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HEAVY METAL CONCENTRATION IN MARINE SEDIMENTS AND VEGETATION (*CALTHA PALUSTRVIS*) FROM RIVER RAMOS IN BAYELSA AND DELTA STATES OF NIGERIA

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Heavy metals concentration in marine sediments and vegetation from River Ramos have been studied. Metals such as arsenic, mercury, cadmium, lead, chromium, nickel, iron, copper and zinc were analysed using atomic absorption spectrometer (AAS). The levels of these metals were determined from top and bottom river sediments, side and middle vegetation. The analytical results revealed that arsenic levels were high in all the samples. Secondly, the highest concentration of metals were found on the top sediment (68.00mg/kg dry weight) and vegetation (64.90mg/kg dry weight). Other metals such as mercury, chromium, nickel and iron were found to have high levels. The high levels of the above mentioned heavy metals are the cause of pollution, the concentration due to other metals such as cadmium, lead, copper and zinc was low. The high accumulation of heavy metals in the matrics are due to activities of oil companies and geochemistry of rocks.

Key words: Sediments, Vegetation, Heavy metals, *Caltha paluslvis*, Oil spillage, Oil companies.

Introduction

Heavy metal pollution is an environmental problem in Bayelsa and Delta State of Nigeria. Lakes, rivers, coastal waters vegetation and soils are polluted by humans and industrial activities from uplands which eventually find ways into the above water bodies. The water bodies were polluted with heavy metals to different extent (Boyle 1978). The polluted water can spread diseases amongst people who use it for washing, cooking or bathing etc. The presence of heavy metals is particularly harmful.

The building up of data has taken place throughout geological history as long as sea and rivers have existed (Rose et al 1979). Economically delta deposits are most important, since oil and gas are often associated with them, besides, the study of lateral and vertical sequences, geomentry and fauna, diapiric structures are usually found in association with delta sediments because of rapid rates of sedimentation (Trefry and Metz 1985). An assessment of the environmental contamination can only be better achieved, if the main steps in their geochemical pathways within the various natural ecosystem are understood (Peterson and Alloway 1979).

The red algae and finger corals are brittle and quite easily broken to form coarse sand and gravel. In the deeper water around the bank, grasscovered muddy sand is present. The mounds have developed through sediment trapping by mangroves, rooted green algae, sea-grass, red algae and branching corals to form a build up which rises from water deepest of around 3-5 metres (Bosence *et al* 1985) in Lagoon,. Sediments are mostly skeletal-pelletal sands, with little lime mud. Locally, swamps occur around the edge of the Lagoons, colonized by the black halophytic plants (Kinsman and Holland 1969). Here lime muds and pelleted muds accumulate and are extensively bioturbated by crustaceans. Milking in gult water (Stanley 1970) is produced by shoals of fish stirring up the bottom sediment and discharge from oil tanks. Locally, chemical and biochemical precipitation of various minerals is an important deposition of Mn, Fe, Pb etc (Mohamed 1987).

Trace metal analyses were performed for cobalt, chromium, copper, manganese, lead and zinc. Chromium and manganese were found to be in the highest concentration in all sediments whereas copper and lead were low in most of the sediments (Nuberg 1982). Trace metals such as chromium, manganese, cobalt, copper and zinc play a biochemical role in the life processes of aquatic plants and animals and their presence in trace amounts in the quatic environment is essential. These metals are toxic at high concentration (Xie and Sun 1982). The toxicity of arsenic varies widely with the chemical nature of compounds in which this element occurs (Ndiokwere and Ezihe 1990).

River Ramos formed the natural boundary between Delta and Bayelsa States. It is suspected that sediments and vegetations have contributed to the high pollution through leaching. Therefore objective of this study is to identify the levels of heavy metals in marine sediment and vegetation and to find the possible effects of these heavy metals on human and aquatic life.

Area of Study. River Ramos is quite a large river which flows directly into the atlantic ocean. The river is the receiving end of all wastes resulting from the industrial activities. The river is the natural boundary between Delta and Bayelsa State of Nigeria.

Materials and Methods

Sediments and vegetations were collected from two stations (station A and B). Station A is the bank of the river where top sediments and side vegetation were collected.

Station B is the middle of the river where bottom sediments and middle vegetation were also collected. The same species of vegetations were collected from both stations.

Sediment and vegetation samples were dried and kept in corked plastic containers and placed in a refrigerator in the laboratory before digestion. The sediment samples were sieved and 5.00g of samples were digested in acid mixtures (HNO_3, $HClO_4$, HF) with equal ratio. In the case of vegetation, 5.00g of the sample was crushed to smooth level. Equal volumes of HNO_3, $HClO_4$ and HF mixtures were added to digestive flasks. The mixture was placed on a water bath until white fumes of the gas were observed. The digested samples were transferred to the fume house and left overnight. The samples were cooled and filtered. Each digest was made up to 100ml in the volumetric flask using deionized water. The digested samples were kept in a refrigerator before they were finally taken to the analytical laboratory for heavy metal analysis using atomic absorption spectrometer model Perkin Elmer 3110.

Results and Discussion

A number of sediments and vegetation samples were analysed. The results are presented in Table 1. The concentration of heavy metals were measured in mg-kg dry weight.

The concentration of arsenic in both sediments and vegetation were high. The sediments and vegetation collected at the top and side of river Ramos have higher arsenic content than those of the bottom and middle of the river. It is possible that materials containing arsenic must have been dumped on the land closer to the river. The accumulation levels of arsenic in river Ramos is dangerous. This can render fishing almost impossible in marine waters.

Mercury levels found in bottom sediment and vegetation obtained from the middle of the river did not show much difference. These results revealed that accumulation of mercury is more in the bottom of the river than those of the top. These levels of mercury in sediments exceeded 0.03 $\mu g\ g^{-1}$ dry weight of control sediment standard art 60m depth off the California coast (Bascon 1982).

The accumulation of cadmium and lead in both sediments and vegetation must be traced to the industrial activities. The uptake rate of cadmium and lead in top sediments and side vegetation were more than those of the bottom and middle. This may be due to the contaminant sources.

Considering the accumulation levels of chromium, nickel and iron, the uptake rate of these metals were more at the bottom sediments and vegetation location at the middle of the river. The levels of chromium and nickel in this study were lower than 23.10 $\mu g\ g^{-1}$ chromium and 12.20 $\mu g\ g^{-1}$ nickel of control sediments standard. There results reveal that some of the trace metals normally accumulated more in the bottom and middle of the river than those of the side locations.

The uptake rate of copper and zinc were low in all the sample locations. These levels obtained in both metals were insignificant in terms of contamination. However, higher values were found in top sediments and side vegetation.

The causes of these elevated metal levels may be attributed to frequent oil spills and geological nature of the marine area. All the pollution loads from up north and south are transported down to the marine water. The various oil well locations and constant oil spillage may be attributed to sediments and vegetation contamination.

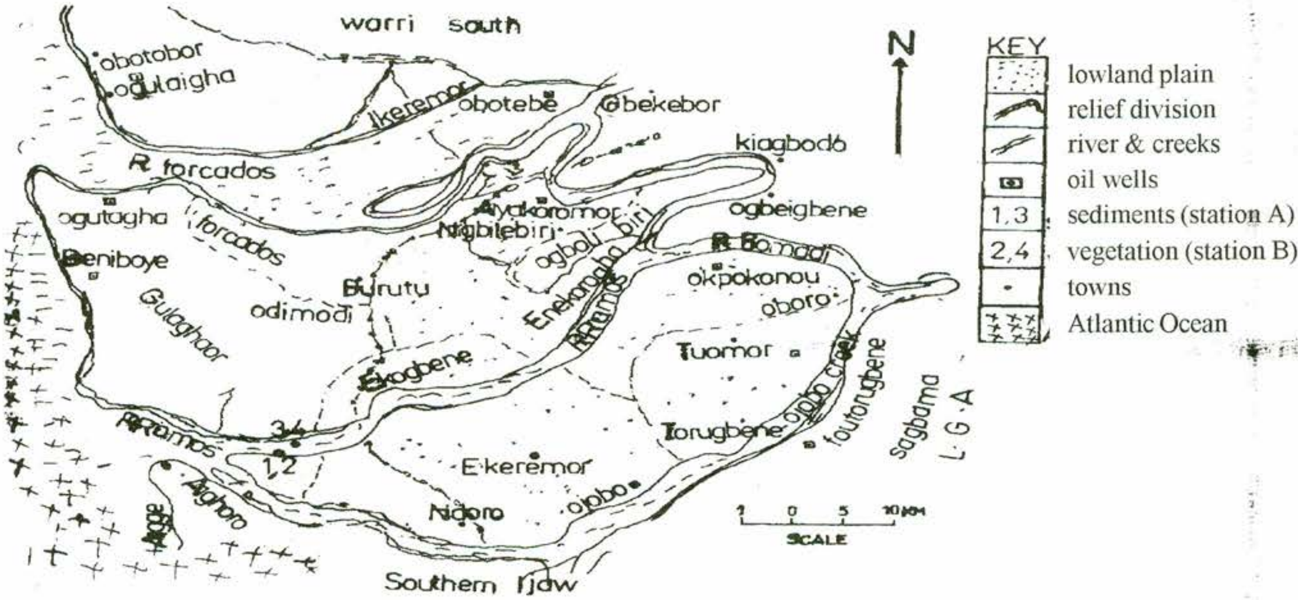
A major contributor to high levels of arsenic, mercury, chromium, nickel and iron in river Ramos is proximity of activity of various oil companies and geo chemical processes.

Conclusion

The uptake rate of arsenic metals in this study were highly elevated. If no urgent measure is taken fishing (major occupation of the inhabitant of the Delta areas) will be impossible. Arsenic is poisonous which contaminate water, sediment, vegetation, fish and aquatic life. Other heavy metals

Table 1
Concentration of heavy metals in sediment and vegetation

Parameters	As	Hg	Cd	Pb	Cr	Ni	Fe	Cu	Zn
Top Sediment	68.00	0.23	0.10	0.20	1.40	3.90	4.36	0.21	1.33
Bottom Sediment	54.00	0.66	0.04	0.18	2.30	4.82	197.00	0.15	0.52
Slide Vegetation	64.90	0.16	0.07	0.11	0.05	3.87	2.60	0.17	0.93
Middle Vegetation	50.00	0.63	0.03	0.08	1.94	4.65	273.00	0.08	0.43



Map of Brutu (Delta State) and Ekeremor (Bayelsa State) showing the sampling points

such as mercury, chromium, nickel and iron were found to have elevated accumulation levels. The concentration of iron in bottom sediments and vegetation at the middle of river (bottom sediment 197.00 mg-kg dry weight and middle vegetation 273.00 mg-kg dry weight) were extremely high.

The elevated levels of metals in marine waters could be attributed to oil spillage resulting from activities of oil companies and geochemistry of the rocks. These high levels of metals in the samples will in no doubt cause a serious pollution to river Ramos. The various oil companies located in Delta and Bayelsa states have been paying compensation to the indigens where oil spillage had occur. This is not enough, serious caution should be taken in carrying industrial activities so as to save people and aquatic life. The ecological problems should be seriously redressed.

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