

**HEAVY METAL IN PEN SHELLS (BIVALVIA-PINNIDAE) AT MERAMBONG
ISLAND AND MERAMBONG SEAGRASS SHOAL**

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My special dedication to my family:

My beloved baba and emak,

Baharuddin Abdullah and Kathijah Abd Kader

Thank you for always being there where i need you most.....

My dearest brothers and sister,

Mohd Faizal

Muhammad Fairuz

Nur Fadilah

To my lovely friend,

Noraziah

Thank you for everthing.....

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“In the name of Allah, the most gracious, the most compassionate”

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ABSTRACT

Pen shell of the family *pinnidae* is a popular food source and had high commercial value in a number of Asia-Pacific countries. Pen shell is also one of the important fisheries resources and it can easily be established as important commercial species. Environmental studies on pen shells species was conducted at Merambong Island and Merambong Seagrass shoal off South Western Johor coast, Malaysia. A total of 39 samples of pen shells were collected from two different stations during low tides. From the samples, four species of pen shells were identified. Among the 4 species, 3 species belonged to the genus *Pinna* (*P.bicolor*, *P.deltodes*, and *P.atropurapurea*) and one species was *Atrina* (*A.vexillum*). Seawater samples were collected during low tide (0-0.2m height) at four stations which located at Merambong Island and Merambong Seagrass Shoal. Concentration of heavy metal arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), iron (Fe), manganese (Mn) and zinc (Zn) were measured in water and soft tissues of the pen shells. The highest concentrations of heavy metal in water were As, Cu, and Hg in ranged between 0.100-0.142, 0.142-0.189, and 0.028-0.046 mg/L respectively. The highest metals were As, Cr and Hg in both of *P.bicolor*, *P.deltodes*, *P.atropurapurea* and *A.vexillum*. The highest concentration of metal in water and pen shells were recorded at Merambong Island, while the lowest concentration was recorded at Merambong Seagrass Shoal. Land based activities and waste discharged from nearby areas which includes oil refineries and power station are main source of metal pollution in the area.

ABSTRAK

Pen shell merupakan sejenis makanan laut yang terkenal terutamanya di negara-negara Asia. Kajian ke atas siput beliung meliputi kawasan pulau merambong dan kawasan hamparan rumput laut yang terletak di selatan barat Malaysia. Sejumlah 39 sampel pen shell dipungut dari dua station semasa air surut. Daripada sampel yang diperolehi, empat spesies dikenalpasti. Tiga spesies dikenalpasti dalam jenis *Pinna* (*P.bicolor*, *P.deltodes*, and *P.atropurpurea*) dan satu spesies jenis *Atrina* (*A.vexillum*). Sampel air laut diambil semasa air surut iaitu pada ketinggian 0m-0.2m di empat station. Kandungan logam As, Cd, Cr, Cu, Pb, Hg, Ni, Fe, Mn dan Zn dikenalpasti pada air dan tisu lembut siput beliung. Kandungan tertinggi logam berat pada air laut adalah As, Cu, dan Hg iaitu masing-masing mencatatkan bacaan dalam lingkungan 0.100-0.142mg/L, 0.142-0.189mg/L dan 0.028-0.046mg/L. Kandungan logam yang tertinggi dalam empat spesies pen shell adalah Fe, Mn dan Zn. Bagaimanapun, kandungan logam yang ditemui dalam siput beliung masih di bawah nilai yang dibenarkan oleh piawai pemakanan (FAO dan WHO). Kandungan logam pada air laut dan pen shell yang dicatatkan di pulau merambong lebih tinggi jika dibandingkan dengan kawasan hamparan rumput laut. Aktiviti pengerokan untuk tebusguna tanah, pelabuhan yang melibatkan memecat minyak, dan station bahan api dikenalpasti sebagai pegumbang pencemaran.

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LIST OF SYMBOLS

AMWQC	ASEAN Marine Water Quality Criteria
APHA	American Public Health Association
As	Arsenic
BOD	Biochemical Oxygen Demand
Cd	Cadmium
Cu	Copper
COD	Chemical Oxygen Demand
Cr	Chromium
DO	Dissolved Oxygen
DOE	Department of Environmental
FAO	Food and Agriculture Organization
Fe	Iron
Hg	Mercury
IMWQS	Malaysia Interim Marine Water Quality Standards
Mn	Manganese
Ni	Nickel
Pb	Lead
SMWQC	Singapore Marine Water Quality Criteria
TSS	Total suspended solid
UTM	Universiti Teknologi Malaysia
WHO	World Health Organization
Zn	Zinc

CHAPTER 1

INTRODUCTION

1.1 Overview

Malaysia has about 4,800 km of coastline comprising two distinctly different physical formations, namely the mangrove fringed mud flats and sandy beaches. The coastal zone of Malaysia has a special socio-economic and environmental significance. It supports a large percentage of the population and it is also the center of economic activities encompassing urbanisation, agriculture, fisheries, aquaculture, oil and gas exploitation, transportation and communication, recreation, etc. Increasing human populations and associated such as port expansion, urbanization, industrial development and agricultural activities along the Johor Strait especially at Pulai River have focused attention on the risk of those activities to the estuaries and coastal (New Straits Times, 2008).

Coastal environment are subjected to contamination especially metals through inputs from point and diffuse which transported via river discharge and atmospheric deposition. The pollution entering in coastal systems will incorporated into biota and may interferences the chemical and biological process in the water column, sediment and biota. Metal contaminants are found in the water column and can persist in the sediments of coastal habitat, including urbanized areas, as well as fairly uninhabited regions, and are a potential environmental threat (Larsen 1992; Readman *et al.* 1993; Buchholtz ten Brink *et al.* 1996).

Pen Shells is one of marine animals that can found at Merambong Island and Merambong seagrass shoal off South Western Johor coast, Malaysia. Pen shells belong to phylum Mollusca, class Bivalvia and family *Pinnidae* (Barnes, 1987). The *Pinnidae* or razor, wing or pen shells area a family of large wedge-shape bivalves that live in mud and sand or amongst rocks or corals. They are widely distributed in the Indo-Pacific from southeastern Africa to Melanesia and New Zealand, north to Japan and to New South Wales and New Zealand. Pen shells are also found in Mediterranean and American waters (Rosewater, 1961; Butler, 1987; Scheltern, 1983; Zavodnik *et al.*, 1991; Munguia, 2004). According to Mohd Idris, seven species were clearly identified from the seagrass bed of Sungai Pulai, Peninsular Malaysia. Little is known of pen shells population in Malaysia waters. Pen shells are also one of the important fisheries resources and it can easily be established as important commercial species.

1.2 Statement of Problem

The major threats to marine and aquatic habitats are a result of increasing human population and coastal development, which contribute to an increase in anthropogenic pollutant loads. These pollutants are released into estuarine and coastal habitats by way of point and nonpoint source discharges. The development around Sungai Pulai, such as the Port of Tanjung Pelepas and the Tanjung Bin powerplant are destroying the mangroves and seagrass bed. The fragile ecosystems cannot tolerate a series of heavy industries development. The bunkering terminal near the tip of Johor's southeastern coast near to the Port of Tanjung Pelepas (PTP), will be used to provide integrated services and uninterrupted bunkering to ships. With all the activities will affect the ecosystem and aquatic life.

Pen shells, area large fan-shape bivalve mollusks that live embedded in one place in the sediment. They can be exposed to contaminants present in both the water and the sediment. Pen shells filter water to remove fine organic and inorganic particles as a food source and regularly pass water over their gills to take oxygen.

Metals present either in solution in the water or adsorbed to the inorganic and organic matter can be accumulated in their body tissues. This accumulation makes them a useful indicator of the biologically available metals in the marine environment. Marine shells of the family *Pinnidae* are a popular food source and high commercial value. Metal accumulation in pen shell may lead to fatal diseases and have a negative effect towards the economy

Analysis of metal concentrations in living organisms, such as molluscs, complement sediment analysis by indicating which metals might be bioavailable in the environment. Once in the environment, metals can be cycled through the ecosystem food web, accumulating in organisms either directly from the primary pollution source or by consumption of other organisms with metals stored in their tissues. Organisms can also be exposed to metals through the re-suspension or mobilisation of the sediment. It is important to note that the affects of pollution on coastal fishery resources may not necessarily represent a serious, widespread threat to all species and life history stages.

1.3 Objectives of Study

The objectives of the study are:

- (i) To determine pen shell species at Merambong Island and Seagrass Shoal;
- (ii) To determine water quality of pen shell at Merambong Island and Seagrass Shoal; and
- (iii) To determine heavy metal concentration in pen shell.

1.4 Scope of Study

This study was sub-divided it into two area including sampling and analysis. Sampling will be carried out around the Merambong Island and Merambong Seagrass Shoal. the considering parameter for this study are water quality which consist total suspended solid (TSS), turbidity, temperature, Disolve Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH, Ammoniacal Nitrogen, Oil and Grease. Concentration of heavy metal arsenic (As), cadminium (Cd), chromium (Cr), cooper (Cu), lead (Pb), mercury (Hg), nickel (Ni), iron (Fe), manganese (Mn) and zinc (Zn). The sampling of water quality is taken at four stations with four times of frequency for both tides (study period is within August 2009 to January 2010).

Specimens of pen shells were collected three times during low tide (study period is within August 2009 to January 2010). The samples were taken for species identification. The identification of the species was base on the characteristics of internal and external of the valves.

1.5 Need of Study

It is important to study about the metal concentration in pen shell due to several reasons. The most important reason is pen shells of the family *Pinnidae* are a popular food source where it may had high commercial value. Besides that, high contamination of pen shell by metal may lead to health risk to human. Thus, it is critical to carry out an analysis to determine the level of metal concentration in pen shell. This finding also important to determine water quality and can find either the water quality or environment of Merambong Island and Merambong Seagrass Shoal will effect the population of this pen shell species.