CHAPTER 1

INTRODUCTION

1.1 Introduction

Plastics, are materials made up of large and organic molecules that can transform into variety of products. Plastics are composed from long carbon chains called polymers that give unique properties to their useful products. Moreover, plastics are mostly synthetic and moldable due to their chemically fabricated materials and can be classified as versatile and economical as they pose outstanding technical properties such as cost less and weigh less (D'ambrières, 2019). Due to increasing of plastic usage globally, high levels of microplastic are detected in lakes, rivers and oceans. Volume of plastic waste loaded into the ocean is estimated to quadruple between 2010 and 2050 globally, which the sea could contain more plastic by weight than marine lives by half of the century (Worldwide Fund for Nature, 2020). Microplastics are formed and introduced to the environments by degradation or fragmentation of plastics through various reactions either physically (wave, wind and tidal abrasion), chemically (absorption of an organic pollutant) and biologically (biofilm formation) in the environment and can be described as the type of smaller plastic debris that possess variety of shapes and sizes, and exert the length less than 5 millimeters with diameter less than 0.2 inches (Aparna, 2019).

Corona disease 2019 (Covid 19), which is originated from a novel coronavirus, namely SARS-CoV-2, has spread throughout the world since the disease was first discovered around December 2019 in Wuhan, China (WHO,2020). This Covid 19 was declared as pandemic by WHO when the infection spread globally and pose threat to global public health (Liu and Schauer, 2020). This pandemic highlighted the significant role of self-isolation or self-quarantine at home which triggered the use of single use polymeric materials such as plastic packaging, food containers and plastic bottles (Fadare et al., 2020) prior to online deliveries. Therefore, the extensive use of disposable plasticware made of polymeric materials and non-recyclable food packaging during this current pandemic has caused an emerging plastic waste contaminant including gloves, surgical masks and personal protective equipment (Aragaw, 2020).

Addition to this global pandemic, microplastics have been an alarming issue as they became threats towards marine animals and human being. The annual production of plastic materials currently more than 320 million tons and this possibly could disrupt the ecosystem directly or indirectly in the human environment if there is corruption of the food chain and become a potential threat to human health in long term effects (Waring et al., 2018). Microplastics comes from various sources which majority based on plastic products such as bottles, cups, wrappers, packaging and polystyrene containers. Microplastics are also known to degrade into smaller fragments through photolysis, thermal-oxidation, hydrolysis and physical abrasion by sedimentation of particles (Bergmann et al., 2015). The occurrence of microplastics can be categorized into two sources, primary and secondary sources. The primary source basically originated from small scrubbers in personal care products and also plastic pellet while the secondary source is rampantly utilized from the degradation of larger plastic polymers (Sarijan et al., 2019).

In addition, microplastics are pertinent as potential transporter to carry chemical pollutants directly or indirectly when they ingested lower-trophic level organisms that have consumed microplastics initially. The ingested microplastics could be digested in the tract, causing false satiation of the marine animals and may risking the health of seafood consumers when the hazardous compounds transfer into the organisms in the food web (Karami et al., 2018). The ASEAN region contributes about 20 % of plastic production globally which includes Malaysia. Plastic consumption worldwide has portrayed an enormous increase from 2 million tons since its production in 1950 to 407 million tons in 2015 (AIT RRC.AP, 2018)..

As reported also by National Solid Waste Management Department, Malaysia has been listed as the biggest user of single use plastics and plastic waste generation in a domain accountable for more than 50% of the litter in the oceans globally since 2017 (Chen et al., 2021). Following that, Malaysia has produced the total losses of 0.5 to 1.9 kg per capita daily of municipal solid waste with 24 % of plastic being the highest of the total solid sediments (Md Amin et al., 2020). According to Worldwide Fund for Nature (2020), an analysis of the worst Asian's ocean polluters falls to Malaysians which are the largest individual users of plastic packaging. Nevertheless, the environmental statistics related to the numerous of plastic pollution in the marine ecosystem is still insufficient especially in Malaysia in terms of microplastic contamination. This is a significant concern as unrealistically high doses of

microplastics exposure in marine environment may lead to uncertain conclusions about the harmful effects towards marine organisms in experimental study.

Recently, the average estimation of plastic packaging used by the Malaysian each year is 16.78 kg which is more than half of the plastic debris enter the ocean. 90 % of marine plastics are microplastics and this become a concern issue as these microplastics are capable to enter the human food chain either by inhalation or by ingestion through food consumption. Plastics recently found in aquatic animals that are commonly consumed by humans, including shrimp bivalves, oysters, cockles, mussels and fish from variety of trophic levels (Smith et al., 2018). Malaysians are among the world's top fish consumers, which taking at least 56.5 kg of fish per person per annum (The Star, 2014). Therefore, this statistic shows that Malaysian fish consumption is above the world average of below 20 kg per capita and become the second highest country after Japan in fish consumption making number fifth of overall world ranking (Izzah et al., 2016).

Malaysia has conquered 93 % of the total shellfish manufacturing and listed as one of the top manufacturers of adult cockles in Asia where this species included more than 50 % to the aquaculture production nationally (Saffian et al., 2020). Therefore, it is important to access the safety and quality of the products including plastic contaminations. There are many studies done regarding microplastic contamination in fish and seafood, but no study involves with cockles and mussels' landings in sea sites especially west coast peninsular Malaysia. Research indicates that accumulation of chemicals on plastics such as hexachlorinated hexanes and polycyclic aromatic hydrocarbons can be transferred to the body's tissues of animals after ingestion which easily enters the food web. Even though cockles are reported to survive in polluted environment due to its filter feeder's properties by accumulating pollutants inside their body tissue, but this mechanism could create potential health hazard to consumer. Major contaminants reported in seafood were polychlorinated biphenyls and methyl mercury, which become the major factor for human to be exposed with harmful chemicals from the ingestion of contaminated seafood (Ahmad et al., 2016).

1.2 Research problem

Incidence on plastic wastes being thrown in the ocean is no longer new. At least eight million tons of plastic enter the oceans per annum and make 80 % of all marine debris from water surface to sink into the deep bottom sea (IUCN, 2020). As a result, of

plastic contamination, microplastics are unintentionally being eaten by aquatic species of wildlife including fish and shellfish which mistaken as food. Since microplastics are associated with toxic chemicals from industries, there is issue concerning physical and chemical toxicity. These microplastics could also transferred along the supply chain which later could harm the consumer if being exposed constantly. Microplastics and their potential harmful chemicals regulated in marine food webs is an alarming issue in Malaysia as the country is surrounded by South China Sea and Street of Malacca (West Coast Peninsular Malaysia), where people depend greatly on marine animals for food sustainability. Previous studies on hazards contamination in fish and seafood has been found but no study involves with cockles and mussels' landings in sea sites west coast peninsular Malaysia. Therefore, due to their long-term effect to the environment, marine organisms and human ecosystem especially marine life in West Coast Peninsular Malaysia, screening on the abundance of microplastics on mussels and cockles is necessary. Detection and identification of this hazards in cockles and other shellfish represent the quality and safety of products. Information generated in this study will be useful as management of food safety measures without neglecting the environmental health measures.

1.3 Scope of study

This study is carried out at two sampling sites from West Coast Peninsular Malaysia, which is associated with chemical contaminants and toxicants, Tanjong Karang, Selangor and Sebatu, Melaka to screen out the potential microplastics contaminants on filter feeders such as cockles and mussels as these two places were attributed with the habitat and cultivation sites of these filter feeders. Physical analysis using light and fluorescence microscopy were conducted to characterize the presence of potential microplastics presence while chemical analysis using FTIR analysis were conducted to confirm the type of microplastics on the mussels and cockles biota. The results obtained may be useful for food safety measures and environmental control.

1.4 Purpose

To determine the microplastic contaminant present in cockles and mussels' landings, as well as seawater samples at different strategic sites in west coast Peninsular Malaysia, Tanjong Karang, Selangor and Sebatu, Melaka using physical and chemical analysis, light microscope and Fourier-Transform Infrared (FTIR) spectroscopy respectively.

1.5 Objectives

Therefore, the objectives of this study are:

1) To characterize the presence of potential microplastics contaminants in the cockles and mussels' landings from Tanjong Karang, Selangor and Sebatu, Melaka through physical analysis using light microscope.
2) To confirm and identify the microplastics presence in cockles and mussels through chemical analysis using Fourier-Transform Infrared (FTIR) spectroscopy.
3) To compare the occurrence of microplastic between cockles and mussels from Tanjong Karang, Selangor and Sebatu, Melaka using statistical analysis.