towards "Evil". Like Text 2, it also has positive attitudes towards "Good". The scale intensifiers such as "much more … than" and "so …" are also employed to give strong evaluations on the characters. In short, the opposite attitudes clearly illustrate love and respect to "Good", and hatred and disdain to "Evil".

The appraisal system in Text 4 is similar with that in Text 3. They also include both negative and positive affects which express feelings of Cam and the Prince. However, in terms of judgements, Text 4 employs only the positive ones to judge Tam. Additionally, there are no appreciations in Text 4 partly because it is a shortened version of Text 3 with the focus on people. Text 4 was used in a grade 10 literature text book when Many educators and writers believed that in the versions of Tam Cam like Text 3, the image of Tam at the end of the tale is concerned with violent aspects. That way, she could not a perfect representative for "Good". Thus, some details about the deaths of Cam and the stepmother has been deleted and edited before introduce them in the textbook. As a result, negative judgements are used less in Text 4 than Text 3.

Another system of appraisal is negotiation which "is concerned with interaction as an exchange between speakers" (Martin & Rose 2009, p. 219). This system can be seen clearly in Texts 3 and 4 rather than in Texts 1 and 2. While Texts 1 and 2 are typical examples of narrative genre with all speech functions are statements of giving information, Texts 3 and 4 have dialogues with exchanging roles between speakers.

In Text 3, there appears negotiating information between Cam and Tam, and between a crow and the stepmother.

Demanding information: "***She asked Tam*** *how she could be beautiful like that."*

Answering: "***Tam told her*** *that taking a bath in boiling water had helped her."*

This interaction between Cam and Tam explain Cam's death. Many authors usually accused Tam of killing Cam. However, the person who demands information is Cam. Tam plays the role of responding. This means the deep origin of her death is her greed and envy. Because of being jealous with Tam and wanting to attract the Prince and become his wife, Cam leads herself to the death.

The interaction between the crow and the stepmother are used as a metaphor. The crow appeared with three questions. However, these questions are used to give, not to demand information: inform the mother about her daughter's death. Thus, the stepmother's response is a kind of response only, not to give answers to these questions:

Initiating: *"Delicious? What is so delicious? The mother is eating her daughter's flesh. Is there anything left for me?"*

Responding: "*The mother was angry and told it off."*

In Text 4, there is no character like the crow informing the stepmother about her daughter's death because the story is shortened. However, the interaction between Cam and Tam happened similarly.

Demanded information: *My dearest sister how could I become as white and beautiful as you?*

Response: *Do you want me to help?*

The speech of demanding information by Cam happens first. It means Cam died because of her greed and envy too. However, Tam's response is to offer goods - and - services. With this offer, the sense of Tam's initiative in killing Cam is raised. In addition, the negotiation between Tam and her servants further raises this sense: Tam demanded "goods and services" to kill Cam: "***Tam*** *then* ***asked her servants*** *to dig a deep hole and* ***told Cam*** *to stand down in the hole. Then* ***Tam asked the servants*** *to pour boiling water into the hole".* Thus, when being edited to make the image of Tam become more perfect, Text 4 does not reach its aims. In contrast, Tam in Text 4 becomes even more "violent" than in Text 3.

5. The cultural values of the fairy tales

The ending texts of four Cinderella versions reveal some common cultural ideas and beliefs. First of all, it is the belief that "Good" will live "happily ever after" (Zipes, 1997) (Cinderella/ Tam married to the Prince and lived happily in a palace). Secondly "the witch must die" (Cashdan, 1999) or "Evil" must be punished (the stepsisters, Cam, and the stepmother became blind or died at the end).

Additionally, the way of creating characters in the tales partly presents the society in which they appeared. Heroine characters are representatives of Good with beauty in both appearance and personality. The anti-heroin characters, in contrast, are envy, haughty and wicked people. The relationship between these characters is stepdaughters and stepmothers or stepsisters. The struggles between "Good" and "Evil" are expressed in the struggles between these characters because in the past, stepmothers were believed to treat her stepchildren very badly. Thus, in many fairy tales, stepmothers may be associated with witch (Zipes 1997, p. 49) and usually are representatives of "Evil" and ugliness.

Although many authors argued of the entertainment and education value of the different versions, analysis on experiential and interpersonal meanings of four texts comes to the two following conclusions. For two Western versions, while Text 2 illustrates an idea on remorse and forgiving in fairy tales, Text 1 presents an idea of punishments "Evil" through violent scenes. Generally, people think that Text 2 is good for children in terms of giving moral lessons and entertaining. However, in terms of entertaining - one of the main purposes of Western fairy tales, some studies show that "even strengthen violence and cruelty causes

anxiety in children" (Alcantud - Diaz, 2012). In terms of moral lesson, Text 1 belongs to "warning tales" (Degh, 1979) which are written to warn children of punishments when doing bad things. This way, the fairy tales may frighten them. As a result, they will not do the wrong things. The moral lessons embedded in this way are quite possible and may act effectively.

For the Vietnamese versions, Text 3 is believed to include too many violent activities. It has also raised questions of moral lessons and doubts about "Good". However, this ending is quite explainable if people look back into its context of appearance. This fairy tale was created by the working class to express their desires and their wishes of having a better life; of having justice, and of over-wining higher classes and other powers who usually have ill treatments on them. When details of the fairy tales reveal that, "Evil" never turns into "Good" like in Text 2 (Cam and the stepmother killed Tam many times), the highest punishment on them - death is the most appropriate ending. It is because if they live, the struggles will never come to the end. Thus, there are no problems with the embedded moral lessons about the happy ending of "Good" and the harsh punishment on "Evil".

The doubts of "Good" and the change of the ending from Text 3 into Text 4 also need to be re-examined. In fact, the language in Text 3 is carefully chosen to reveal messages. As analysed above, Cam actively asked Tam about the way to make her more beautiful, and then she jumped into the boiling water by herself. The actor of the violent actions is hidden by a passive voice: *"Cám's body was then cut and put into a jar of food to send to her mother*". It might not be Tam. Thus, this does not affect to the simile of Tam with "Good". The change of Text 3 into Text 4 is expected to embed better moral lesson and make a more perfect simile of "Good". However, from a perspective of discourse analysis mentioned above, it become worse. This is because in Text 4, Tam is the person who "demands goods-and-services" to kill Cam and her stepmother.

6. Conclusion

In summary, the Vietnamese and Western versions of Cinderella share some similar functions and cultural aspects. However, the meanings are revealed differently inside language. Because Western cultures more highly evaluate facts than opinions and thoughts, in their discourses, the processes of behaviour or mental are less than in the Vietnamese discourses which expect language of opinions and thoughts to make language more vivid.

This paper does not evaluate the rightness or wrongness of controversies on the moral lessons, violent aspects and "Good" represented in Cinderella characters of different versions. Nevertheless, the analysis on languages the texts employed shows that the happy ending version is not always better than the unhappy ending with some violent scenes in terms of both entertaining and educating functions. In addition, to convey or change any message, the choices of language should be done carefully through applying different approaches in discourse analysis.

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THE BIOLOGICAL CHARACTERISTICS OF INTERACTIONS BETWEEN "EPISYRPHUS BALTEATUS DE GEER" INSECTIVORE HOVERFLY ON CERATOVACUNA LANIGERA (ZEHNTNER) IN THO XUAN DISTRICT, THANH HOA PROVINCE

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Abstract: *The growth process of Episyrphus balteatus passes 4 stages of development: egg, larva (maggot), pupa and adult. The average life cycle time of the fly at 27.8 ^{0}C is 18.7 days, at 25.3 ^{0}C is 20.1 days. The average life time of the fly at 27.8 ^{0}C is 25.9 days, at 25.3 ^{0}C is 28.6 days. The fly of E. balteatus lays eggs within 9 days of insemination with an average of 39.5 ± 2.11 eggs/adult fly. On the sixth day, the maximum numbers of eggs are 5,6 eggs/adult/day. At mean temperature condition of 25.3 ^{0}C, mean moisture of 82.5%, an 1-instar maggot eats an average of 17.2 ± 0.37 aphids, a 2-instar maggot eats an average of 69.7 ± 0.62 aphids, a 3-instar maggot eats an average of 196.2 ± 2.15 aphids. At a temperature of 27.8^{0}C, and moisture level of 77.6%, the maggot eats fewer aphids. An 1-instar maggot eats an average of 15.9 ± 0.44 aphids, a 2-instar maggot eats an average of 57.5 ± 0.51 aphids, a 3-instar maggot eats an average of 188.7 ± 1.84 aphids.*

Keywords: *Episyrphus balteatus, hover fly, sugarcane wooly aphid, predation rate.*

1. Introduction

1.1. Background

During the development and growth process, sugar-cane is readily harmed by pests that cause reduction in productivity and quality of the raw sugar-cane. Among these pests, sugarcane wooly aphid (*Ceratovacuna lanigera* (Zehntner)) is the main pest having a rapid life cycle and high rate of increase of populations that can lead to major pest outbreaks. However, in the natural environment, *Ceratovacuna lanigera* (Zehntner) is restrained by natural enermies, especially the ladybird beetle (Coccinellidae), and the aphid-eating hoverfly (Syrphidae), parasitic wasp (Encytidae). The aphid-eating hoverfly (*Episyrphus balteatus* de Geer) plays the most important role in restraining numbers of *C. laniger*. When the density of the larva population of aphid-eating hoverfly is high, it is able to restrain successfully the *C. Lanigera* population. This study examines the intereaction between this hoverfly and the sugarcane wooly aphid in Tho Xuan district, Thanh Hoa province in Vietnam.

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1.2. Monitoring methods in the field

Monitoring procedure was conducted in accordance with QCVN 01-38:2010, monitoring protocols. The varieties of sugar cane in the study field were ROC22, ROC10, VĐ94 -128, MY55 -14.

The study sites were in lowland and highland locations. The planting spacing ranged from 1 m to 1.25ms. We monitored each crop for seven days each session. We assessed two plants every 5ms for presence of aphid-eating hoverfly and sugarcane woolly aphids. We observed the top and lower surface of leaves and the other parts of each plant, counting them and then catching a sub-sample to bring to the laboratory for verification.

2. Research method in the laboratory

2.1. Research method for the biological and ecological characteristics of E. balteatus hoverfly in laboratory's conditions

Mature *E. balteatus* hoverflies were caught in the field then placed into an insect net cage where VDD94-128 variety and sugarcane woolly aphids were established to simulate a natural environment. We monitored daily for fertilized *E. balteatus* eggs then leaves with eggs were placed in a worm bin to assess the duration until hatching. Moist filter paper was also put inside the bin and the the petioles were wrapped with macerated cotton to keep the leaves fresh. The leaves were changed every 2 days.

After recording the egg-openning period, we monitored the feeding stage of the 1st-stage larva (maggot) in the worm bin (n=30). In each "worm" bin there were moist filter papers, sugar cane leaves and sugar cane woolly aphids. Afterthe pupa emerged as adults, we selected breeding pairs of flies of the same emerging-dated and placed them into a net cage where the host plants and aphids were available.

2.2. Method of identifying the predacity of E. balterus flies under laboratory conditions

Daily at 0800 hrs, we added 50 aphids (1st and 2nd instars) in each of 30 worm bins, counting regularly the remaining aphids on leaves. We monitored the predation rate until the larva transformed into a pupa.

3. Findings and discussion

3.1. Morphological characteristics and dimensions of the development phases of Episyrphus balteatus insectivore hoverfly on Ceratovacuna lanigera

In each different development period, *E.balteatus* eggs varied in shape, dimension, and color. To identify exactly every development phase of this fly, 10 individuals of each phase were fed at an average temperature: 26.5 ^{0}C and average huminity of 83.5%, which achieved the results as follows:

Eggs: the eggs were tubular-shaped, new-laid eggs were white color, then turned into milkiness color when eggs were close to hatching. Dimensions of eggs: 1.57 ± 0.08 mm in length, 0.66 ± 0.10 mm in width.

Larva: referred to as maggot type with 3 instars. Pure white color when emerging from eggs 3.5-4 mm in length and 1-1.5 mm in width. Full-grown maggots were 10.5 ± 0.45 mm long and 2.45 ± 0.16 mm wide, double-end oblong and flat-body shape, mouthpart pull-back into the front end.

Pupa: at the begining of puparation time, pupae were the same color as larva. When nearly emerging as adult, the color turned darker. Pupae have large head and a smaller tail with a mean length of 7.23 ± 0.35 mm and mean width of 2.91 ± 0.25 mm.

Adult: the female has a larger abdomen than the male, with an egg sticking tray. The male has a flat abdomen, and thinner and longer body than the female. The female mean body length was 8.7 ± 0.58 mm, mean width 2.44 ± 0.22 mm, with a mean wing span of 17.44 ± 0.74 mm. The mean body length of a male was 9.43 ± 0.5 mm, the mean width was 2.49 ± 0.23 mm, and mean wing span 17.81 ± 0.73 mm. The compound eyes are red brown color and occupy most of the size of the head.

Figure 1. *Photo of development stages of E. balteatus (de Geer) fly*

	
Aldult stage	Egg stage
	
Pupa stage	Larva stage

(Photo: Taken in June/2013)

3.2. Biological particularity of aphid-eating E. balteatus hoverfly

Characteristics of development stages

Egg stage: eggs of *E. balteatus* hoverfly are laid scatteredly on the surface of sugarcane leaves. Eggs are laid near, or on, the aphids. Development stage of egg was from 1 to 3 days.

Larva (Maggot) stage: maggots began to consume prey 3hrs after emerging. They showed preference for eating the 2-instar aphids than the 1-instar aphids. The larva stage has 3 instars.

Pupa stage: pupa's color is like that of the larva at the begining, with 2 black bands on its back. When nearly emerging to be an adult, the pupa's color tends to be darker, and turns to light brown when the adult body can be seen through the cocoon.

Adult stage: adult emerge in the morning and is the most active in the early morning or in the late afternoon. When coming out of the cocoon, the adult's body is weak. After a few hours, the body is harder and the body's color turns darker and darker but cannot fly yet. The adults prefers light so it often moves toward the bin's cover.

Table 1. *The development time of stages of E. balteatus fly which is fed C. Lanigera in the laboratory*

Development Stages	Development time of stages of E. balteatus fly (day(s))					
	1st Feeding Period			2nd Feeding Period		
	Max.	Min.	Average	Max.	Min.	TB ± Se
Egg	3	1	2.35 ± 0.203	3	1	2.18 ± 0.205
Larva	8	4,5	7.4 ± 0.266	8	4	6.98 ± 0.345
Pupa	9	7	8.45 ± 0.24	8	6	7.87 ±0.147
Adult	10	6	8.55 ± 0.378	8	5	7.28 ± 0.248
Before laying	3	1,5	1.87 ± 0.202	3	1	1.75 ± 0.207
Life cycle	24	16	20.07 ± 0.543	22	12	18.7 ± 0.617
Life	34	20	28.62 ± 0.759	29	17	25.93 ± 0.75
Average Temp. (°C)	25.3 ± 0.75			27.8 ± 0.78		
Average Humidity (%)	82.5 ± 1.83			77.6 ± 1.77		

(Note: n = 30 individuals)

3.3. Fecundity and frequency of birth of the flies of E balteatus

The fecundity of *E. balteatus* and its frequency of laying batches of eggs depend on the environmental temperature and moisture conditions. We raised 10 couples of the adults. The daily quantity of eggs and total of hatched eggs are shown in table 2.

Table 2. *Fecundity of E. balteatus raised by feeding on the aphis of C. lanigera under different temperature condition in the laboratory.*

Date of egg dropping	Quantity of eggs (number/mature/day)			Temp. (°C)	Moisture (%)
	Minimum	Maximum	Average		
1	1	3	2,4± 0,50	26,7	81
2	2	4	3,2 ± 0,56	28,2	83

3	3	5	3,8 ± 0,56	27,5	79
4	3	6	4,2 ± 0,66	29,2	74
5	4	7	4,6 ± 0,69	28,1	68
6	5	8	5,6 ± 0,69	29,3	85
7	5	7	5,4 ± 0,67	29,1	83
8	3	5	3,5 ± 0,51	26,8	79
9	1	2	1,28 ± 0,30	27,3	80
Egg dropping ability	27	43	39,4 ± 2,11	27,6	81,2

(Note: n = 10)

The flies of *E. balteatus* drop eggs within 9 days, the frequency of egg dropping gradually increased and reached the maximum quantity on the sixth or seventh day (5.3 - 5.6 number/mature/day), then decreased to the minimum of 1.28 ± 0.38 number/adult/day on the next day. At the temperature and moisture conditions of the laboratory, their average egg dropping ability is 39.5 ± 2.11 number/adult (Table 3.3).

3.4. The rate of hatching of E. balteatus in the laboratory

The rate of hatched eggs is an important biological criterion to identify the quantity of flies of the next litter that are likely to develop in the field. If the rate of hatched eggs is low, even though the fecundity of the adult is high, if the quantity of prey in the field is high, then the quantity of flies is not sufficient to manage the pest population. Therefore, we examined the rate of egg production of adults raised in the laboratory. The results are shown in table 3.

Table 3. *The rate of hatched eggs of the fly of E. balteatus in the laboratory*

Checking date	**Total of check eggs (nos)**	**Total of hatched eggs**		**Average temperature (^oC)**	**Average moisture (%)**
		Quantity (nos)	**Rate (%)**		
10/5 - 12/5	38	34	89,5	26,4	87,4
15/5 - 17/5	32	26	81,2	25,8	77,9
19/5 - 21/5	35	28	80,0	25,6	83,4
23/5 - 25/5	33	30	90,9	26,7	87,8
28/5 - 30/6	40	34	85,0	28,6	81,4
2/6 - 4/6	34	24	70,6	29,7	75,9

At different temperature and moisture conditions, the rate of successfully hatched eggs is different. At the average temperature condition of 27.1^0C and humidity of 87.8%, the rate of

hatched eggs reached 90.9%. At 29.7^{0}C and humidity of 75.9%, the rate of hatched eggs was 70.6% (Table 3.4). Therefore, temperature and moisture are two factors which affect the rate of hatched eggs in the labortory.

3.5. Identifying the ability of eating the aphis (C. lanigera) of the flies of E. balteatus

The flies of *E. balteatus* play an important role in controlling the quantity of the aphis of *C. lanigera*. In order to examine the consumption by *E. Balteatus* of the aphids, we assessed the level of consumptions of 1,2 -instar aphids. The consumption by *E. balteatus* of both instar stages is high (Table 4).

Table 4. *Predacity of the E. balteatus fly on aphids (C. lanigera)*

Age	Predacity of maggots through the raising stages					
	Stage 1			Stage 2		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Maggot at 1-instar	15	19	17.2 ± 0.37	13	18	15.9 ± 0.44
Maggot at 2-instar	62	73	69.7 ± 0.62	51	67	57.5 ± 0.51
Maggot at 3-instar	175	207	196.2±2.15	168	192	188.7±1.84
Average temperature (^{0}C)	25.0 ±0.75			27.8±0.78		
Moisture (%)	82.5±1.83			77.6±1.77		

4. Conclusions and recommendations

4.1. Conclusion

The growth process of *E. balteatus* passes through 4 stages of development: egg, larva (maggot), pupa and adult. The average life cycle time of the fly at 27.8 ^{0}C is 18.7 days, at 25.3 ^{0}C it is 20.07 days. The average life time of the fly at 27.8 ^{0}C is 25.93 days, at 25.3 ^{0}C it is 28.62 days. The flies of *E. balteatus* lay eggs within 9 days with an average of 39.5 ± 2.11 eggs/adult fly. The maximum numbers of eggs are laid on the sixth day (5.6 eggs/adult/day).

At the average temperature condition of 25.3 ^{0}C, and average moisture of 82.5%, an 1-instar maggot eats an average of 17.2 ± 0.37 aphids, a 2-instar maggot eats an average of 69.7 ± 0.62 aphids, a 3-instar maggot eats an average of 196.2 ± 2.15 aphids. At the average temperature condition of 27.8^{0}C, and average moisture of 77.6%, the maggot eats less aphids.

An 1-instar maggot eats an average of 15,9 ± 0,44 aphids, a 2-instar maggot eats an average of 57.5 ± 0.51aphids, a 3-instar maggot eats an average of 188.7 ± 1.84 aphids.

4.2. Recommendation

The findings from this study provide a reference document for students whose major is crop protection at universities and colleges.

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NURSERY CONDITIONS FOR *ONCIDIUM* (SWEET SUGAR) GROWTH AND DEVELOPMENT AT SEEDLING AND ADULT STAGES

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Abstract: *Viet Nam is a tropical country with monsoons, which is suitable for growing different kinds of flowers including Oncidium-sweet sugar Orchids. Production of Orchids in Viet Nam has not fully developed, compared with the potentials of this kind of flowers due to a lack of appropriate process of technology to produce Orchids. Research on techniques to grow Oncidium-Sweet Sugar Orchids in the period of seedling and production with a hope of contributing to the development of Orchids in Viet Nam.*

Effects of flowerbeds used on living scale and growth of Oncidium-sweet sugar Orchids in the period of seedling after 8 weeks are presented. To sum up, coir is the best condition for growing oncidium in the period of seedling.

Effects of nutrition on one- year- old oncidium sweet sugar Orchids grown in coir beds (after 8 weeks). In this period, using NPK 30-10-10 with the concentration of 1g/l/m^2 and watering once in every three days shows the best result.

Effects of nutrition on the growth and development of oncidium sweet sugar Orchids from 6 to 18 months old (after 8 weeks). In this period, using NPK 20-20-20 with concentration of 1g/l/m^2 gives the best result.

Effects of oncidium bulbs on the appearance of oncidium buds after 9 weeks. Under the same nutrition supply, the oncidium sweet sugar Orchids give the highest scale of bud production when treated for blooming as in R1 (bulb diameter of 2.5-3 centimeters).

Keywords: Oncidium-sweet sugar Orchids, nursery condition, effect.

1. Introduction

In ornamental world, orchid plays a special and royalty position that give orchid very high value on the market. They also hold an ecological partner to maintain biodiversity of the forests (Kaushik, 1983). Orchids are one of the most valued cut-flowers and potted plants among flowering plants and stay at top price on international flower markets. The orchid also

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occupies a significant position in the cut flower industry due to its attractiveness, long shelf life, high productivity, right season of bloom, ease of packing and transportation. The orchids represent one of the successfully mass propagated by tissue culture method and rapidly commercialized micro-propagation techniques into ornamental industry.

Most orchids originated in the tropical humid forests of Central and South America, India, Sri Lanka, Burma, South China, Thailand, Malaysia, Philippines, New Guinea and Australia (Chandra, 2015). A single orchid fruit bears several thousands of seeds; all of those seeds lack essential components for self-germination. In spite of a very large number of seeds produced, only few seeds germinate in nature. Currently, the horticultural markets depend on natural orchid populations as a source of stock plants, but most of them are not propagated and commercialized successfully. Although these orchid species are still common, the development of an industrial means for their propagation is required to reduce collection pressures on wild plants.

Vietnam is located at tropical region that is a mother land of several tropical orchids and one of these is *Oncidium* (Sweet sugar). Although the country holds orchid biodiversity but it is still poor in orchid production and sales. In the present study, an attempt was made to investigate growth conditions that fit to *Oncidium* development: "Nursery conditions for *Oncidium* (Sweet sugar) growth and development at seedling and adult stages".

2. Subjects and research methods

2.1. Subjects for research

Post-vitro Oncidium Sweet sugar Orchids, aged 1 year (after 2 weeks of growing) and aged 6-18 months.

2.2. Research methods

Experiments implemented in the artificial conditions, which enables adjustments in lights and temperature, in the net-houses of Hong Duc University.

The experiments were arranged as follows:

Randomly, repeated every three times, each treatment using 10 samples.

Regularly observed, data collected after every 10 to 15 days.

Data analyzed using IRRISTAT.

3. Results and discussion

3.1. The effects of the flowerbeds used on living scale and growth of Oncidium-sweet sugar Orchids in the period of seedling

All four substrates increased shoot length growth but coir had showed highest shoot growth in length. The same trend also occurred in root number development and this may be

due its capacity to maintain substate moisture which enhances root development. Although leaf number in coir was lower moss substrate but it was still much higher than fern and charcoal. Overall, growth and developemtal parameters in coir increased survival rate of seedlings after transfering from in-vitro condition.

Conclusion: coir was the most suitable substrate for *Oncidium* seedling growth and development.

Table 1. *Effects of flowerbeds used on living scale and growth of Oncidium-sweet sugar Orchids in the period of seedling after 8 weeks.*

Observation Index (OI) / Substrate (S)	Growth in height (cm)	Growth in number of roots (root)	Growth in number of leaves (leaf)	Percentage of alive samples
S1: Moss	0.41	1.55	0.32	88.11
S2: Coir	0.81	2.47	0.27	92.12
S3: Ferns	0.52	1.75	0.07	72.16
S4: Charcoal	0.37	1.65	0.27	76.21
LSD (5%)	0.28	0.70		
CV%	3.90	0.20		

3.2. The effects of nutrition on one- year- old oncidium sweet sugar Orchids grown in coir beds after 8 weeks of observation

Nutrients are essential components for plant growth and development in both macro and micro elements. Four nutrient formulas were tested to understand nutrient requirement of *Oncidium* development. Three formulas (F1, F2 and F3) used different NPK contents while the last one (F4) was combination of F1 and F2 including fish suspension as additional nutrients.

The treatment F2 NPK 30-10 -10 with using in 3-day intervals showed most efficiently supplied nutrients for *Oncidium* of one year old. This treatment increased significantly shoot growth and development in terms of shoot length, leaf and root number.

Table 2. *Effects of nutrition on one - year - old oncidium sweet sugar Orchids grown in coir beds (after 8 weeks)*

Observation Index (OI) / Formula (F)	Speed of height growth (cm)	Growth in number of leaves (leaf)	Branch producing scale (%)
F1: NPK 30-10-10 (0.5g/l)	0.43	0.73	17.52
F2: NPK 30-10-10 (1g/l)	0.93	0.89	22.19
F3: NPK 30-10-10 (1.5g/l)	1.25	0.24	11.37

F4: 3 times of using NPK 30-10-10 (1g/l) + 2 times of using NPK 20-20-20 (0.5 g/l) + 1 time of using fish milk (2.5ml/l)	0.31	0.28	6.16
LSD (5%)	0.39	0.23	
CV %	4.00	4.90	

3.3. The effects of nutrition on the growth and development of oncidium sweet sugar Orchids from 6 to 18 months old

Five treatments (T1 to T5) were applied to 6-18 month old plants to find the most suitable condition for *Oncidium* nursery before potting them. Shoot length and leaf number were best performed in T1 treatment with NPK only even this formula applied without additional nutrients such as vitamins and fish suspension. Shoot numbers were almost similar in all treatments with basic NPK components and additional elements. The treatment T1 NPK 20-20-20 (1g/l/m^2) showed most efficiently supplied nutrients for *Oncidium*at 6-18 month old.

Table 3. *Effects of nutrition on the growth and development of oncidium sweet sugar Orchids from 6 to 18 months old (after 8 weeks)*

Observation Index (OI) / **Treatment (T)**	**Speed of height growth (cm)**	**Growth in number of leaves (leaf)**	**Branch producing scale (%)**
T1: NPK 20-20-20 (1g/l)	2.11	2.98	0.93
T2: NPK 30-20-10 (1g/l)	1.64	2.78	1.03
T3: NPK 12-2-14 (1g/l)	1.56	2.70	1.06
T4: 5 times of using NPK 30-10-10 (1g/l) + 1 time of using vitamin B1 (3ml/l) + 1 time of using fish milk (3ml/l)	1.39	2.60	1.06
T5: 5 times of using NPK 12-2-14 (1g/l) + 1 time of using vitamin B1 (3ml/l) + 1 time of using fish milk (3ml/l)	0.73	2.50	1.17
LSD (5%)	0.95	0.19	0.10
CV %	4.30	1.10	5.00

3.4. The effects of oncidium bulbs on the appearance of oncidium buds

The length and size of pseudobulbs are known to affect flowering ability. Thirty adult *Oncidium* plants different in length of pseudobulbs were treated with flowering stimulants for

9 weeks. The results showed that pseudobulbs with 2.5-3cms in length formed highest flower numbers and inflorescent length. The pseudobulbs which had length of more than 3cms reduce flowering induction and bud formation significantly. This finding is important that helps keep *Oncidium* plants at right stage for controlling flowering. Generally, in the same conditions of nutrients and coir, applying flower induced treatments on pseudobulbs in size 2,5-3cm(R1) showed the highest flower bud formation compared to other treatments.

Table 4. *Effects of oncidium bulbs on the appearance of oncidium buds after 9 weeks*

Observation Index (OI) / Recipe (R)	Number of trees (tree)	Number of trees with buds (tree)	Appearance scale (%)	Height of shoot (cm)	Diameter of shoot (cm)
R1: 2.5- 3cm	30	17	56.67	82.01	0.32
R2: >3 - 4 cm	30	2	6.67	65.54	0.36

4. Conclusion and suggestions

4.1. Conclusion

Coir is the most suitable for growing oncidium. In this coir bed, the flower develops well and strongly and produces a lot of roots.

The most suitable nutrition supply for one-year-old oncidium is NPK 30:10:10 with the concentration of 1g/l/m^2 and for 6 to 18 month-old oncidium is NPK 20:20:20 1g/l/m^2.

4.2. Suggestion for further study

Further experiments should continue to be conducted on techniques which have been used to control the flower blooming./.

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CURRENT SITUATION OF SALINIZATION AND WATER EXPLOITATION AT THE LOWER SECTION OF MA RIVER SYSTEM, THANH HOA PROVICE IN THE PERIOD 2005 - 2015

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Abstract: *The lower section of Ma river system is facing complicated salinization, depending on its morphology, slope, tide regime and the increasing effect of climate change. As a result, for effective exploitation of fresh water (salinity ≤ 1.0‰) it needs to take care of the impact of tide regime on rivers' salinization. Using data of "History of the tide" of Thanh Hoa Hydrometeorology center in some details to limit damages in water supply for irrigation and living of residents in coastal districts of Nga Son, Hau Loc, Hoang Hoa, Quang Xuong, Sam Son city and Thanh Hoa city.*

Keywords: *Salinization, lower section of Ma River, water resource, Thanh Hoa.*

1. Rationale for the study

Thanh Hoa province is a bridge between the Northern Delta and the South Central Coast. On the territory of the province located the third largest river system of the country, that is Ma river system. Ma river system plays an important role in the formation of natural landscape as well as socio-economic development of Thanh Hoa province. The total amount of water flows in the river system is 20.1km^3 per year, which is a significant source of water supply for living and production of residents. Alluvium of the river is the main source to raise the level of Thanh Hoa plain, the third largest plain of Vietnam. Moreover, Thanh Hoa province is bounded by the South Bien Dong in the east with the coastline of 102km long. Thus, there is a high risk of salinization at the river mouth of Ma river system. Evaluating current situation of salinization at the lower section of this river system not only serves water management and exploitation for living of people in Thanh Hoa plain, but also forcasts and prevents salinization risk, disminishes potential damages.

The study "*Current situation of salinization and water exploitation at the lower section of Ma river system, Thanh Hoa province in the period 2005 - 2015"* is a significant basis for water management and exploitation in Thanh Hoa's territory.

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2. Literature review

Surveys on water resource in Thanh Hoa province have been carried out since the late 1970s by agencies, such as the Northern Water Resources Planning and Investigation Federation; National Center for Meteorology and Hydrography; Water Resources Planning and Investigation Organization 2F; Department of Natural Resources and Environment of Thanh Hoa province; Thanh Hoa Department of Agriculture and Rural Development. Research of these agencies were presented in the form of written reports. In recent years, the number of studies on water resource and salinization in Thanh Hoa's territory is small and they were mostly taken by Department of Natural Resources and Environment of Thanh Hoa province. Studies focusing on salinization at the lower section of the river system are more uncommon and dispersed, except data annually collected by Thanh Hoa Hydrometeorology Center. Besides, there are several studies of Thanh Hoa's territory such as Thanh Hoa Geography (2005) by Assoc. Prof Le Van Truong [3], Thanh Hoa Monograph, volume 1 (2006). However, these studies only presented generally about natural and socio-economic conditions of Thanh Hoa province without assessing the detail of water resource and salinization at the coastal areas.

3. Methodology

3.1. Data collecting, analyzing and processing method

Data for this study was collected from Department of Natural Resources and Environment of Thanh Hoa province and Thanh Hoa Hydrometeorology Center. Collected figures were classified, then processed into tables, charts and maps.

3.2. Cartographic method - GIS

Based on the data of water resource and salinization at the river mouth of Thanh Hoa's territory; cartographic method has been used for contributing a map of salinization at the river mouth of Thanh Hoa province.

3.3. Field-work method

Some field trips were carried out to the lower section of Ma River system to collect data and take water samples for salinity investigation. In addition, these observations are necessary to give objective and practical conclusions.

3.4. Assessment method

This method was used when comparing salinization figures of Ma river system, Thanh Hoa Province with national environmental standards. Thereby, current situation of salinization in the Province would be clear and recommendations could be given for management and sustainable exploitation of water resource.

4. Result of study

4.1. Tidal characteristics at the lower section of Ma river system

Tidal characteristics at the tidal section of Ma river system are similar to the tidal regime's of Thanh Hoa's coastal area, it is inhomogeneous diurnal tide. There is one flood-tide and one ebb-tide in most days of a month. The time for a flood-tide is 8 - 9 hours and an ebb-tide is 16 - 17 hours in average. The tidal movement is uninterrupted over space and time.

By time, a tidal cycle lasts averagely 13 - 14 hours and includes three periods:

- The ebb-tide period: 2 - 3 days, the crest of tide is low, the ebb-tide is high, the tidal amplitude is small.

- The flood-tide period: 3 - 5 days, the crest of tide is high, the ebb-tide is low, the tidal amplitude is high.

- The transition period: 4 - 6 days, all the crest of tide, the ebb-tide and the tidal amplitude are medium.

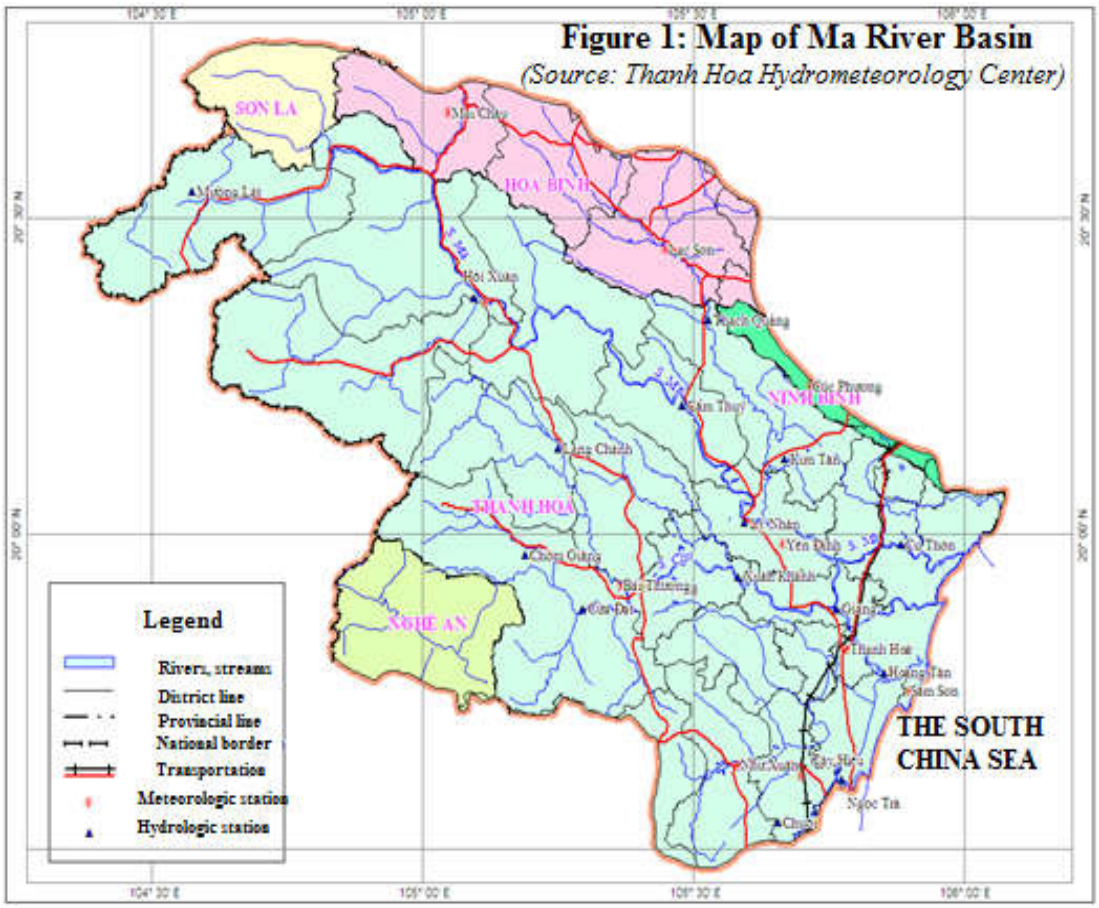
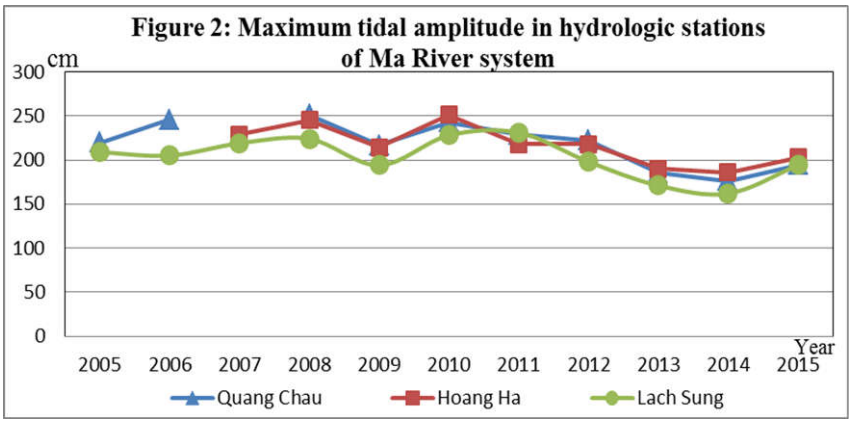


Figure 1: Map of Ma River Basin
(Source: Thanh Hoa Hydrometeorology Center)

By space, the tidal amplitude decreases gradually from the river mouth to the upstream. Ebb-tide and flood-tide appear slowly from the sea to inland.



(Data source: Department of Natural Resources and Environment of Thanh Hoa province)

4.2. Current situation of salinization at the lower section of Ma river system

Salinity movement at the lower section of Ma river system is similar to tidal level. Collected data shows that in a tide the maximum salinity occurs at the same time or 1 - 2 hours later than the crest of tide; the minimum salinity occurs simultaneously with the ebb-tide. By the water depth, salinity increases steadily from the surface to the bottom. Salinity of river water in Ma river system was given in table 1.

Table 1. *Salinity of river water in some hydrologic stations of Ma River system (in ‰)*

Year	Giang		Ham Rong		Nguyet Vien		Quang Chau	
	Max	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**
2005					14.7		29.7	
2006					12.0		28.1	
2007	2.3	0.1	9.2	0.1	14.4	0.5		
2008	1.2	0.1	9.0	0.1	12.6	0.1	27.2	1.9
2009	0.2	0.1	6.7	0.1	9.8	0.1	26.7	1.3
2010	6.1	0.1	12.3	0.2	17.5	0.3	28.3	3.9
2011	0.7	0.1	6.5	0.1	9.8	0.1	24.0	0.3
2012	0.2	0.1	5.6	0.1	10.2	0.1	25.0	0.7
2013	0.6	0.1	7.0	0.1	9.5	0.1	26.1	1.0
2014	0.4	0.1	5.2	0.1	7.5	0.1	21.9	1.1
2015	0.7	0.1	3.0	0.1	5.6	0.1	21.6	0.4
Average	*1.2*	*0.1*	*5.7*	*0.1*	*10.2*	*0.3*	*25.9*	*1.3*
Maximum	6.1	0.1	13.5	0.3	17.5	2.5	29.7	3.9
Year	*2010*	*1990*	*1999*	*1999*	*2010*	*1999*	*2005*	*2010*

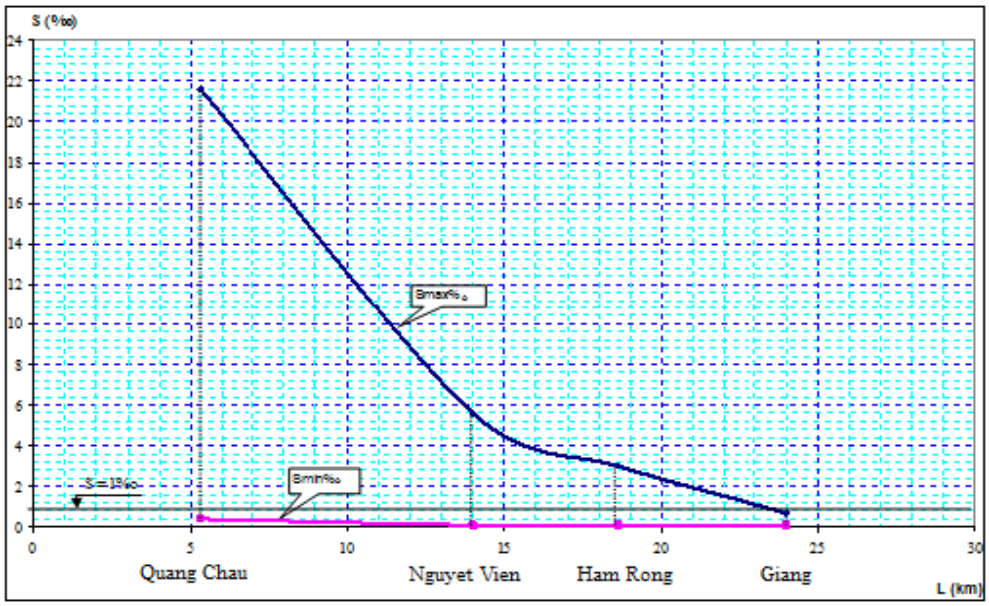
(Source: Department of Natural Resources and Environment of Thanh Hoa province)

The data in table 1 shows that the highest salinization occured in 2010: in Ma river, salted water penetrated into land up to 29kms; in Len river was 22kms; in Yen river and Hoang river was 26kms; in Nhon river was 23kms; in Lach Truong and De channel, sea water broke into all rivers; in Hoat river, brine went up to My Quan Trang and in Bao Van river salted water infiltrated up to Bao Van. In comparison with in many years, salinity in some main rivers such as Ma and Len went to the highest in history in 2010. In particular, in Ma river, the highest salinity in Giang hydrologic station (24km from the estuary) is normally under 1.0‰, in some years, this salinity was above 1.0‰ such as 2007: 2.3‰; 2008: 1.2‰, only in 2010, salinity in this station reached 6.1‰. After 2010, salinity in all rivers of Ma river system has been decreased.

Because of seasonal water regime, salinization on Ma river system in studied period changed considerably by season. In dry season (from November to May), the rivers' flow dropped significantly, salinization penetrated further inland: salinity at rivers' mouths were high (26‰ - 28‰), the maximum exploitable salinity of 1‰ entered deeply (18 - 23kms). This phenomenon increased drought and salinization situation in dry season. In rainy season (from June to October), the rivers' flow rose and water level was high, salinity was not likely to infiltrate farther into the mainland. Additionally, the tide regime changed unpredictably in this wet season, especially in abnormal and harsh weather conditions caused by climate change.

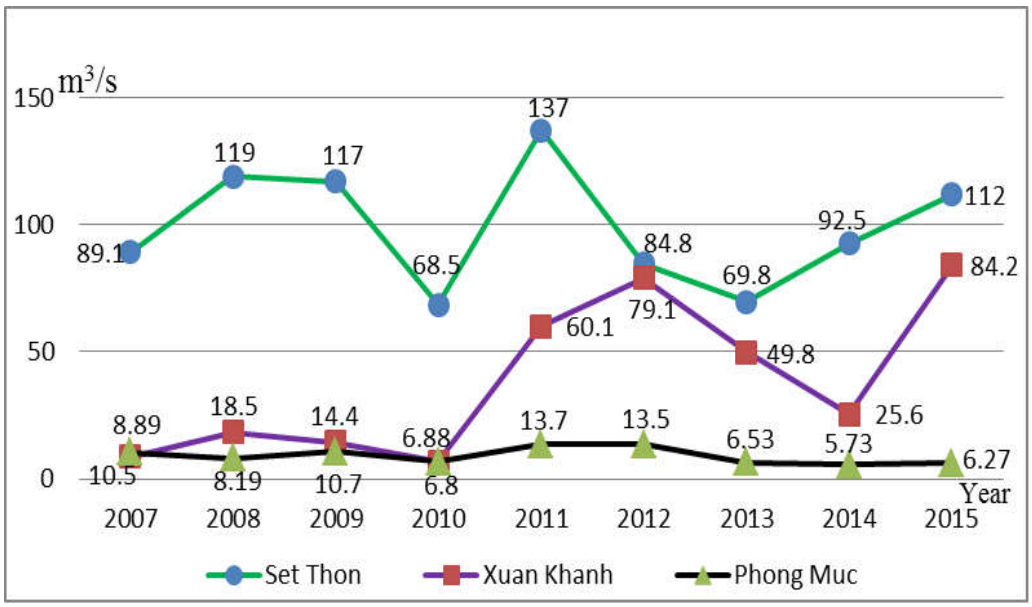
By space, salinization in Ma river system fell slowly from river mouth to upstream due to the variation in the amount of water comes from upstream and the weakening of the tide. Salinity was at the highest in rivers' mouths which was equivalent to sea water (30‰ - 32‰). Figure 3 shows that salinization potential at the lower section of Ma river system was very high resulted from abnormal change on the rivers' flow (Figure 4) and high salinity in the rivers' mouths.

Figure 3. *Changed salinity along Ma river, March 2015*



(Source: Thanh Hoa Hydrometeorology center)

Figure 4. *Average river's flow in hydrologic stations of Ma river system*



(Data source: Department of Natural Resources and Environment of Thanh Hoa province)

Depending on tributaries, the level of salinity intrusion in rivers was also varied.

In Ma river: From Quang Chau (Quang Xuong district) to Giang Fork:

The crest of tide salinity: 0.7 - 21.6‰ (annual average: 1.3 - 26.9‰)

The ebb-tide salinity: 0.1 - 0.4‰ (annual average: 0.1 - 1.5‰)

Penetration of 1% salinity in river mouth: 23kms (Thieu Khanh commune, Thanh Hoa city).

In Len river: From Ganh Wharf (Hau Loc cistrict) to Cu Thon (Ha Trung district):

The crest of tide salinity: 0.3 - 18.1‰ (annual average: 1.9 - 23.2‰).

The ebb-tide salinity: 0.1 - 0.4‰ (annual average: 0.1 - 1.7‰)

Penetration of 1% salinity in river mouth: 18.0kms (Ha Phu commune, Ha Trung district).

In Lach Truong river: From Hoang Ha (Hoang Hoa district) to Ma river distributary door:

The crest of tide salinity: 0.4 -17.6‰ (annual average: 2.5 - 20.6‰)

The ebb-tide salinity: 0.1 - 0.5‰ (annual average: 0.1- 1.6‰)

Penetration of 1% salinity in river mouth: 18kms (Hoang Hoa district)

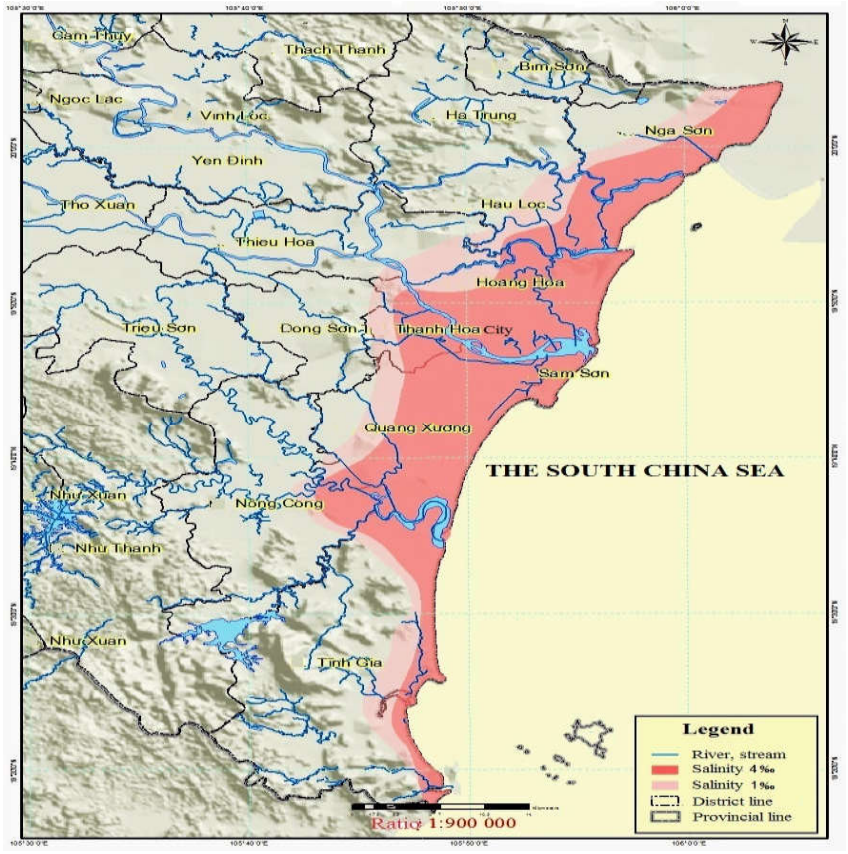
In De channel: From Nam Huan wharf to De bridge (Hau Loc district):

The crest of tide salinity: 15.0 - 22.1‰ (annual average: 22.6 - 26.4‰)

The ebb-tide salinity: 0.2-3.9‰ (annual average: 0.8-5.3‰)

Penetration of 1‰ salinity in all the channel.

Figure 5. *Map of salinization at the coastal area of Thanh Hoa province in March 2015*



(Source: Thanh Hoa Hydrometeorology Center)

4.3. Impact of salinization to water exploitation at the lower section of Ma river system

The allowed salinity of water that can be exploited as freshwater is ≤ 1.0‰. Based on the collected data, freshwater that can be exploited in Ma river system is as follows:

River sections that can be exploited freshwater continuously (Non-saline)

In these river sections, water can be exploited continuously without considering influences of tide. However, for the best use of water it is recommended to exploit water on the flood-tide.

Ma river	From Giang to upstream : 23kms from the sea
Lach Truong river	From Van Ninh to upstream : 17.5kms from the sea
Len river	From Cu Thon to upstream : 18kms from the sea
Yen river	From Ben Mam to upstream : 25kms from the sea
Hoang river	From Quang Ngoc to upstream : 23kms from the sea
Nhom river	From Cau Lac to upstream : 23kms from the sea

The range of freshwater use on these river sections is applied in flood-tide days in dry season; in the days of low tide, salinity cannot influence deeply on the rivers so that the range can be receded a little downstream. Nevertheless, due to complicated combining two-way flows at the lower section, it needs to be aware of tide - salinity rules in order to take advantage of river water in a reasonable manner.

River sections that can be exploited for freshwater (Saline)

Ma river	Giang - Quang Chau : 6 - 23kms from the sea
Len river	Cu Thon - Tham Ferry : 9 - 18kms from the sea
Lach Truong river	Van Ninh - Hoang Ha : 12 - 18kms from the sea
Yen river	Ben Mam - Ngoc Tra : 12 - 25kms from the sea
Hoang river	From Quang Ngoc downward : < 23kms from the sea
Nhom river	From Lac Bridge downward : < 23kms from the sea

In these river sections, the time for freshwater exploitation depends on tide - salinity development, location and river. It is recommended to exploit freshwater in ebb-tide days because in these days the tidal pressure is reduced; therefore, salinity is lower than in flood-tide days. Water can be also exploited before and after the ebb-tide when salinity is at the lowest.

River sections that cannot be exploited freshwater (Heavy saline)

Ma river	From Quang Chau to the sea : 0 - 6kms from the sea
Len river	From Tham Ferry to the sea : 0 - 9kms from the sea
Lach Truong river	From Hoang Ha to the sea : 0 - 12kms from the sea
Yen river	From Ngoc Tra to the sea : 0- 12kms from the sea

Because these river sections are next to the sea, tide and salinity are all highly penetrated. The lowest salinity is from 1.0‰ and above. Therefore, the tide - salinity development needs to be comprehended when exploiting water source.

5. Conclusion and recommendation

The tidal river section of Ma river system (the coastal plain) in the territory of districts: Nga Son, Hau Loc, Hoang Hoa, Thanh Hoa city, Sam Son city, Quang Xuong, Nong Cong and Tinh Gia, is a region with diversified socio-economic development potential and crowded population. Water supply for living and economic development of the region is very high and urgent. However, freshwater exploitation in this tidal area faced many difficulties because characteristic of tidal regime in dry season was affected by salinisation. Moreover, in recent years, the flows on main rivers in dry season decreased, leading to droughts and water shortages, deeper salinization inland, making it difficult for agricultural production.

In the studied period (2005 - 2015), the highest salinization occured in 2010. Although salinity in recent years went down, especially on Lach Truong river (normally, sea water breaks into all the river, but in 2015, it went up only 17kms in Hoang Dat commune, Hoang Hoa district), this was not the general trend because the tide - salinity development would be even more complicated under impacts of climate change. This is another factor leading to salinization potential at the lower section of Ma river system has been threaten the living and production of residents. Besides tidal factor, penetration of salinity into rivers also depends on rivers' morphology, rivers' slope, weather conditions and human impacts. In order to effectively exploit freshwater of Ma river system (salinity ≤ 1.0‰) in dry season, some points below need to be attended:

Exploiting freshwater at the tidal river sections is conditional exploitation (depending on tide - salinity development). The safe time for pumping water (under allowed salinity) bases on river section, tide, and time.

Taking advantage of ebb-tide days when salinity of rivers is low to exploit water. When pumping stagnant water in flood-tide days, it is necessary to check and monitor the salinity development because this time is quite short and the salinity often changes very fast.

Annually, Hydrometeorology Center has published "History of the tide" in some details; thus, freshwater exploitation process should apply this to seize the tidal regime on river systems of Thanh Hoa province to limit damages and take advantages of tide at the highest level.

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AN OVERVIEW OF RESEARCH ON CORPORATE SOCIAL RESPONSIBILITY IN SOME DEVELOPING COUNTRIES AND LESSONS FOR VIETNAM

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Abstract: *The literature review and the practice of corporate social responsibility (CSR) in Vietnam of this article will show the fact that CSR has a great contribution to the success in business and production activities of the enterprises. However, social responsibility in Vietnam is in the first step of awareness and implementation, meanwhile a proper implementation of CSR can bring along a variety of competitive advantages. In order to improving CSR of Vietnameses' enterprises, it should increase the awareness of CSR for stakeholders; form the standards, codes of conduct at national and regional level on CSR; gradually adopt CSR reporting and require CSR as a selection criterion for investors in Vietnam.*

Keywords: *Corporate Social Responsibility (CSR), developing countries, Vietnam.*

1. Introduction

In the current international integration, the role of implementing social responsibility is increasingly important in business activities of enterprises in developing countries. In these countries, there is a growing recognition of the significant effect of the enterprises activities on employees, customers, communities, the environment, competitors, business partners, investors, shareholders, governments and others. It is also becoming increasingly clear that firms can contribute to their own wealth and to overall societal wealth by considering the effect they have on the world at large when making decisions in developing countries (Paul Hohnen, 2007). A key driver of CSR is the impact it can have as a lever for improving competitiveness and as a means of reducing costs and creating new value. Most businesses seek to be profitable, and this can be done in a manner which creates shared value for all stakeholders. High performing organizations manage their societal, economic and environmental responsibilities in an ethical manner which benefits them, their workers and their wider local communities (Richard Bruton, 2014). However, some businesses do not understand the process of putting social responsibility into the business.

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This article uses the theoretical research method to explore some of the issues related to CSR, role, impact and situation of CSR in developing countries through studies of authors in the world to understand the nature and trends; review the practice of CSR in Vietnam and finally draw direction for the implementing the CSR issue in Vietnam. The literature review in some developing countries of this article shows the fact that the success in business and production activities of the enterprises will lead to the great contribution of the provincial budget, fulfilling their tax obligations to the State, ensuring the employee lives, protecting environment and supporting the poor communes and poor, etc. which are as evidence for the implementation of social responsibility effectively. Moreover, in the context of Vietnam, to guide and facilitate the implementation of good CSR, the best way for enterprises is to strengthen information and propaganda for stakeholders to understand the nature and contents of the issue "social responsibility" in the business to know and comply.

2. Literature review

2.1. Corporate Social Responsibility

CSR is a rather new concept for many companies and it is becoming a strategic approach to run businesses on a sustainable basis during international integration. The EU commission describes CSR as "A concept whereby companies integrate social and environmental concern in their business operations and in their interaction with their stakeholders on voluntary basis" (Dahlsrud, 2008, p.7). It depends upon the business organizations: how they integrate this concept and adapt to it, if deciding whether to go beyond the minimum legal requirement. The companies' social and environmental integration is essential for demonstrating their interest among stakeholders.

Business dictionary defines CSR as a company's sense of responsibility towards the community and environment (both ecological and social) in which it operates. Companies express this citizenship through their waste and pollution reduction processes, by contributing educational and social programs and by earning adequate returns on the employed resources. A broader definition expands from a focus on stakeholders to include philanthropy and volunteering (Paul Hohnen, 2007).

According to United Nations Industrial Development Organization, Corporate Social Responsibility is a management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders. CSR is generally understood as being the way through which a company achieves a balance of economic, environmental and social imperatives (Triple Bottom Line Approach), while at the same time addressing the expectations of shareholders and stakeholders. In this sense it is important to draw a distinction between CSR, which can be a strategic business management concept, and charity, sponsorships or philanthropy. Even though the latter can also make a valuable contribution to poverty reduction, it will directly enhance the reputation of a company and strengthen its brand, concept of CSR clearly goes beyond that.

Blowfield and Frynas (2005) defined CSR as an umbrella term and distinguished different aspects of CSR that companies have to consider, such as social and environmental aspects in their business strategy and ensuring responsible behavior when dealing with other business companies. Behaving as ethical corporate citizen, Carroll (2008) uses Corporate Social Performance model to measure social performance of business organizations.

According to Carroll (1991), CSR involves the conduct of a business so that it is economically profitable, law abiding, ethical and socially supportive. To be socially responsible then means that profitability and obedience to the law are foremost conditions when discussing the firm's ethics and the extent to which it supports the society in which it exists with contributions of money, time and talent. The different layers of the pyramid illustrated different types of obligations that society expects from businesses (Figure 1).

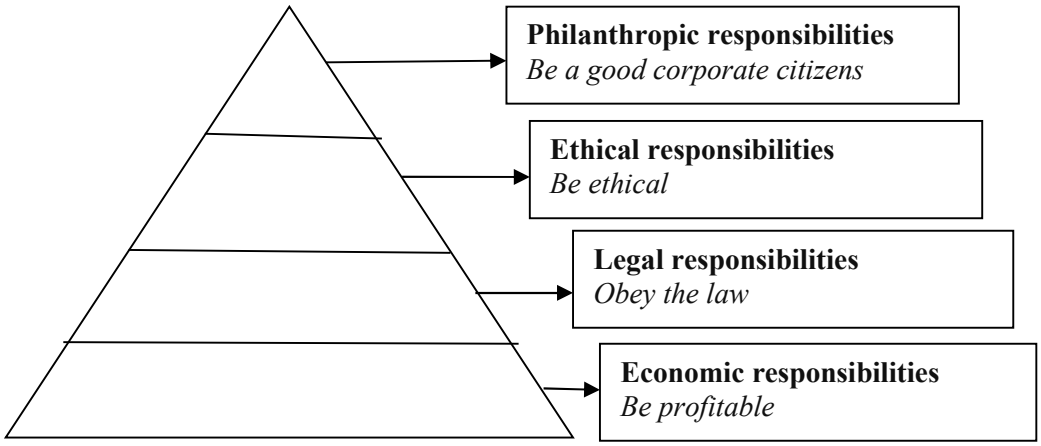

Figure 1. *CSR pyramid by Carroll (1991)*

In spite of any definitions, the term CSR refers to the concept of business being accountable for how it manages the impact of the processes on stakeholders and take responsibility for producing a positive effect on the society. CSR has been defined as the continuing commitment by business to behave properly, fairly and responsibly and contribute to economic development while improving the life of the workers and their families as well as the local community and society at large.

2.2. Overview of research on Corporate Social Responsibility in some developing countries

Asia is the region most often covered in the literature on CSR in developing countries, with a significant focus on China (e.g. Zhuang and Wheale, 2004), India (e.g. Balasubramanian et al. 2005), Indonesia (e.g. Blowfield, 2004), Malaysia (e.g. Zulkifli and Amran, 2006), Pakistan (e.g. Lund-Thomsen, 2004)[1]. The Journal of Corporate Citizenship special issue on CSR in Asia (issue 13, 2004) provides a good overview of the status of the debate. Editors Birch and Moon (2004) note that CSR performance varies greatly between

[1] CRS in global context (Crane, 2010), pp. 3-20, Routledge (eJournal)

countries in Asia, with a wide range of CSR issues being tackled (e.g. education, environment, employee welfare) and modes of action (e.g. foundations, volunteering, and partnerships). Chapple and Moon (2005) find that nearly three-quarters of large companies in India present themselves as having CSR policies and practices versus only a quarter in Indonesia. Falling somewhere between these two extremes are Thailand (42%), Malaysia (32%), and the Philippines (30%). CSR in developing countries represent "the formal and in-formal ways in which business makes a contribution to improving the governance, social, ethical, labor and environmental conditions of the developing countries in which they operate, while remaining sensitive to prevailing religious, historical and cultural contexts' (Visser et al. 2007).

The study of Syed Kamran Hameed, 2010 ịn Pakistan is based on empirical findings where all the facts and information are gathered through qualitative approach. The six different companies in which three multinational MN's and three domestic companies have CSR in their strategy have been selected. The descriptions of all their CSR strategies is then compared with the theoretical framework. The analysis of empirical findings under theoretical assumptions reveals that most of the CSR is carried in a similar way which is based on community development through charity or philanthropy (Syed Kamran Hameed, 2010). To increase the general awareness about CSR the companies have to consider environmental, social, and ethical awareness in their business strategy and try to go beyond philanthropy or charity and adopt a long term sustainable strategy in the business to become ethical corporate citizen. This can make Pakistan a place for an attractive business environment for investors.

The "social contract' between the corporation and the community is of critical importance. The motivations for these contracts are continuously being revisited to understand how CSR programs can nurture and contribute to the growth of firms. While CSR issues are attracting a great deal of attention in the developed world, there is a need for more research into CSR in the developing world. The paper of Ali Quazi et.al (2007) consider the CSR practices of a small sample of multinational corporations (MNCs) and local firms in Bangladesh to better understand this situation. According to this research, CSR is no longer exclusively a developed country phenomenon. Managers operating in developing countries are also showing interest and commitment to CSR. Despite being one of the world's poorest countries, CSR actions in Bangladesh have raised significantly importance as noted from the findings of the study. It is believed that the interest in CSR initiatives in Bangladesh has been fuelled largely by MNCs. As countries like Bangladesh are increasingly exposed to global standards, it is anticipated that the growth of CSR will continue. From a marketing standpoint, CSR is also becoming attractive to Bangladeshi companies for strategic reasons. Firms use their CSR records to create the image of socially responsible firms and thereby influence consumer buying decisions in favor of the goods and services marketed by them.

In other developing countries of Africa or Latin America, the researchers showed that CSR in developing countries is different from its typical manifestation in the developed world such as America and Europe (Correa et al., 2004; Oliveira, 2006; Visser, 2007) due to the 10 different drivers: cultural tradition, political reform, social economic priorities, governance

gaps, crisis response, market access, international standardization, investment incentives, stakeholder activism, supply chain (Crane, 2010).

Dang Thi Hoa and her partner (2016) in a research on CRS in the context of Vietnam enterprise showed that CRS is considered to be one of the most important requirements for an enterprise if it wants to grow significantly in comparison with its local business and reach out to businesses around the world. However, in Vietnam, the implementation of CRS is relatively difficult. The main reason is that the understanding of CRS by enterprises is still incomplete as they simply think that CRS is for charity, while CRS is a very necessary requirement for a business operating in today's society (Dang Thi Hoa, 2016).

Phu-Hop Mai (2017) in the research of "The CSR in Vietnam to day" continuously illustrated that "the good implementation of CSR by the corporate does not only ensure the sustainable development of the corporate but also the society". Similar to the trend, in Vietnam, the businesses who are bringing the CSR into strategy often are big ones and most with export market. Meanwhile, the medium and small enterprises, which are accounted for over 97% of all business[2], have not seen opportunities and benefits of the CSR; some of them have even misunderstood or intentionally misunderstood the importance of SCR (Phu-Hop Mai, 2017).

Taking all of the review, the author of the paper assumed that the order of the CSR layers in developing countries, which are included four indicators of the various responsibilities (mentioned as CSR pyramid), differs from Carroll's classic pyramid. Following, in developing countries, economic responsibilities still get the most emphasis, which lied in the bottom of the pyramid. Meanwhile, philanthropy is assumed as the second highest priority, followed by legal and then ethical responsibilities.

3. The practice of Corporate Social Responsibility for sustainable development in the case of Vietnam

In Vietnam, the government has recently raised the awareness of businesses and stakeholders on CSR, to be regarded as an important content in the agenda of sustainable development. The issue of social responsibility of enterprises recently has been interested by state's departments by applying certification to management system, such as quality management system (ISO 9000), environmental management system (ISO 14000), labor and social responsibility assembly (SA 8000).

The international organizations in Vietnam have been putting much effort in promoting and implementing CSR contents, including: working conditions, occupational health and safety, labor relations and human resource management, energy savings; reducing carbon emissions; use of recycled materials; use of solar energy; improved drinking water sources; literacy; school construction; relief, support victims of disasters; establish and fund research

[2] Source: Statistic of Vietnam General Statistical Office

centers. The concept of CSR has been introduced into Vietnam through the operation of foreign invested multinational companies such as: "Program I love Vietnam" of Vietnam Hondas company; "Hygiene education program for children" by Unilever company; "Training Program-Topic 64" by Microsoft, Qualcomm and HP Computer companies; "Congenital Heart Defect-Support Program" and "Can Tho Bridge Incident Victims Program" by Vinacapitat, Samsung's companies; "Vision rehabilitation program for poor children" by Western Union.

Each year, the Chamber of Commerce and Industry of Vietnam, the Ministry of Labor, Invalids and Social Affairs, the Ministry of Trade and Industry together with the associations of Footwear, Textiles award *"Social responsibility of businesses towards the sustainable development"* in order to honor the way enterprises implement social responsibility, from those, many large enterprises in Vietnam have found that social responsibility is one of the indispensable requirements in the context of globalization and international integration. If businesses do not comply with CSR, they will not be access to the world market.

Many businesses when implementing social responsibility have brought about practical results in production and trade. Recent survey results by the Institute of Labor Science and Social Affairs carried out on 24 enterprises of the two branches Shoes and Textile show that, thanks to the implementation of programs of social responsibility, sales of these businesses have increased by 25%, labor productivity has increased from 34.2 million to 35.8 million/1 employee/year; exports increase from 94% to 97%[3]. Besides economic efficiency, these businesses also strengthen their reputation with customers; create loyalty and satisfaction of employees of enterprises, attracting labor force with high expertise. These enterprises implement the full responsibility to pay taxes to the state; registered implementation of social responsibility in the form of a commitment to environmental protection.

However, many enterprises have not implemented seriously its social responsibility in operation, leading to cases of cheating in business, financial statements; uninsured work safety, substandard products and causing environmental pollution. Typical is the case of discharging wastewater without treatment causes serious pollution to rivers and communities of the Miwon Company, Viet Tri Paper Company, Hyundai Vinashin (Khanh Hoa). In addition, many businesses that violate the law on wages, insurance benefits, workplace safety. These phenomenons also are not uncommon, have been pressing for social causes. Regarding safety issues, according to statistics reported by the Ministry of Labor, Invalids and Social Affairs from 2014 to 2016, the accidents happened nation wide in working tend to increase in the number, making higher labor victims in these accidents (Table 1). Number of death employees in 2016 is 862 employees, an increase of 29,4% over the previous year. In December 2016, authorities discovered 898 violations of regulations on environmental sanitation, which handled 719 cases with a total fine of 7.8 billion. Generally, in 2016, 14,580

[3] Cited following molisa.gov.vn (website of Ministry of Labour, War invalids and Social Affairs)

cases of violations of regulations on environmental protection have been detected in the whole country, of which 8,249 cases have been handled with a total fine of over 462 billion VND[4] .

Table 1. *Statistical occupational accident situation from 2014 to 2016*

No	Statistic Criteria	Year 2014	Year 2015	Year 2016
1	Number of cases	6.709	7.620	7.981
2	Number of victims	6.941	7.785	8.251
3	Number of cases with deaths	592	629	799
4	Number of death victims	630	666	862
5	Number of seriously injured victims	1.544	1.704	1.952
6	Number of female victims	2.136	2.432	2.371
7	Number of cases with from over 2 victims	166	79	106

(Source: Ministry of Labor, Invalids and Social Affair[5])

Experienced three decades of innovation, from a poor country, Vietnam has become a country with average income levels in the world. However, simultaneously with the development, the contradictions in social life are rising. A new social phenomenon appeared and also shows the contradiction: that is the both struggling and cooperation relationship between employers and employees in recent years. In fact, in recent times, many labor disputes and strikes have occurred in enterprises, especially in foreign investment enterprises and private enterprises. They affect the environment investment and economic growth - as well as social order and safety in the business society and local areas. Most of the reasons given for their workers held strike at all businesses are focused on many issues, such as overtime, working conditions, low compensation and salary, which do not provide enough for employees' life. Especially, in many companies, rules and regulations are too harsh for workers, which not only dis-encourage employees to increase productivity but also have an impact back. In a state enterprise as Vinasin, a statistic in 2010 showed that there were about 17,000 workers change jobs or quit; 5,000 workers lost their jobs; many workers of several factories and factories slowed paid for months (Pham Duy Nghia, 2011)[6]. In addition, many of the strikes occurred mainly in the textile business, footwear, seafood processing, timber processing, electronic assembly, of the invested enterprises from Korea, Taiwan Japan, Hong Kong who are now using more labor. Another reason is a capitalist-style management: the harsh and cruel treatment of the employers to the employees also causes strikes. According to the Institute of Workers and Staff Union of Vietnam Labor Confederation, 2014, in recent 10 years, there have been 878 strikes occurred in FDI, accounting for 70.7% of the total number of strikes in Vietnam[7].

[4] Source: Statistical report of socio-economic situation in 2016 of GSO (website: http://www.gso.gov.vn)
[5] Statistical report on occupational accidents situation from 2014 to 2016 from the website (www.molisa.gov.vn)
[6] Fulbright Economics Teaching Program document from 2011 - 2013
[7] www.congdoan.vn

There are different opinions about the causes of failure to implement business ethics and social responsibility of enterprises in Vietnam. Some people believe that the social responsibility of enterprises in Vietnam have not been legalized in all businesses. For large businesses with export market, as required by the customer, social responsibilities are forced to perform. For small and medium enterprises, due to financial constraints and lack of legal constraints, most businesses only understand social responsibility as "charitable donations". Some others said that the implementation of social responsibility will increase costs of businesses, reduce competitiveness but not foresee benefits, so small and medium businesses do not want to implement social responsibility. However, in recent years, due to environmental disasters and the negative consequences on society caused by businesses, social responsibility issues pose imperatively for Vietnam legal system. In short, social responsibility in Vietnam is in the first step of awareness and implementation. Certainly, along with the development process of the country, social responsibility will be enhanced more with the completion of the legal framework, the state apparatus and institutions of market economy and social institutions.

4. Lessons learned for improving Corporate Social Responsibility in Vietnam

4.1. Increase the awareness of CSR for stakeholders

CSR is not a new theme in Vietnam. Many businesses, especially those enterprises exporting to the EU, Japan and North America regularly faced with the reporting requirements related to CSR. Many seminars, conferences, forums, courses on CSR were held. However, it seems that CSR has not really been interested in Vietnam, both in terms of perspective, content and the way to be done. Most businesses do not have adequate awareness about CSR and its role for enhancing the competitiveness and the sustainable development of their businesses, even some still consider CSR as the cost burden. In particular, the people, the community, employees, consumers increasingly harder approach on this issue, while these are the associated benefits.

Therefore, we must first continue to propagate, disseminate and raise awareness about CSR in a stronger, scope and wider audience, not confined to entrepreneurs, businesses, agencies, organizations that must go to the community and local residents, including the introduction of the general education program. Businesses and stakeholders should actively aware of CSR.

4.2. Form standards, codes of conduct at national and regional level on CSR

Vietnam has not yet built the CSR codes of conduct. A few businesses, if they want their makes, so it is very difficult to apply in a systematic way. So we need to build the CSR evaluation standards in Vietnam that is based on international experience, actual conditions in the country. Along with that is the building of the CSR in an independent and responsible evaluation system.

4.3. Gradually adopt CSR reporting

Annual reports or periodic CSR is not just a promotional tool, but also is the media for the owner, the state, the community and the stakeholders reviews, communicate with the enterprise's operations.

The adoption of CSR reporting regime in Vietnam is a process of perfecting the steps both from the government and enterprises and other organizations, and might not have the conditions to apply in the short term. However, from the experience of world, Vietnam enterprises should adopt the report mode for large-scale enterprises, which have much greater impact on society and the environment.

4.4. Gradually take CSR as a selection criterion for investors in Vietnam

Businesses implement CSR are firms having capable of capital, technology, business ethics and sense of contribution to the local community. The implementation of harmonized business strategy, long-term sustainability of enterprises with foreign capital implement CSR can provide learning opportunities for local firms, forcing domestic firms to gradually raise awareness and social responsibility to be involved in production networks of foreign companies.

5. Conclusion

A proper implemention of CSR can bring along a variety of competitive advantages, such as enhancing access to capital and markets, increasing sales and profits, operational cost savings, improving productivity and quality, efficient human resource base, improving brand image and reputation, enhancing customer loyalty, better decision making and risk management processes. In order to improving CSR of Vietnamese' enterprises, it should increase the awareness of CSR for stakeholders; form the standards, codes of conduct at national and regional level on CSR; gradually adopt CSR reporting and take CSR as a selection criterion for investors in Vietnam.

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GLOBAL ATTRACTORS OF NONLOCAL REACTION DIFFUSION EQUATIONS WITH EXPONENTIAL NONLINEARITIES

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Abstract: *In this paper, we investigate the existence, uniqueness, and continuity of weak solutions with respect to initial values for a nonlinear parabolic equation of reaction-diffusion nonlocal type by an application of the Faedo-Galerkin approximation and Aubin-Lions- Simon compactness results. The nonlocal quantity appears in the diffusion coefficient. Moreover, we deal with a new class of nonlinearities which is no restriction on the growth of the nonlinearities. The long -time behaviour of solutions to that problem is considered via the concept of global attractors for the associated semigroups.*

Keywords: *Nonlocal reaction diffusion equation, weak solution, nonlocal type, global attractors, exponential nonlinearity.*

1. Introduction

Let $\Omega \subset \mathbb{R}^n, n \geq 1$, be a bounded open set with a sufficiently smooth boundary $\partial\Omega$. We are concerned with the following initial boundary valued problem

$$\frac{\partial u}{\partial t} - a(|u|_2^2)\Delta u + f(u) = g(x), \quad x \in \Omega, t > 0,$$
$$u(x,t) = 0, \quad x \in \partial\Omega, t > 0, \tag{1.1}$$
$$u(x,0) = u_0(x), \quad x \in \Omega,$$

where the nonlinearity f, the external force g and the diffusion coefficient a satisfy the following conditions:

(H_1) $a \in C(\mathbb{R}, \mathbb{R}_+)$ isLipschitz continuous in the sense that there exists a constant L such that

$$|a(t) - a(s)| \leq L|t - s|, \quad \forall t, s \in \mathbb{R}, \tag{1.2}$$

and bounded, i.e, there are two positive constants m, M such that

$$0 < m \leq a(t) \leq M, \quad \forall t \in \mathbb{R}, \tag{1.3}$$

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(H_2) $f:\mathbb{R}\to\mathbb{R}$ is a continuously differentiable function satisfying

$$f(u)u \geq -\mu u^2 - c_1,\ f'(u) \geq -\alpha, \tag{1.4}$$

where c_1, α are two positive constants, $0 < \frac{\mu}{m} < \lambda_1$ and λ_1 is the first eigenvalue of $(-\Delta, H_0^1(\Omega))$.

$$(H_3)\ g \in L^2(\Omega). \tag{1.5}$$

During the last decade, the nonlinear parabolic equations with nonlocal terms have been extensively studied associated with many operators for various issues and applications such as in physics, in fluid mechanics, in financial mathematics, in population dynamics, etc. One of the justification of such models is the fact that in reality the measurements are not made pointwise, but through some local average. For more details, we refer to, for instance, [2], [3], [6], [7], [8], [9] and in the references therein. In recent years, many mathmaticians have been studying problems associated with the Laplacian operator which appears in a variety of physical fields (see for example [2], [6], [8]). Usually, there are two main kinds of nonlinearities which have been considered (see [2], [6]). The first one is the class of nonlinearities that is locally Lipschitzian continuous and satisfies a Sobolev growth condition

$$|f(u)| \leq c(1+|u|^{\rho}), \quad \rho < \frac{n}{n-2}$$

$$f(u)u \geq -\mu u^2 - c,$$

$$f'(u) \geq -\alpha,$$

The second one is the class of nonlinearities that satisfies a polynomial growth

$$c_1|u|^p - c_0 \leq f(u)u \leq c_2|u|^p + c_0,$$

$$f'(u) \geq -\alpha,$$

for some $p \geq 2$. Note that for both the above classes of nonlinearities require some restriction on the upper growth of the nonlinearities imposed which an exponential nonlinearity, for example, $f(u) = e^u$, does not hold. In this paper, we will relax the condition on f in order to remove this restriction. We will consider the problem (1.1) with the homogeneous Dirichlet boundary condition, in which the diffusion coefficient a depends on the L^2-norm of the solution (see [2], [3], [6], [7] for more types of the nonlocal diffusion coefficient), the nonlinearity satisfies an exponential growth type condition and the external force g belongs to $L^2(\Omega)$.

The problem (1.1) contains some important classes of parabolic equations, such as the semilinear heat equations (when $a = const > 0$), the Laplacian equation (when $a = 1$), etc. The existence and long-time behaviour of solutions to these equations have attracted interest in recent years.

The structure of the paper is organized as follows. In section 2, we prove the existence, uniqueness, continuity and joint continuity of weak solutions with respect to the initial values by using the compactness method and weak convergence techniques in [2]. In section 3, we prove the existence of global attractors for the semigroup generated by the problem in various spaces. The main novelty of the paper is that the nonlinearity can grow exponentially.

Before to start, let us introduce some notation that will be used in the sequel. As usual, the inner product in $L^2(\Omega)$ will be denoted by $(.,.)$ and by $|.|_2$ its associated norm. The inner product in $H_0^1(\Omega)$ is presented by $((.,.))$ and by $\|.\|_2$ its associated norm. By $\langle .,. \rangle$, we represent the duality product between $H^{-1}(\Omega)$ and $H_0^1(\Omega)$ and by $\|.\|_*$ the norm in $H^{-1}(\Omega)$. We identify $L^2(\Omega)$ with its dual, and so, we have a chain of compact and dense embeddings $H_0^1(\Omega) \subset\subset L^2(\Omega) \subset H^{-1}(\Omega)$. We use C to denote various constants whose values may change with each appearance.

2. Existence and uniqueness of weak solutions

In this section, we will study the existence and uniqueness of weak solution to (1.1). It is worth if we first give the definition of weak solution of our problem. In what follows, we assume that the initial data $u_0 \in L^2(\Omega)$ is given.

Definition 2.1. A weak solution to (1.1) is a function u that, for all $T > 0$, belongs to $L^2(0,T;H_0^1(\Omega)) \cap C([0,T];L^2(\Omega))$, $f(u) \in L^1(\Omega_T)$, $u(0) = u_0$ and such that for all $v \in H_0^1(\Omega) \cap L^\infty(\Omega)$, we have

$$(\frac{d}{dt}u(t),v) + a(|u|_2^2)((u(t),v)) + \langle f(u),v\rangle = (g,v), \tag{2.1}$$

where $\Omega_T = \Omega \times (0,T)$ and the previous equation must be understood in the sense of $\mathcal{D}'(0,T)$.

It is known that (see [1]) that if $u \in V$ and $\frac{\partial u}{\partial t} \in V^*$, then $u \in C([0,T];L^2(\Omega))$. This makes the initial condition in problem (1.1) meaningful. The existence of weak solution is assured by the following theorem

Theorem 2.1. Let $u_0 \in L^2(\Omega)$ and $0 < T < +\infty$. Assume (H_1), (H_2), and (H_3) hold. Then problem (1.1) has a unique weak solution on the interval $(0,T)$, i.e, there exists a function u such that

$$u \in L^2(0,T;H_0^1(\Omega)) \cap C([0,T];L^2(\Omega)),\ u_t \in L^2(0,T;H^{-1}(\Omega)),\ u(0) = u_0,$$

$$\frac{d}{dt}(u,v)+a(|u|_2^2)((u,v))+\langle f(u),v\rangle=(g,v), \tag{2.2}$$

forall $v\in H_0^1(\Omega)\cap L^\infty(\Omega)$, where (2.2) must be understood as an equality in $\mathcal{D}'(0,T)$. Moreover, the mapping $u_0\to u(t)$ is continuous on $L^2(\Omega)$.

Proof

i) Existence. Due to the theory of ordinary differential equations in variant t, we can find, for each integer $n\geq 1$, the Galerkin approximated solution by the following form

$$u_n(t)=\sum_{j=1}^{n}u_{nj}(t)w_j, \tag{2.3}$$

where $\{w_j; j\geq 1\}\subset H_0^1(\Omega)\cap L^\infty(\Omega)$ is a Hilbert basis of $L^2(\Omega)$ such that $\bigcup_{n\in\mathbb{N}}\text{span}\{w_1,w_2,\cdots,w_n\}$ is dense in $H_0^1(\Omega)\cap L^\infty(\Omega)$, and $u_{nj}(t)$ are solutions of the following problem

$$\frac{d}{dt}(u_n(t),w_j)+a(|u_n|_2^2)((u_n(t),w_j))+\langle f(u_n(t)),w_j\rangle=(g,w_j), \tag{2.4}$$

$$(u_n(0),w_j)=(u_0,w_j).$$

Now, multiplying by $u_{nj}(t)$ in (2.4), summing from $j=1$ to n. We obtain

$$\frac{1}{2}\frac{d}{dt}|u_n(t)|_2^2+a(|u_n|_2^2)\|u_n(t)\|_2^2+\int_\Omega f(u_n(t))u_n(t)dx=\int_\Omega gu_n(t)dx. \tag{2.5}$$

Taking (1.4) into account and using the Cauchy inequality, we get the estimate

$$\frac{1}{2}\frac{d}{dt}|u_n(t)|_2^2+a(|u_n|_2^2)\|u_n(t)\|_2^2-\mu|u_n(t)|_2^2-c_1|\Omega|\leq\frac{1}{2\varepsilon}|g|_2^2+\frac{\varepsilon}{2}|u_n(t)|_2^2, \tag{2.6}$$

since λ_1 is the first eigen value of $(-\Delta,H_0^1(\Omega))$ satisfying $0<\frac{\mu}{m}<\lambda_1$. Therefore, in view of (1.3), we deduce

$$\frac{1}{2}\frac{d}{dt}|u_n(t)|_2^2+(m-\frac{\mu}{\lambda_1}-\frac{\varepsilon}{2\lambda_1})\|u_n(t)\|^2\leq\frac{1}{2\varepsilon}|g|_2^2+c_1|\Omega|, \tag{2.7}$$

with sufficient small ε that makes $m-\frac{\mu}{\lambda_1}-\frac{\varepsilon}{2\lambda_1}>0$ satisfied. Now, integrating (2.7) between 0 and $t\in(0,T)$, we get

$$|u_n(t)|_2^2+2(m-\frac{\mu}{\lambda_1}-\frac{\varepsilon}{2\lambda_1})\int_0^t\|u_n(s)\|_2^2\,ds\leq\frac{1}{2\varepsilon}|g|_2^2\,T+c_1|\Omega|T+|u_0|_2^2. \tag{2.8}$$

This inequality yields

$\{u_n\}$ is bounded in $L^\infty(0,T;L^2(\Omega))$,

$\{u_n\}$ is bounded in $L^2(0,T;H_0^1(\Omega))$.

Note that $-a(|u_n|_2^2)\Delta u_n$ defines an element of $H^{-1}(\Omega)$, given by the duality $\langle -a(|u_n|_2^2)\Delta u_n, w\rangle = a(|u_n|_2^2)\int_\Omega \nabla u_n \nabla w dx$, for all $w \in H_0^1(\Omega)$. In addition, from (1.3) and the boundedness of $\{u_n\}$ in $L^2(0,T;H_0^1(\Omega))$, we deduce that $\{-a(|u_n|_2^2)\Delta u_n\}$ is bounded in $L^2(0,T;H^{-1}(\Omega))$. From (1.3) and (2.5), we can obtain that

$$\frac{1}{2}\frac{d}{dt}|u_n(t)|_2^2 + m\lambda_1 |u_n(t)|_2^2 + \int_\Omega f(u_n(t))u_n(t)dx \le \frac{1}{2\varepsilon}|g|_2^2 + \frac{\varepsilon}{2}|u_n(t)|_2^2.$$

We choose $\varepsilon = m\lambda_1$, and then this leads to

$$\frac{1}{2}\frac{d}{dt}|u_n(t)|_2^2 + \int_\Omega f(u_n(t))u_n(t)dx \le \frac{1}{2m\lambda_1}|g|_2^2. \tag{2.9}$$

Integrating (2.9) from 0 to T, we have

$$\frac{1}{2}|u_n(T)|_2^2 + \int_0^T\int_\Omega f(u_n(t))u_n(t)dxdt \le \frac{1}{2m\lambda_1}|g|_2^2\, T + \frac{1}{2}|u_0|_2^2.$$

The last inequality implies that

$$\int_{\Omega_T} f(u_n(t))u_n(t)dxdt \le C, \tag{2.10}$$

For some positive constant C, we define $h(u_n) = f(u_n) + \nu u_n$, where $\nu > \mu$. In view of (1.4), it is easily to prove that $h(u_n)u_n + c_1 \ge 0$ for all $u_n \in \mathbb{R}$, we have

$$\begin{aligned}
&\int_{\Omega_T} |h(u_n(t))|\,dxdt = \int_{\Omega_T\cap\{|u_n|>1\}} |h(u_n(t))|\,dxdt + \int_{\Omega_T\cap\{|u_n|\le 1\}} |h(u_n(t))|\,dxdt\\
&\le \int_{\Omega_T\cap\{|u_n|>1\}} |h(u_n(t))u_n(t)|\,dxdt + \int_{\Omega_T\cap\{|u_n|\le 1\}} |h(u_n(t))|\,dxdt\\
&\le \int_{\Omega_T\cap\{|u_n|>1\}} |h(u_n(t))u_n(t) + c_1|\,dxdt + \int_{\Omega_T\cap\{|u_n|>1\}} c_1 dxdt + \int_{\Omega_T\cap\{|u_n|\le 1\}} |h(u_n(t))|\,dxdt\\
&\le \int_{\Omega_T} |h(u_n(t))u_n(t) + c_1|\,dxdt + c_1|\Omega_T| + \sup_{|s|\le 1}|h(s)||\Omega_T|\\
&= \int_{\Omega_T} h(u_n(t))u_n(t) + c_1 dxdt + c_1|\Omega_T| + \sup_{|s|\le 1}|h(s)||\Omega_T|\\
&= \int_{\Omega_T} f(u_n(t))u_n(t)dxdt + \nu\int_{\Omega_T} u_n(t)^2 dxdt + 2c_1|\Omega_T| + \sup_{|s|\le 1}|h(s)||\Omega_T| \le C,
\end{aligned}$$

since $\{u_n\}$ is bounded in $L^\infty(0,T;L^2(\Omega))$, Ω is bounded, and combining with (2.10), we deduce that $h(u_n)$ is bounded in $L^1(\Omega_T)$, and so is $f(u_n)$. As a consequence, there exists

$u \in L^{\infty}(0,T;L^2(\Omega)) \cap L^2(0,T;H_0^1(\Omega))$, $\xi_1 \in L^1(\Omega_T)$ and $\xi_2 \in L^2(0,T;H^{-1}(\Omega))$, and a subsequence of u_n (relabelled the same) such that

$$u_n \rightharpoonup^* u \text{ weakly-star in } L^{\infty}(0,T;L^2(\Omega)),$$

$$u_n \rightharpoonup u \text{ in } L^2(0,T;H_0^1(\Omega)),$$

$$f(u_n) \rightharpoonup \xi_1 \text{ in } L^1(\Omega_T), \tag{2.11}$$

$$-a(|u_n|_2^2)\Delta u_n \rightharpoonup \xi_2 \text{ in } L^2(0,T;H^{-1}(\Omega)), \tag{2.12}$$

for all $T > 0$. We will show that $\xi_1 = f(u)$ and $\xi_2 = -a(|u|_2^2)\Delta u$ by using the compactness method. On the other hand, $\frac{du_n}{dt} = a(|u_n|_2^2)\Delta u_n - f(u_n) + g$ plays a role as an operator on $H_0^1(\Omega) \cap L^{\infty}(\Omega)$. We deduce that $\{\frac{du_n}{dt}\}$ is bounded in $L^2(0,T;H^{-1}(\Omega)) + L^1(\Omega_T)$, and therefore in $L^1(0,T;H^{-1}(\Omega) + L^1(\Omega))$. As far as we know $H_0^1(\Omega) \subset\subset L^2(\Omega) \subset H^{-1}(\Omega) + L^1(\Omega)$. By the Aubin - Lions - Simon compactness lemma (see [5]), we have that $\{u_n\}$ is compact in $L^2(0,T;L^2(\Omega))$. In view of Lemme1.3, p.12 in [4], we identify ξ_1 and ξ_2 in (2.11) and (2.12) respectively,

$$f(u_n) \rightharpoonup f(u) \text{ in } L^1(\Omega_T), \tag{2.13}$$

$$-a(|u_n|_2^2)\Delta u_n \rightharpoonup -a(|u|_2^2)\Delta u \text{ in } L^2(0,T;H^{-1}(\Omega)), \tag{2.14}$$

Then, if we consider fixed n, $\varphi \in \mathcal{D}(0,T)$, and $w \in span\{w_1, w_2, \cdots, w_n\}$, it holds for all $m > n$

$$-\int_0^T (u_m(t), w)\varphi'(t)dt + \int_0^T a(|u_m|_2^2)\langle -\Delta u_m(t), w\rangle \varphi(t)dt + \int_0^T < f(u_m(t)), w > \varphi(t)dt = \int_0^T (g, w)\varphi(t)dt.$$

Now, let m tend to infinity, using (2.13) and (2.14), and compactness of $\{u_n\}$ in $L^2(0,T;L^2(\Omega))$.

$$-\int_0^T (u(t), w)\varphi'(t)dt + \int_0^T a(|u|_2^2)\langle -\Delta u(t), w\rangle \varphi(t)dt + \int_0^T < f(u(t)), w > \varphi(t)dt = \int_0^T (g, w)\varphi(t)dt,$$

for all $w \in H_0^1(\Omega) \cap L^{\infty}(\Omega)$, since $\bigcup_{n\in\mathbb{N}} \text{span}\{w_1, w_2, \cdots, w_n\}$ is dense in $H_0^1(\Omega) \cap L^{\infty}(\Omega)$. Therefore, $\frac{du}{dt} - a(|u|_2^2)\Delta u + f(u) = g$, in $\mathcal{D}'(0,T;H^{-1}(\Omega) + L^1(\Omega))$, an taking into account the regularity of u and u', it holds that $u \in C([0,T];L^2(\Omega))$. Finally, we

only need to check that $u(0)=u_0$, we also fix $n\geq 1$, $\varphi\in H^1(0,T)$ such that $\varphi(T)=0$ and $\varphi(0)\neq 0$, and $w\in span\{w_1,w_2,\cdots,w_n\}$, and consider $m>n$. We have

$$-(u_0,w)\varphi(0)-\int_0^T(u_m(t),w)\varphi'(t)dt+\int_0^T a(|u_m|_2^2)\langle -\Delta u_m(t),w\rangle\varphi(t)dt$$
$$+\int_0^T\langle f(u_m(t)),w\rangle\varphi(t)dt=\int_0^T(g,w)\varphi(t)dt.$$

Let $m\to\infty$

$$-(u_0,w)\varphi(0)-\int_0^T(u(t),w)\varphi'(t)dt+\int_0^T a(|u|_2^2)\langle -\Delta u(t),w\rangle\varphi(t)dt$$
$$+\int_0^T\langle f(u(t)),w\rangle\varphi(t)dt=\int_0^T(g,w)\varphi(t)dt. \qquad (2.15)$$

On the other hand, from (2.1),

$$-(u(0),w)\varphi(0)-\int_0^T(u(t),w)\varphi'(t)dt+\int_0^T a(|u|_2^2)\langle -\Delta u(t),w\rangle\varphi(t)dt$$
$$+\int_0^T\langle f(u(t)),w\rangle\varphi(t)dt=\int_0^T(g,w)\varphi(t)dt. \qquad (2.16)$$

Then, comparing (2.15) with (2.16), it holds that $(u_0,w)\varphi(0)=(u(0),w)\varphi(0)$ with $w\in span\{w_1,w_2,\cdots,w_n\}$. This leads to $u(0)=u_0$, and u is a weak solution to problem (1.1).

ii) Uniqueness and continuous dependence on the initial data. Let us denote by u_1 and u_2 two weak solutions of (1.1) with initial data u_{01}, $u_{02}\in L^2(\Omega)$. Then

$$(\frac{d}{dt}u_1,v)+a(|u_1|_2^2)\int_\Omega\nabla u_1\nabla v dx+\langle f(u_1),v\rangle=(g,v),$$

and

$$(\frac{d}{dt}u_2,v)+a(|u_2|_2^2)\int_\Omega\nabla u_2\nabla v dx+\langle f(u_2),v\rangle=(g,v),$$

thus

$$(\frac{d}{dt}(u_1-u_2),v)+a(|u_1|_2^2)\int_\Omega\nabla u_1\nabla v dx-a(|u_2|_2^2)\int_\Omega\nabla u_2\nabla v dx+\langle f(u_1)-f(u_2),v\rangle=0,$$

which leads to

$$(\frac{d}{dt}(u_1-u_2),v)+a(|u_1|_2^2)\int_\Omega\nabla(u_1-u_2)\nabla v dx+\langle\hat{f}(u_1)-\hat{f}(u_2),v\rangle$$
$$=(a(|u_2|_2^2)-a(|u_1|_2^2)\int_\Omega\nabla u_2\nabla v dx+\alpha(u_1-u_2,v),$$

where $\hat{f}(s) = f(s) + \alpha s$. Taking $v = (u_1 - u_2)(t)$ for a.e.t, we have

$$\frac{1}{2}\frac{d}{dt}|u_1 - u_2|_2^2 + a(|u_1|_2^2)\int_\Omega |\nabla(u_1 - u_2)|^2 dx + \int_\Omega (\hat{f}(u_1) - \hat{f}(u_2))(u_1 - u_2)dx$$
$$\leq |a(|u_2|_2^2) - a(|u_1|_2^2)| \int_\Omega |\nabla u_2||\nabla(u_1 - u_2)|dx + \alpha\int_\Omega |u_1 - u_2|^2 dx.$$

Thanks to (1.4) we have $\int_\Omega (\hat{f}(u_1) - \hat{f}(u_2))(u_1 - u_2) \geq 0$. So

$$\frac{1}{2}\frac{d}{dt}|u_1 - u_2|_2^2 + a(|u_1|_2^2)\int_\Omega |\nabla(u_1 - u_2)|^2 dx$$
$$\leq |a(|u_2|_2^2) - a(|u_1|_2^2)| \int_\Omega |\nabla u_2||\nabla(u_1 - u_2)|dx + \alpha\int_\Omega |u_1 - u_2|^2 dx.$$

Applying the Cauchy - Schwarz inequality and putting this together with (1.2) and (1.3), we get the estimate

$$\frac{1}{2}\frac{d}{dt}|u_1 - u_2|_2^2 + m\|u_1 - u_2\|_2^2 \leq L\|u_2|_2^2 - |u_1|_2^2\|u_2\|_2\|u_1 - u_2\|_2 + \alpha|u_1 - u_2|_2^2.$$

Then, applying Young's inequality we obtain

$$\frac{1}{2}\frac{d}{dt}|u_1 - u_2|_2^2 + m\|u_1 - u_2\|_2^2 \leq \frac{m}{2}\|u_1 - u_2\|_2^2 + \eta(t)|u_1 - u_2|_2^2,$$

which gives $\frac{d}{dt}|u_1 - u_2|_2^2 \leq \eta(t)|u_1 - u_2|_2^2$. Then, with some more computation, we obtain $\sup_{t\in[0,T]} |u_1(t) - u_2(t)|_2 \leq C|u_{01} - u_{02}|_2$, where C is some constant which, we will see later, depends on $T, \lambda_1, \mu, m, |\Omega|, c_1, |g|_2^2$. Hence, we get the desired results, i.e, the solution is uniqueness and continuous dependence on the initial data.

3. Global attractors

Thanks to Theorem 2.1, we can define a continuous (nonlinear) semigroup $S(t): L^2(\Omega) \to L^2(\Omega)$ associated to problem (1.1) as follows $S(t)u_0 := u(t, u_0)$, where $u(t, u_0)$ is the unique weak solution of (1.1) with the initial datum u_0. We will prove that the semigroup $S(t)$ has a global attractor $\mathcal{A}$ in $L^2(\Omega)$. For the sake of brevity, in the following important lemmas, we give some formal caculations, the rigorous proof is done by use of Galerkin approximations and Lemma 11.2 in [5].

Lemma 3.1. The semigroup $\{S(t)\}_{t\geq 0}$ has a bounded absorbing set in $L^2(\Omega)$.

Proof. Multiplying (1.1) by u we have

$$\frac{1}{2}\frac{d}{dt}|u|_2^2 + a(|u|_u^2)\|u\|_2^2 + \langle f(u), u\rangle = (g, u). \tag{3.1}$$

We perform the similar way as (2.6), (2.7) by using hypotheses (1.2) - (1.5), the Cauchy's inequality and the Gronwall's inequality, we obtain

$$|u(t)|_2^2 \le |u_0|_2^2 \, e^{-(m\lambda_1-\mu)t} + R_1,$$

where

$$R_1 = R_1(\lambda_1, \mu, m, |\Omega|, c_1, |g|_2^2) = \frac{2c_1|\Omega|(m\lambda_1-\mu)+|g|_2^2}{(m\lambda_1-\mu)^2}.$$

Therefore, if choosing $\rho_1 = 2R_1$, we are sure that

$$|u(t)|_2^2 \le \rho_1, \tag{3.2}$$

for all $t \ge T_1 = T_1(\lambda_1, \mu, m, |u_0|_2)$, and so the proof is completed.

Lemma 3.2. The semigroup $\{S(t)\}_{t\ge 0}$ has a bounded absorbing set in $H_0^1(\Omega)$.

Proof. Multiplying (1.1) by $-\Delta u$, and integrating by parts, we have

$$\frac{1}{2}\frac{d}{dt}\|u\|_2^2 + a(|u|_2^2)|\Delta u|_2^2 = -\int_\Omega f'(u)(\nabla u)^2 dx - \int_\Omega g\Delta u dx \le \alpha\|u\|_2^2 + \frac{1}{2m}|g|_2^2 + \frac{m}{2}|\Delta u|_2^2,$$

Of course, we have already used the Cauchy inequality, and putting this with (1.3), it leads to

$$\frac{d}{dt}\|u\|_2^2 \le 2\alpha\|u\|_2^2 + \frac{1}{m}|g|_2^2. \tag{3.3}$$

On the other hand, integrating (3.1) from t to $t+1$ and using (1.3) and (1.4) and the estimation (3.2)

$$\begin{aligned}\int_t^{t+1}\|u\|_2^2 ds + \frac{1}{2m}|u(t+1)|_2^2 &\le \frac{1}{2m}|u(t)|_2^2 + \frac{c_1}{m}|\Omega|^2 + \frac{\mu+1}{m}\int_t^{t+1}|u|_2^2 ds + \frac{1}{4m}|g|_2^2 \\ &\le \rho_2 = \rho_2(\lambda_1, \mu, m, |\Omega|, C_1, |g|_2^2),\end{aligned} \tag{3.4}$$

for all $t \ge T_1 = T_1(\lambda_1, \mu, m, |u_0|_2)$. By the uniform Gronwall inequality, from (3.3) and (3.4) we deduce that

$$\|u(t)\|_2^2 \le \rho_2, \tag{3.5}$$

for all $t \ge T_2 = T_1 + 1$. The proof is complete.

As a direct consequence of Lemma 3.1, and Lemma 3.2 and the compactness of the embedding $H_0^1(\Omega) \subset\subset L^2(\Omega)$, we get one of the main results of this section.

Theorem 3.1. Suppose that the hypotheses (H_1), (H_2), and (H_3) hold. Then the semigroup $S(t)$ generated by problem (1.1) has a connected global attractor $\mathcal{A}$ in $L^2(\Omega)$.

With more sophisticated arguments, it is possible to show that the regularity of the attractor increases as a becomes more regular.

Lemma 3.3. The semigroup $\{S(t)\}_{t\geq 0}$ has a bounded absorbing set in $H^2(\Omega)\cap H_0^1(\Omega)$.

Proof. Differentiating the first equation of problem (1.1) with respect to t, then taking the dual product of the resultant with u_t yields

$$\frac{1}{2}\frac{d}{dt}|u_t|_2^2+a(|u|_2^2)|\nabla u_t|_2^2+\int_\Omega f'(u)u_t^2dx=-2a'(|u|_2^2)\int_\Omega uu_tdx\int_\Omega\nabla u\nabla u_tdx.$$

and perform the following estimate deduced from the Holder's inequality

$$\frac{d}{dt}|u_t|_2^2+2m|\nabla u_t|_2^2-2\alpha|u_t|_2^2\leq 4|a'(|u|_2^2)||u|_2|u_t|_2|\nabla u|_2|\nabla u_t|_2. \tag{3.6}$$

We make a use of the estimates (3.2) and (3.5) $(i.e.|u(t)|_2^2\leq\rho_1,\|u(t)\|_2^2\leq\rho_2)$, and we define

$$\gamma=2\sup_{s\leq\rho_1}|a'(s)||u|_2|\nabla u|_2. \tag{3.7}$$

we get from (3.6) and (3.7) that

$$\frac{d}{dt}|u_t|_2^2+2m\|u_t\|_2^2-2\alpha|u_t|_2^2\leq 2\gamma\|u_t\|_2|u_t|_2.$$

Applying the Young's inequality, we get the estimate

$$\frac{d}{dt}|u_t|_2^2+2m\|u_t\|_2^2-2\alpha|u_t|_2^2\leq 2\gamma(\varepsilon\|u_t\|_2^2+\frac{1}{4\varepsilon}|u_t|_2^2). \tag{3.8}$$

The last inequality leads to the following estimation if we choose $0<\varepsilon\leq m$

$$\frac{d}{dt}|u_t|_2^2\leq(2\alpha+\frac{\gamma}{2\varepsilon})|u_t|_2^2. \tag{3.9}$$

Multiplying the first equation in (1.1) by u_t, we obtain

$$|u_t|_2^2+a(|u|_2^2)\int_\Omega\Delta uu_tdx+\int_\Omega f(u)u_tdx=\int_\Omega g(x)u_tdx,$$

so

$$a(|u|_2^2)\int_\Omega\nabla u\nabla u_tdx+\int_\Omega f(u)u_tdx-\int_\Omega g(x)u_tdx=-|u_t|_2^2\leq 0.$$

Using (1.3), we have

$$m\int_\Omega\nabla u\nabla u_tdx+\int_\Omega f(u)u_tdx-\int_\Omega g(x)u_tdx\leq 0.$$

We define $F(s)=\int_0^s f(\sigma)d\sigma.$

Hence

$$\frac{d}{dt}(\frac{m}{2}\|u\|_2^2+\int_\Omega F(u)dx-\int_\Omega g(x)udx)\leq-|u_t|_2^2\leq 0. \tag{3.10}$$

On the other hand, integrating (3.1) from t to $t+1$, and using (3.2), and (1.3), we have

$$\int_t^{t+1} [m \| u \|_2^2 + \int_\Omega f(u)udx - \int_\Omega g(x)udx]ds \le \rho_1. \tag{3.11}$$

It follows from (1.5) that

$$F(u) \le f(u)u + \alpha \frac{u^2}{2}, \quad \forall u \in \mathbb{R}. \tag{3.12}$$

From (3.11) and (3.12), we get

$$\int_t^{t+1} [m \| u \|_2^2 + \int_\Omega f(u)udx - \int_\Omega g(x)udx]ds \ge \int_t^{t+1} [\frac{m}{2} \| u \|_2^2 + \int_\Omega F(u)dx - \int_\Omega g(x)udx]ds - \alpha \frac{\rho_1}{2}$$

for all $t \ge T_1$. Thus

$$\int_t^{t+1} [\frac{m}{2} \| u \|_2^2 + \int_\Omega F(u)dx - \int_\Omega g(x)udx]ds \le (1+\frac{\alpha}{2})\rho_1. \tag{3.13}$$

Therefore, from (3.10) and (3.13), by using the uniform Gronwallinequality, we obtain

$$\frac{m}{2} \| u \|_2^2 + \int_\Omega F(u)dx - \int_\Omega g(x)udx \le \rho_3, \tag{3.14}$$

for all $t \ge T_2 = T_1 + 1$. Integrating (3.10) from t to $t+1$ and using (3.14), we have

$$\int_t^{t+1} | u_t |_2^2 \le \rho_3, \tag{3.15}$$

for all $t \ge T_2$. In view of (3.9) and (3.15) and using the uniform Gronwall inequality again, we get

$$| u_t |_2^2 \le \rho_3, \tag{3.16}$$

for all $t \ge T_3 = T_2 + 1$. On the other hand, multiplying the first equation in (1.1) by $-\Delta u$, using (1.3) and (1.5), we obtain

$$m | \Delta u |_2^2 \le \alpha \| u \|_2^2 + | u_t |_2 | \Delta u |_2 + | g |_2 | \Delta u |_2 . \tag{3.17}$$

Applying the Cauchy inequality, from (3.17), we have

$$m | \Delta u |_2^2 \le \alpha \| u \|_2^2 + \frac{1}{2\varepsilon} | u_t |_2^2 + \frac{1}{2\varepsilon} | g |_2^2 + \varepsilon | \Delta u |_2^2 . \tag{3.18}$$

Taking $\varepsilon = \frac{m}{2}$, it follows from (3.18) that

$$| \Delta u |_2^2 \le \frac{2\alpha}{m} \| u \|_2^2 + \frac{2}{m^2} | u_t |_2^2 + \frac{2}{m^2} | g |_2^2 . \tag{3.19}$$

Using the estimates (3.5) and (3.15), it implies that

$$|\Delta u|_2^2 \le \rho_4, \tag{3.20}$$

for some constant ρ_4, and all $t \ge T_3$. This completes the proof.

Due to the compactness of the embedding $H^2(\Omega) \cap H_0^1(\Omega) \subset\subset H_0^1(\Omega)$, we get the following important result.

Theorem 3.2. Suppose that the hypotheses (H_1), (H_2), and (H_3) hold. Then the semigroup $S(t)$ generated by problem (1.1) has a global attractor $\mathcal{A}$ in $H^2(\Omega) \cap H_0^1(\Omega)$.

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