UNIVERSITI TEKNOLOGI MARA

SEDIMENT-WATER-BIOTA LINKAGE MECHANISM OF ANTHROPOGENIC POLLUTANT MARKER ELEMENTS FROM GEBENG WATER BODIES, PAHANG MALAYSIA

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ABSTRACT

A study was carried out to determine the non-radioactive (Fe, K, Al, Cd, Cu, Cr, As, Pb, Zn, and Ni) and radioactive elements (U, Th) in sediment, water and biota from Gebeng industrial water bodies. The purpose of the study was to investigate the linkage mechanism of anthropogenic pollutant marker elements in sediment, water and biota in Gebeng water bodies. The water and sediment samples were taken from 28 sampling points along Sungai Balok, Sungai Tunggak, coastal water area and Gebeng industrial area. The biota sample consists of *Rastrelliger kanagurta* (Indian mackerel), *Nibea soldado* (Soldler croaker), *Atule mate* (Yellowtail scad), *Bagrus nemurus* (Sagor catfish), *Himantura walga* (Dwart whipray) and *Portunus pelagicus* (Flower crab). For sediments and biota, the samples were oven-dried, pulverized and acid digested prior to be analysed. The pollutant marker elements were analytically characterized using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). The range of elements concentration in sediment were; Fe (27628 – 70358 μg/g), Al (7047 – 65700 μg/g), K (1492 – 13585 μg/g), Cu (8.27 – 162.32 μg/g), Pb (3.92 – 177.58 μg/g), Zn (13.42 – 313.75 μg/g), Cr (22.00 – 109.33 μg/g), Ni (5.33 – 35.50 μg/g), As (10.48 – 61.45 μg/g), Cd (0.53 – 1.53 μg/g), U (01.5 – 5.73 μg/g) and Th (0.48 – 23.99 μg/g) respectively. Then, the range of elements in water were Fe (170 – 6565 μg/L), Al (9.66 – 7791.40 μg/L), K (149 – 4980 μg/L), Cu (41.62 – 3380 μg/L), Pb (0.04 – 5.61 μg/L), Zn (9.89 – 308.85 μg/L), Cr (0.30 – 28.43 μg/L), Ni (1.00 – 52.38 μg/L), As (5.36 – 135.16 μg/L), Cd (0.09 – 0.38 μg/L), U (0.16 – 4.095 μg/L) and Th (BDL – 1.03 μg/L) respectively. The range of elements in biota were; Fe (2.67 – 42.72 μg/g), Al (0.16 – 92.05 μg/g), K (10.46 – 84.90 μg/g), Cu (0.004 – 8.53 μg/g), Pb (0.02 – 10.23 μg/g), Zn (0.14 – 43.75 μg/g), Cr (0.18 – 13.93 μg/g), Ni (0.04 – 8.57 μg/g), As (0.025 – 32.69 μg/g), Cd (0.002 – 3.03 μg/g), U (0.005 – 0.34 μg/g) and Th (0.09 1.68 μg/g) respectively. The assessment of the degree of pollutant in sediment were done based on sediment quality indices include pollution load index, enrichment factor and geo-accumulation index. The elements that show significant pollutant elements are Cd, As, Cu and Pb. The statistical analysis (principal component analysis, cluster analysis and Pearson correlation analysis) signified that Cu, Pb, Zn, Ni; Fe, Cr; Al, K, As, Cd, U and Th are of the similar group; and can be considered of the similar specific origins with strong and positive correlation. The sources of the most significant pollutants, that are As and Cd could be from industrial activities in Gebeng. While U, Th, Al and K most likely from natural sources. The distribution of significant elements in sediment also was potrayed in the form of map. Linkage mechanism of pollutant marker elements in sediment-water-biota is in the sequence of water to sediment > water to fish > sediment to fish.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Technological development has no political borders. It covers all types of technology that sustain and enhance world economy. In conjunction with all kinds of technology particularly in the field of industrialization and other socio-economic development activities, it may release environmental pollutants especially non-radioactive and radioactive elements to the marine ecosystems. These developments contribute to the non-radioactive and radioactive elements to enter the water, sediment and may be consumed by marine organisms (marine filter feeder). The pollution may have negative impact on the living organism those that are accumulated in the body system, such as non-radioactive and radioactive elements. The radioactive elements may originated from naturally occurring radioactive materials (NORMs) or man-made radioactive materials.

In marine environment, non-radioactive elements originated from two vital sources which are naturally and manmade sources (Firat et al., 2008). The pollution of water and accumulation of the elements in marine are causes by urbanization, expanding in population and increase in agricultural activities (Alkharkhi et al., 2007). According to Hasyimah et al., (2011), discharged of manmade sources of pollutant will disturb the hydrosphere equilibrium in water. From the circumstance, it will further affect the natural structure and functions of marine life. The contamination of elements in marine ecosystems may contribute to severe environmental and health problem even in a small concentration. The contaminations that exist in sediment may accumulate in marine biota such as fishes and marine filter feeder and finally will enter the food-chain.

Elements have their own characteristics that can make them become toxic and harmful to environmental life. If the concentration of elements is in excess and in large amount, it can be toxic. Studies on the distribution and forms of metals in sediments can provide the actual environmental impact and their bioavailability.