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Metal contamination of surface water, sediment and *Tympanotonus fuscatus* var. *radula* of Iko River and environmental impact due to Utapete gas flare station, Nigeria

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Metal contamination of surface water, sediment and *Tympanotonus fuscatus* var. *radula* of Iko River and environmental impact due to Utapete gas flare station, Nigeria

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Abstract Inter-seasonal studies on the trace metal load of surface water, sediment and *Tympanotonus fuscatus* var. *radula* of Iko River were conducted between 2003 and 2004. The impact of anthropogenic activities especially industrial effluent, petroleum related wastes, gas flare and episodic oil spills on the ecosystem are remarkable. Trace metals analyzed included cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), nickel (Ni), vanadium (V) and zinc (Zn). Sediment particle size analysis revealed that they were characteristically psammitic and were predominantly of medium to fine grained sand (>73%), less of silt (<15%) and clay (<10%). These results correlated with low levels of trace elements such as Pb ($0.03 \pm 0.02 \text{ mg kg}^{-1}$), Cr ($0.22 \pm 0.12 \text{ mg kg}^{-1}$), Cd ($0.05 \pm 0.03 \text{ mg kg}^{-1}$), Cu ($0.04 \pm 0.02 \text{ mg kg}^{-1}$) and Mn ($0.23 \pm 0.22 \text{ mg kg}^{-1}$) in the sediment samples. This observation is consistent with the scarcity of clayey materials known to be good scavengers for metallic and organic contaminants. Sediments indicated enhanced concentration of Fe, Ni and V, while other metal levels were relatively low. The concentrations of all the metals except Pb in surface water were within the permissible levels, suggesting that the petroleum contaminants had minimal effect on the state of pollution by trace metals in Iko River. Notably, the pollutant concentrations in the sediments were markedly higher than the corresponding concentrations in

surface water and *T. fuscatus* tissues, and decreased with distance from point sources of pollution.

Keywords Trace metals · Water pollution · Sediment · Coastal environment · Nigeria

1 Introduction

In recent years, rivers in Nigeria have been subjected to pollution attributed to industrial and domestic sources of pollutants, owing to unethical practices and poor enforcement of environmental laws and regulations. Most natural aquatic ecosystems are severely threatened by human-mediated contamination because several industrial establishments are concentrated near river basins for obvious reasons (Uthe et al. 1986; Ntekim et al. 1992; Yahya 1994; Tarras-Wahlberg et al. 2000; Oketola et al. 2006). Studies have shown that apart from anthropogenic sources of heavy metals in sediment and biota, concentrations of metals in aquatic ecosystems could arise from atmospheric deposition, drainage basin and land-use histories (Yang and Rose 2005).

Concerns about inputs, effects and fate of inorganic and organic pollutants relative to the health and vitality of aquatic ecosystems have begun to emerge in Niger Delta and have led to quite a number of researches in areas considered as pollution hotspots especially from petroleum related activities. One of the principal reasons for this is that many toxic and bioaccumulative chemicals such as metals, organochlorine pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and dioxins, which are found in only trace amounts in water, can accumulate to elevated levels in sediments. In addition to providing sinks for many harmful chemicals,

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