MICROPLASTIC CONTAMINATION IN MOLLUSC POLYMESODA

SITI HASMAH BINTI MUSTAPHA

A project report submitted in partial fulfilment of the
requirements for the award of the degree of
Master of Engineering (Civil)

School of Civil Engineering
Faculty of Engineering
Universiti Teknologi Malaysia

JULY 2020

DEDICATION

I would like to dedicate this to my beloved mother and father, my lovely husband, children, family, friends and lecturers

Thanks for everything

ACKNOWLEDGEMENT

Praise to be Allah, I am grateful to dear Allah for His Graciousness and blessings that I finally managed to complete this research and project report after going through the challenges and anticipations.

I wish to express my sincere appreciation to my supervisor Dr. Shamila Azman for her encouragement, time, guidance and support from the beginning of my master project until its completion.

Next, I would like to express my appreciation to the science officer and laboratory assistant at Environmental Engineering Laboratory School of Civil Engineering and FTIR Laboratory in Faculty of Science for their guidance and help in operating the laboratory instrument throughout all my laboratory works.

Furthermore, I would like to extend my sincere appreciation to my beloved husband, children, parents, siblings and close friends whom always give support and believe that I can finish my master degree.

Last but not least, thank you so much to anyone whom had helped me whether directly or indirectly throughout the journey of completing this thesis and my master degree

ABSTRACT

This study presents results and discuss on microplastic contamination in mollusc *Polymesoda*. It is a type of clam and also a common seafood. The problem is *Polymesoda sp* feed by filtering sus*p*ended particles in water that surrounds them and this includes microplastics. Study area at Sungai Pengkalan Datu (Pengkalan Datu) and Sungai Semerak (Tok Bali) were selected as it is known to be popular with fisherman. The main objectives of this study are to investigate the presence and abundance of microplastic in *Polymesoda sp* including physical characteristics (colour, shape and type) and to compare microplastics ingestion between two different locations. A number of specimen were collected and the laboratory works consist of sampel digestion with H2O2, density separation with NaCI, observation (stereomicroscope) and verification by Attenuated Total Reflection (ATR) spectroscopy. Microplastics present in Polymesoda *sp* sample collected from Tok Bali and Pengkalan Datu was 0.67 items/individual and 0.83 items/individual. Meanwhile for abundance of microplastics by weight was 0.05 items/g (Tok Bali) and 0.02 items/g (Pengkalan Datu). ATR spectroscopy also showed a positive contamination of microplastics at both locations with 9 types of plastics identified.

ABSTRAK

Kajian ini adalah mengenai pencemaran mikroplastik dalam moluska lokan (*Polymesoda sp*). Ia adalah sejenis kerang dan makanan laut. Masalahnya lokan hidup dan makan dengan menyaring zarah terampai dalam air yang mengelilinginya termasuk mikroplastik. Kawasan kajian adalah di Sungai Pengkalan Datu (Pengkalan Datu) dan Sungai Semerak (Tok Bali) di mana ianya terkenal dengan kawasan nelayan. Objektif kajian adalah menyelidik kandungan pencemaran mikroplastik ke atas lokan dari segi fizikal (warna, bentuk dan jenis) serta membandingkan perbezaan pencemaran mikroplastik bagi dua lokasi tersebut. Sampel lokan diambil, diukur dan dilakukan ujian makmal dengan kaedah pencernaan sampel mengunakan H2O2, perbezaan ketumpatan dengan larutan NaCI, pemerhatian (stereomikroskop) dan pengesahan jenis plastik dilakukan dengan spektroskopi jumlah pantulan dilemahkan (ATR). Microplastik yang dikesan dalam sampel lokan di Tok Bali dan Pengkalan Datu adalah 0.67 item/individu dan 0.83 item/ individu bagi setiap kawasan. Manakala mengikut berat pencemaran mikroplastik adalah 0.05 item/g (Tok Bali) dan 0.02 item/g (Pengkalan Datu). Keputusan spektroskopi ATR juga menunjukkan pencemaran mikroplastik di kedua-dua lokasi dengan 9 jenis plastik.

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LIST OF ABBREVIATIONS

UTM	-	Universiti Teknologi Malaysia
ATR	-	Attenuated Total Reflection
sp	-	Species
n/a	-	Not Available
μ-FTIR	-	Micro Fourier Transform Infrared
GPS	-	Global Positioning System
QReC	-	Quality Reagent Chemical
w.w	-	Wet Weight
PET	-	Polyethylene
HDPE	-	High Density Polyethylene
PVC	-	Polyvinyl Chloride
LDPE	-	Low Density Polyethylene
PP	-	Polypropylene
PS	-	Polystyrene
GPS	-	Global Positioning System
rpm	-	Revolution per minute

LIST OF SYMBOLS

^{0}C	-	Celsius
HNO_3	-	Nitric Acid
Na_2O_2	-	Sodium Peroxide
H_2O_2	-	Hydrogen Peroxide
$NaCI$	-	Sodium Chloride
$\%$	-	Percentage

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

The existence of mangrove forests is important to coastal fisheries industry as it is a breeding ground for aquatic life and contributes to various catch such as lobster (*Macrobrachium rosenbergii*), crab (*Scylla serrata*), shellfish (*Anadara granosa*), mangrove (*Cerithidea spp*.) and mud snail (*Polymesoda*) (Yahya, 2018).

Polymesoda is an animal that inhabit swampy areas such as mangrove swamps and bogs. *Polymesoda* lives in a swampy area by drowning in mud. *Polymesoda* eat phytoplankton or microscopic plants by filtering water. The river water will be sucked through the sapphire, which is usually located in the posterior opening of the shell and later the sus*p*ended particles will be filtered through an organ called gills. These gills have a potassium channel that functions to isolate and release suspended particles. Foods that are trapped in the gills move to the mouth and then move to the digestive system for nutrient absorption (Ong, 2017). Like other bivalves, they breed on an external fertilization, which is the fertilization between the male (sperm) and the female (ovum) that occurs in the water. Male and female *Polymesoda* that have mature reproductive organs release *sp*erm and ovum into the water for fertilization. The fertilized male and female embryos undergo several processes until they become larvae (Rahim, 2012).

At larval stage, the larvae that can move and swim in the water, which is different compared to adult larvae that are only static and immerse themselves in the mud. The process of filtration of water takes place simultaneously with the process of obtaining food by *Polymesoda*. Therefore, this filtering process can improve water clarity by reducing sediment composition and nutrient excess in water. The study of

sediment composition in marine environment normally synthetic fiber, metal (Harsono, 2017) and microplastic (Rozan, 2019). Microplastics are anthropogenic pollutants present in various morphology of less than 5 mm in diameter. Primary microplastics are manufactured in the form of microbeads and synthetic fibre used in various products. Meanwhile, secondary microplastics resulted from the breaking down of larger plastic material into smaller fragments. The wides*p*read of microplastic contamination in marine environment creates a concern on its impact toward the food chain (Rozan, 2019).

1.2 Problem Statement

Kelantan is famous with bivalves and also taken directly by human as their daily diet. Most of the people in kelantan used bivalve as a part of bisness product not just as a meal. *Polymesoda* is most popular and also used in shell out dishes. Unfortunately, human ignore about the contamination in *polymesoda*. The problem is *polymesoda* feed by filtering most of the suspended particle in water that surround them. Most of the elements being trap into their body via feeding habit and pollutant such as metal (Ong, 2017). *Polymesoda* also contain heavy metals contamination and this are given problem in the interest of health and well-being of consumers (Harsono, 2017). Microplastic contaminations have been reported in various organism, water and also sediment. In malaysia, the research of the microplastic are limited. The transfer of the contaminants in polymesoda tissue or affect them physically and also to human are also as a consumer (Shamsul, 2018). This research of microplastic contamination in *polymesoda* in Kelantan river was carried out on detail contamination to protect the health of consumer.

The study on animals and marine organisms can serve as a reference and guidelines in order to increase the awareness on potential risk of microplastics towards human health when consuming organism which have been contaminated by such pollutant. Consuming *polymesoda* might considerably pose little risk but since *polymesoda* are widely available in the market and people are continuously consuming it, there is a high probability of experiencing potential health risk when consuming

mash clam in huge amount which is contaminated by microplastic. Upon the consideration for environmental and commercial importance of *polymesoda* in Kelantan it is important to conduct investigation on the microplastics contamination occurrence in that region (Rozan, 2018).

Figure 1.1 shows the microplastic contamination have been reported in various organism, water and also sediment. Microplastics enter the marine environment and influence food chain, impact on wildlife, and on human. Sedimentation of microplastic also lead to benthic accumulation such as in *Polymesoda sp*. *Polymesoda sp* was choosen in this study because most of element being traped into their body via feeding habit and pollutant such as metal, microplastic, sand and etc. The transfer of the contaminants in *Polymesoda sp* tissue affect them physically and also human (Shamsul, 2018).

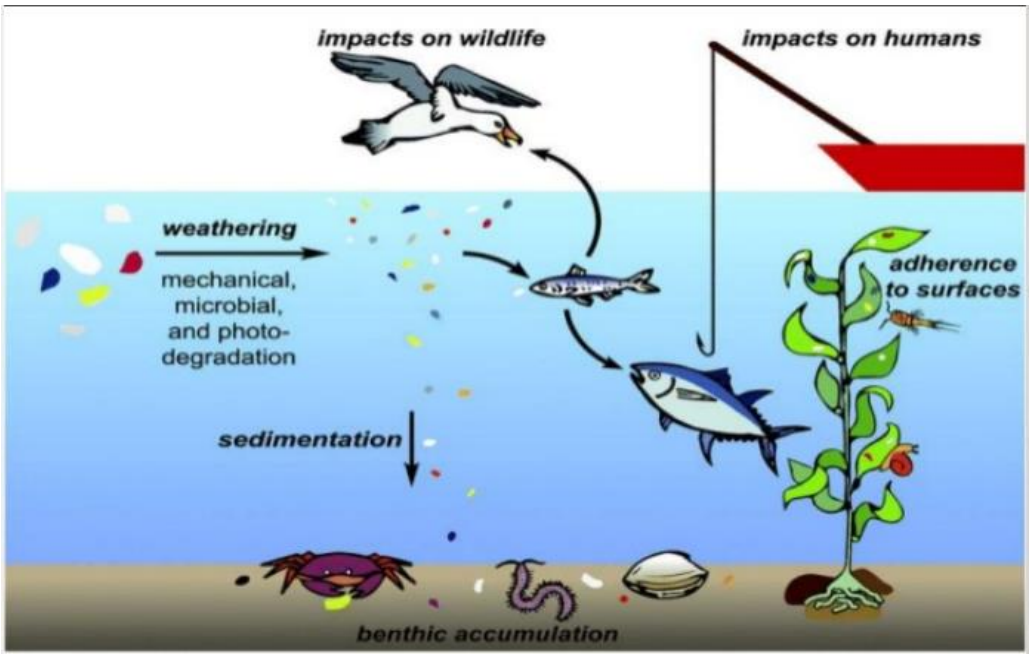

Figure 1.1 Food chain and microplastic contamination (Lin, 2016)

1.3 Aim and Objectives of Study

The objective of the research are formulated :

i. To investigate the presence and abundance of microplastic in *Polymesoda sp*.

ii. To analyse microplastic physical and chemical characteristics in *Polymesoda sp*.

iii. To compare different activities nearest to the river and its relation to microplastic contamination.

1.4 Scope of Study

In this study, research on microplastic contamination was conducted on *polymesoda* in river water. Two different sampling location were chosen to compare the different activities nearest the river that influence microplastic contamination. The study area at Kampung Pulau Melaka (Sungai Pengkalan Datu, Kelantan) and Tok Bali (Sungai Semerak). All samples were caugth wild and the laboratory works consist of digestion of organic tissue, separation of microplastic from the dissolve liquid of digested organic tissue, and observation as well as validation of microplastic using several instruments available at the laboratory. Stereomicroplastic was used to identify the abundance and physical characterictics of microplastics fragment or fiber and attenuated total reflection (ATR) spectroscopy was used to validate whether the selected microplastic indeed originated from plastic or from organic material.

1.5 Significant of Study

It is a concern where anything that exists in the natural environment balances each other where for example if a *sp*ecies of marine organisms is affected by microplastics pollution which lead to its extinction might alter the living environment of other species. Certain predator organisms that prey on the vulnerable organism which already decreased in number thus need to change its diet for survival. In worse condition if the lower trophic level organism becomes extinct, the higher trophic level may face the same condition. With nonstop production of plastic, there is no guarantee that microplastics pollution is going to stop in the future. In fact, more microplastics will be available in the natural environment throughout the coming years adding to the amount of microplastics which already existed. Among the plastics material which cannot be avoided in human lives is the usage of product packaging, tyres, synthetic fabric and many more (Rozan, 2018). Currently there is still no environmental friendly material which can replace the usage of plastic material in our everyday lives and when the amount of microplastics becoming more abundant in the future it will increases the rate of toxicity in contaminated organisms. Since, Kelantan river have fisheries and aquaculture industry making it vulnerable to the environmental and commercial impact caused by microplastics pollution (Rozan, 2018).

Nowadays, information can be *sp*read out easily with the help of technological devices and the awareness on microplastics pollution by the public might cause a doubt in the quality of green mussel supply in the market whether it contain high level of contaminant or not. By conducting research in this field, it may help better understanding on the physical characteristics of microplastics, abundance, sources and most importantly aid knowledge in order for the government sector or interested body to combat further pollution caused by microplastics. In general, this study will add in knowledge on the occurrence of microplastics contamination *polymesoda* in Kelantan river and information provided from this study can serve as a baseline data for understanding on the extent of microplastic contamination along Kelantan River. By comparing data and result of microplastic abundance in Kelantan river at Sungai Semarak and Sungai Pengkalan Datu.

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