DOI :10.31357/fapsmst.2011.00535

STUDY ON CONTROL OF POST HARVEST SHRIMP MELENOSIS BY USE OF METABISULFITE

BY

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M.Sc. 2011

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This thesis is submitted in partial fulfillment of the requirement of the degree of Master of Science in Food Science and Technology

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Nugegoda.

Sri Lanka.

DECLARATION

The work described in this thesis was carried out by me under the supervision of Dr.E.M.R.K.B. Edirisinghe, National Aquatic Resources Research and Development Agency, Crow Island, Colombo 15 and Dr. (Mrs.) Indira Wickramasinghe, Head, Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka.

A report on this has not been submitted in whole or in part to any university or any other institution for another Degree / Diploma.

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10/05/2013

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Date

"We hereby certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation".

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Affectionately dedicated to my Parents, Teachers,

Wife and Daughter

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ACKNOWLEDGEMENT

First and foremost, My greatful acknowledgement with special thanks is extended to my internal supervisor Dr. (Mrs) Indira Wickramasinghe, Head, Department of food science and Technology, Faculty of applied sciences, University of Sri Jayewardenapura, Nugegoda, for the personal interest shown in this study and for the valuable guidance, encouragement and advice provided throughout the course of study and the completion of my task.

Besides, I would like to express my heartfelt gratitude to my external supervisor Dr. E.M.R.K.B. Edirisinghe, Research Officer, National Aquatic Resources Research and Development Agency, Crow Island, Colombo 15, specially for the technical guidance, dedicate valuable time and support provided me at all times during the course of my studies. His interest enthusiasm and commitment were always a source of inspiration to me in the completion of this thesis.

My heartfelt honour goes to Prof. K.K.D.S. Ranaweera, Head, Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, for the academic guidance and continuous support on this project and my appreciation goes to academic and non-academic staff of the Department of Food Science providing me necessary information guidelines regarding the project.

I wish to express my sincere thank to Mr. Indika Ellawala, Director, Alpex Marine (Pvt) Ltd, and the staff members and employees of the organization for the encouragement in

the initiation of this task and for the providing me necessary facilities and support to carry out my research work.

I very much thankful to the managements and the staff of Kamalawasan Farm, Sadasarana Farm, Jalis Farm, Jaufer Farm and J.K. Aqua Farm for the opportunity providing me for this project and allow me to use the facility of farm and the corporation provided in sample collection.

I would like to express my gratitude towards Mr. Kolitha Amarasinghe and management and Laboratory staff of S.G.S. Lanka (Pvt) Ltd, for their kind co-operation in chemical analysis of the samples of this project.

I also would like to extend my thanks to Mr. M.S.M. Miftha, who is the Supplier coordinator and Mr. Vijith Kodagoda, who is the transport manager of the Alpex Marine (Pvt) Ltd, for the help of required arrangement in sample collection and delivering the samples to the laboratory as per the requirements.

Apart from the efforts of me, the success of any project depends largely on the encouragement and guidelines of many others. I take this opportunity to express my last but not least gratitude to my wife Rajeevi, my office colleagues; Malika, Kapila, Jayantha, and my university colleagues; Indika, Anuradha, Shantha and Kolitha, the people who have been supported me in many ways in successful completion of this project.

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ABSTRACT

Melanosis or "Black Spot" is a common phenomenon observed in crustacean seafood at post harvest condition. The black tiger shrimp *(Penaeus monodon)* is the most commercially important aquacultured shrimp species in Sri Lanka and more liable, undergone with melanosis at post harvest stage, which creates quality issues and affect consumer acceptance. Sulfites are generally act as preservatives or anti-oxidants in foods and widely use for seafood products in control of melanosis. The main objective of this study was to study the effectiveness of Sodium metabisulfite ($Na_2S_2O_5$) in control of post harvest melanosis on Black tiger shrimp and further to assess the dipping time and effective strength of solutions comparing with residual Sulfur dioxide (SO_2) in shrimp flesh. Whole chilled post harvest Black tiger shrimp in aquaculture origin was dipped into different $Na_2S_2O_5$ solutions for different time periods and stored in a refrigerator for 7 days below + 5 °C. The effect of $Na_2S_2O_5$ on melanosis development was assayed by visual score method (Otwell and Marshall - 1986) and residual SO_2 content of shrimp flesh was monitored by optimized Monier - William method (AOAC 990.28). The results indicated that the control sample i.e. 0 % $Na_2S_2O_5$ for 1 min dip progressively developed melanosis where as $Na_2S_2O_5$ contained samples indicated delayed onset of melanosis on shrimp in a refrigerated storage and start occurrence of melanosis after 2 days of time with a less progressive rate. Figuring the results, it is concluded that, $Na_2S_2O_5$ have strong properties of delaying melanosis development and considering residual effect, it was suggested that the 1.25 % for 1 minute standard dipping should not exceeded until further studies.

CHAPTER 1

INTRODUCTION

Melanosis is a common phenomenon which can be observed in fruit and vegetables as well as in seafood. Melanosis exists in all crustaceans and is the result of a natural bio mechanism which must not be considered as an indicator of bad post harvest treatment. Melanosis has no impact on the flavor and /or savor of the shrimp and it is not harmful to the consumers. Nevertheless, the black spotted aspect of melanized shrimp severely affects consumer acceptability of the products and significantly diminishes their market value. Melanosis is of major problem in the seafood industry and can cause deleterious changes in the organoleptic properties of the products, resulting shorter shelf life and lower quality. This phenomenon could be the origin of very important economical losses due to decreasing of the commercial value and market rejection (Guillen, 2005).

The black tiger shrimp *(Penaeus monodon)* is the most commercially important aquacultured shrimp species in the world, accounting for 46% of all aquacultured shrimp. Thailand has experienced explosive growth in black tiger shrimp production, from less than 1 000 mt in 1986 to 163, 000 mt in 1992. Strong marketing and low production costs have enabled Thailand to become one of the largest suppliers of shrimp to the major market of USA & Japan. (Hanpongkittikun, *et al.*.1995). Shrimp farming has developed into one of Sri Lanka's most valuable non-traditional industry, earning foreign exchange of over of Rs 5.5 billion from 1990 to 1995. (Jayasinghe, 1999) In Sri Lanka the amount of prawn export is 1,262 mt for last annum (Sri Lanka Export Statistics of EDB 2011).

There are two bio mechanisms, mentioned in the following figure, in post mortem shrimps which result in the formation of the melanosis. One does not require enzymes

but tyrosinase is the principal factor in the other. The harvesting process must be carried out as gently as possible to avoid wounding the animals. After harvesting the main problem is to avoid initiation of the melanosis phenomenon for as long as possible. To do this purpose many techniques can be applied in processing (refrigeration, freezing, heating, dehydration or irradiation,) or the use of inhibitors.

In the case of shrimp, many attempts have been made to replace it but without any true success so far. metabisulfites will act with the intermediate reactions of melanosis, in particular with quinone and sulfaquinone and by involving an inactivation of the enzyme by reducing oxygen which is then unavailable for oxidation reactions. But the effective method of using metabisulfites still is the question in control of melanosis at post harvest condition.

The aim of the present work was to determine the effectiveness of different Sodium metabisulfites treatment concentrations and time of application to avoid melanosis in fresh Black tiger shrimp (*Penaeus monodon*) and to determine the residual Sulfur dioxide content in the edible part of shrimp by means to find out the most suitable treatments procedure and dipping time requirement which meet the guide levels of residual Sulfur dioxide.

1.1. Overall objective

To determine the effectiveness of use of Sodium metabisulfites ($Na_2S_2O_5$) for controlling of post harvest melenosis on Black tiger shrimp (*Penaeus monodon*)

1.2. Specific objectives

- To determine time duration effective of controlling melanosis under chilled/refrigerated condition.
- To determine the level of dipping time or strength of solution required to meet the EEC residue guide level.

CHAPTER 2

LITERATURE REVIEW

2.1. Black tiger shrimp

The giant tiger prawn inhabits the coasts of Australia, South East Asia, South Asia and East Africa. Body colours vary from green, brown, red, grey, blue and transverse band colours on abdomen and carapace are alternated between blue or black and yellow. Adults may reach 33 cm in length and females are commonly larger than males. (FAO Species Catalogue, 1980)

Black tiger shrimp farming has been practiced for more than a century for food and the livelihood of coastal people in some Asian countries, such as Indonesia, the Philippines, Taiwan Province of China, Thailand and Vietnam. From 1970-1975, research on breeding was conducted and monoculture techniques in small ponds were gradually developed at the Tungkang Marine Laboratory in Taiwan Province of China and partly at the IFREMER (Centre Océanologique du Pacifique) in Tahiti in the South Pacific. In Thailand, extensive and semi-intensive farms were commercially established in 1972 and 1974 respectively, after the first success in breeding P. monodon at Phuket Fisheries Station in 1972. Between 1980 and 1987 there was a boom of small-scale intensive farms in Taiwan Province of China due to commercial success in formulated feed development, mainly to produce shrimp for export to Japan. Later, the culture of this species spread throughout southeast and south Asia, as it can grow-up to a large size (40-60 g) with high value and demand in the international market. The locally adapted culture technology has allowed Thai farmers to overcome serious disease, environmental and trade problems and maintain its status as a leading producer (FAO, 2011).