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Trace Elements in Sediments of Selected Gutters and Bar – Beach, Lagos, Nigeria

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ABSTRACT: Sediment samples were collected from selected gutters and Lagos bar beach for the investigation of trace element concentrations. The metals investigated were chromium, lead, arsenic, selenium, cadmium and barium using the atomic absorption spectrophotometry. The results obtained further revealed elevated concentrations metals from both selected gutters and the Lagos bar beach. It was also observed that the Lagos bar beach is the receiving end of all the pollution loads arising from the channeled gutters. These elevated trace element concentrations obtained in sediment in this study were compared with other similar studies. The sediment contaminations by metals were traceable to industries and anthropogenic substances in Lagos metropolis .@JASEM

Keywords: Lagos bar beach, gutter sediments, trace elements, industries and anthropogenic substances.

Lagos State is an African mega city which is located in Southern Western Nigeria on the West Coast of Africa. Water and wetlands cover over 40% of the total land area within the State and an additional 12% is subject to seasonal flooding. The land surface in Lagos State generally slopes gently downwards from North to South. According to projected population growth studies, it has been found that Lagos State population will reach 25 million inhabitants in the next 10 year making the city the third largest in the world (Iwugo et al 2003).

Pollution of water and sediments by industrial discharges of heavy metals mainly cadmium, threatens the biota of mangrove ecotones around the mouth of the Tuy River (Zanders and Rojas, 1996). Cadmium levels found in the top sediments of Lagos lagoon were lower than those of bottom sediments (Nwajei and Gagophien, 2000). The sources of heavy metals in sediments from Ebe and Ora Rivers were attributed to geochemical processes and emissions from fossil fuels from Nkalagu cement factory (Okafor and Nwajei, 2006). The values of metals studied in sediments indicated that adverse biological effects were probably occuring, especially in the innermost region of Montevideo Bay (Buniz et al, 2004).

Heavy metals enrichment of cadmium, cobalt, copper, chromium, iron, manganese, nickel, lead and zinc in sediments from the Lagos lagoon were due to land – based urban and industrial wastes (Okoye 1991). Concentrations of metals measured in both seawater and sediments indicated that the area is seriously polluted. The tidal current affects the distributions of metals which have their highest concentrations at the near shore zone (Dassenakis et al, 1996).

The accumulation of cadmium and lead in both sediments and vegetation were traced to the industrial activities in River Ramos (Nwajei, 2002). Many of the wastes in the environment are toxic and they find their way to land, water/sediments and air (Ademoroti, 1996). Sediments conserve important environmental information (Vongunten et al 1997) and are increasingly recognized as both a carrier and a possible source of contaminants in aquatic systems (Forstner and Salomons, 1991). Suspended particulate materials of the Krishna River metals (Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel, Zinc and Lead) (Remesh, 1996).

A rapid increase in heavy metal contents and a significant decrease in biological activities were found at the recently deposited coastal sediments, indicting a problem requiring urgent remedial action to stop further deterioration of the coastal environment of the beautiful resort area at Sai Kung Bay (Fung and Lo, 1993).

The pollution of aquatic ecosystem by trace metals is a significant problem as trace metals constitute some of the most hazardous substances that can bioaccmulate (Nguyen et al 2005). Flooding is a serious problem in Lagos metropolis because of poor drainage systems. All pollution loads through the gutters accumulates in the sediment of the Lagos Bar Beach, hence it became necessary for the study. The objectives of this study therefore are: to determine the concentrations of hear metals in gutter and bar beach sediments and to identify the various sources of sediments contamination.

Area of Study: Lagos city is a huge metropolis with its population spread along the Nigerian coastline and upon the Islands to the Southwest that forms an archipelago just off the mainland. It has a city area of 787 km^2, lean area of 614 km^3 and water area of 173.14 km^2. Also, it has a population of 15 million and a density of 1,380 kg/m^2.

Lagos lies within the latitudes $6^0\ 23^1$N and $6^0\ 41^1$N and longitudes $2^0\ 42^1$E and $3^0\ 42^1$E. The State is flanged from the North and East by Ogun State, in the West by the Republic of Benin and the South by the Atlantic Ocean/Gulf of Guinea.

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MATERIALS AND METHOD

Ten sediment samples were collected from different locations in Lagos metropolis. These samples were collected for the period covering May to September, 2008. Five sediment samples were collected from the Lagos Bar Beach in different locations whereas five other sediment samples were collected from gutters around Surulere, Ikeja and Apapa. The sediment samples were collected in plastic containers with sealed cover.

The sediments were air – dried at 60^0 C and were sieved over 2mm mesh and ground to obtain homogeneity (Ofino and Pederson, 1996; Egli et al, 2003). 5 g of dried sediment was weighed and digested in acid mixture prepared by mixing 20 ml nitric acid and 5 ml perchloric acid (APHA, 2005).

The resultant solution was placed on hot plate with constant stirring and later transferred into the fume cupboard for over night. On cooling the solution was filtered and the filtrate was made up to 100 ml using deionized water. The solution was stored in the refrigerator prior to metal analysis using atomic absorption spectrophotometry (Unicam 929, London) powered by the solar software. A recovery test of the procedure was carried out by spiking the ten analyzed sediment samples. The percentage recoveries of the analytical method determining by analyzing the sediment samples were as follows: 96% for Chromium, 93% for Lead, 88% for Arsenic, 91% for Selenium, 89% for Cadmium and 98% for Barium.

RESULTS AND DISCUSSION

The sediments samples obtained from gutters and Lagos bar beach were analyzed for metals such as Chromium, Lead, Arsenic, Selenium, Cadmium and Barium. The results revealed that all the aforementioned trace metals were detected. There were variations in the concentrations of metals for sediments of both gutters and Lagos bar beach. The mean concentrations of metals are arranged in the following order: barium > chromium > lead >arsenic > selenium > cadmium for gutter sediments; chromium > barium > lead > selenium > arsenic = cadmium for Lagos bar beach sediments.

A look at results in tables 1 and 2 showed that the concentrations of barium, chromium and arsenic in sediments from selected gutters exceeded those obtained in sediments from the Lagos bar beach. These high levels are traceable to the activities of various industries located in Ikeja, Apapa and Surulere, all in Lagos metropolis. This is an indication that industries in Lagos metropolis are the chief polluters of the Lagos bar beach. The bar beach is the receiving ends of all pollution loads.

The concentrations of metals in this study are considered elevated. Although, the concentrations of chromium, lead and cadmium in sediments in this study are lower than those obtained in sediments from the Lagos Lagoon (Nwajei and Gapophein, 2000). The concentrations of arsenic and chromium in this study were lower than those reported by Nwajei, (2002) from River Ramos in Bayelsa and Delta State of Nigeria. On the other, the concentrations of cadmium (0.04mg/kg dry weight) and lead (0.18mg/kg dry weight) in bottom sediments of the River Ramos (Nwajei, 2002) were lower than those obtained in this study.

Most gutters in the Lagos metropolis contain stagnant wastewaters thereby given room for sediments accumulation. The accumulated gutter sediments are highly contaminated through the discharge of chemicals and anthropogenic substances which do not flow through the channels. Drainage problem and indiscriminate discharge of oil substances into gutter could also account for the elevated trace elements level in both gutters and bar beach sediments. The various companies located in Lagos metropolis have discharge effluents which are not well treated. There is no doubt that trace metals in elevated concentrations are harmful. If an organism uptake of a metal is greater than its ability to get rid of it, the metals tend to accumulate in storage compartments. The accumulation can continue throughout the organism's life and is the major cause of chronic toxicity (Mefkovitz et al 1999).

Data indicate that both gutter sediments and bar beach sediments are polluted. The sediments are good indicator of heavy metals pollution and can be used to monitor the environment.

*Conclusion***:** The sediments from selected gutters in Lagos metropolis and Lagos bar beach were assessed for trace element concentrations. The results obtained revealed that there were variations in metal values for both selected gutters and the bar beach. All the metals assessed were detected. The concentrations of metals in this study were considered elevated. The sources of trace elements were attributed to the presence of various industries and anthropogenic substances in Lagos metropolis. It was also observed that the pollution loads were channeled through the gutters to the bar beach. The trace element concentrations in sediment from the selected gutters and the bar beach could be used to monitor the metal pollutions in urban environment in Nigeria.

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