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ORIGINAL RESEARCH

Physico-chemical Characteristics of Sediment from Sagbama Creek, Nigeria

Enetimi Idah SEIYABOH[1], Sylvester Chibueze IZAH[1]*, Solomon OWEIBI[1]
[1]Department of Biological Sciences, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.
*Corresponding Author email: chivestizah@gmail.com

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ABSTRACT
This study evaluated the physico-chemical properties of sediment from Sagbama creek, Bayelsa state, Nigeria. Triplicate samples were collected from 5 locations using sediment grab. The samples was analyzed using standard procedures. Results of the various physico-chemical parameters studied ranged from 6.73 – 6.87 (pH), 423.53 – 2033.56 (µhmoscm^{-1}), 0.24 – 0.60mg/kg (nitrite), 2.43 – 4.57mg/kg (nitrate), 1.30 – 4.20mg/kg (sulphate), 2.43 – 5.10mg/kg (phosphate), 4.04 – 6.20mg/kg (calcium), 4.77 – 6.12mg/kg (magnesium), 4.21 – 8.62mg/kg (sodium), 1.65 – 2.80mg/kg (potassium), 3.35 – 5.50% (total nitrogen), 6.73 – 10.73 % (organic carbon). Analysis of variance showed that there was significance difference ($P<0.05$) among the various sampling location in each of parameter studied apart from conductivity. Variation among the various locations for each of the parameters showed that anthropogenic activities are having an impact on sediment quality of the creek. But the concentration is within the range that could enhance the survival of benthic organisms.

KEY WORDS: *Surface water, Sediment, Sagbama creek, Physico-chemical assessment*

Introduction

Water quality is a term used to assess the chemical, physical and biological characteristics of water. The physical and chemical properties of water body have ecological importance (Ansa and Francis, 2007). Several factors including season, human activities affects the quality of water (Makinde *et al*., 2015). Of all types of water including rain, ground and surface water, surface water occupies the largest area. To this effect, it has have been widely reported that the earth comprises of 70% water. Surface water is distributed into marine i.e. salt water, estuarine or brackish water i.e. salt and fresh water interphase and freshwater. These water resources exist with sediment.

Sediment is found at the bottom of a river. Water being vital resources is associated with sediment which play essential role in the aquatic ecosystem. Sediment in surface water is mainly from two sources or types including suspended and deposited sediment. Deposited sediment is found in the bottom of surface water including river, stream, pond, creek, creeklets. Since sediment is associated with water, it's a home to some aquatic organisms (Ansa and Francis, 2007). They can be affected by activities that alter water quality including microbial, chemical and physical properties of the water. Sediment in water is caused by runoff after precipitation. As such sediment in water is associated with soil erosion. Since several activities are carried out in the soil, they can easily be contaminated and during runoff they are deposited into the aquatic ecosystem, hence sediment is predisposed to pollution just as water.

Sediment acts as a reservoir for pollutants and therefore a potential source of pollutants to the water column, organisms, and human that consumes such organisms

(Adesuyi *et al*., 2016) such as fish (Izah and Angaye, 2016). As such sediment characteristics of water are altered by anthropogenic activities that find its way into surface water including effluents from different industries such as pharmaceutical, cassava and oil palm processing, pesticides use, different waste discharged into the aquatic ecosystem. Agedah *et al*. (2015), Ogamba *et al*. (2015a,b) have previously reported that wastes are discharged into surface water especially in communities aligning surface water especially in Bayelsa state.

Bayelsa state is situated in the Central Niger Delta Sedimentary basin of Southern Nigeria (Nwankwoala *et al*., 2014; Ohimain *et al*., 2009). Several economic activities take place in surface water such as dredging (Seiyaboh *et al*., 2013 ; Ohimain *et al*., 2008a,b), water transportation using speed boat, canoe etc.

Globally, sediments is widely studied and it acts as a sinks and sources of contaminants in aquatic systems because of their variable physical and chemical properties (Davies and Tawari, 2010; Ansa and Francis, 2008). Studies have been conducted in some surface water sources in Nigeria including Warri river in Delta state (Aghoghovwia *et al*., 2015), trans-okpoka creek, upper bonny Estuary (Davies and Tawari, 2010), Iko River (Etesin *et al*., 2013), Mada River, Nasarawa State (Tukura *et al*., 2012), river Orogodo in Agbor, Delta State (Issa *et al*., 2011), Kolo creek (Inengite *et al*., 2016), Andoni Flats (Ansa and Francis, 2007). Hence this study aimed at assessing the physico-chemical characteristics of sédiment from Sagbama creek, Bayelsa state, Nigeria.

Materials and Methods

Study Area

Sagbama is the head quarter of Sagbama local government area of Bayelsa state. Like other region of Bayelsa state, Sagbama Creek is of the tributary of River Nun and its close to Obuluru Camp, Gberude Camp and Torugbene. The climatic condition of the area is peculiar to what is observed in other region of the Niger Delta. The prevailing climatic condition of the rea have been previously described by Aghoghovwia *et al*. (2016), Ogamba *et al*. (2015a,b)

Sample Collection

A field sample collection was undertaken between June and July 2014 to Sagbama creek. Five sampling location was established including Tungbo, Tungabiri, Bolou, Agoro and Kabi. Triplicate sample of the sediment was collected using eckman grab. The samples were collected with aluminum foil and then transported to the laboratory for analysis in an ice box.

Physicochemical and heavy metal analysis

The sediment characteristics were analyzed using standard methodology. For instance pH was analyzed by the method described by Bates (1954). Calcium, magnesium, potassium and calcium were analyzed the method described by Nwakaudu et al. (2012). Organic carbon was determined by the method of described Osuji and Adesiyan (2005) as described by Akubugwo *et al.* (2007). Nitrates, nitrite, phosphates and sulphates were analyzed by the method described by Dewis and Freitas (1970). Nitrogen content was determined using the method described by Udoh and Ogunwale (1986). Conductivity was analyzed based on the method previously described by Aigberua et al. (2016)..

Statistical analysis

SPSS software was used to carry out the statistical analysis. A one-way analysis of variance was carried out at P = 0.05, and mean separation was carried out using Duncan multiple range test statistics.

Results and Discussion

The physicochemical characteristics of sediment from Sagbama creek is presented in Table 1. The concentrations ranged from 6.73 – 6.87 (pH), 423.53 – 2033.56 (µhmoscm^{-1}), 0.24 – 0.60mg/kg (nitrite), 2.43 – 4.57mg/kg (nitrate), 1.30 – 4.20mg/kg (sulphate), 2.43 – 5.10mg/kg (phosphate), 4.04 – 6.20mg/kg (calcium), 4.77 – 6.12mg/kg (magnesium), 4.21 – 8.62mg/kg (sodium), 1.65 – 2.80mg/kg (potassium), 3.35 – 5.50% total nitrogen), 6.73 – 10.73 % (organic carbon). The various parameters showed significant variation ($P<0.05$) among the various locations except for conductivity. The variation in the various locations could be differences in the anthropogenic activities in the water way during the study period. The various concentration observed in this study is higher than the physicochemical (including total nitrogen, phosphate, magnesium, sodium, potassium, total carbon) characteristics of sediment from Iko river (Etesin *et al*., 2013). Lower pH (during dry season) and conductivity at both seasons (wet and dry) have also been observed in sediment as reported by Etesin *et al*. (2013). Again higher

concentration of phosphate has been observed in sediment from Muda river in Nassarawa state. High nutrients (nitrite, nitrate, sulphate, phosphate, calcium, magnesium, potassium, and total nitrogen may be from runoff during precipitation. Tukura *et al*. (2012) have reported that in aquatic ecosystem organic matter is from primary production, nitrogen is from anthropogenic sources like

Table 1: Physicochemical properties of sediment from Sagbama creek

Parameters	Agoro	Bolou	Kabi	Tungbo	Tungabiri
pH	6.97^{b}	6.73^{a}	6.78^{a}	6.78^{a}	6.82^{ab}
Conductivity, µhmoscm^{-1}	2033.56^{a}	423.53^{a}	900.33^{a}	295.17^{a}	657.67^{a}
Nitrite, mg/kg	0.60^{b}	0.59^{b}	0.51^{b}	0.24^{a}	0.57^{b}
Nitrate, mg/kg	4.57^{bc}	3.81^{b}	4.81^{c}	2.43^{a}	3.97^{bc}
Sulphate, mg/kg	3.83^{bc}	2.41^{b}	4.20^{c}	1.30^{a}	3.22^{bc}
Phosphate, mg/kg	3.80^{ab}	3.35^{ab}	5.10^{b}	2.43^{a}	3.63^{bc}
Calcium, mg/kg	6.20^{c}	4.57^{ab}	6.26^{c}	4.04^{a}	4.93^{b}
Magnésium, mg/kg	5.15^{ab}	5 .24^{b}	4.77^{a}	5.21^{ab}	6.12^{a}
Sodium, mg/kg	4.70^{a}	5.57^{a}	4.21^{a}	8.67^{a}	6.42^{a}
Potassium, mg/kg	2.20^{b}	1.85^{a}	2.80^{c}	1.65^{a}	1.83^{a}
Total nitrogen, %	4.88^{b}	4.80^{b}	5.50^{c}	3.35^{a}	3.83^{a}
Organic carbon, %	9.75^{c}	8.72^{b}	10.73^{d}	6.73^{a}	8.10^{b}

Data is expressed as mean; Different superscript letters along the row indicate significance difference (P<0.05)

agricultural fields and domestic sewage containing nitrogenous compounds, phosphate is from dead organic matter from top layer which may have leached into the water sediment via runoff. Furthermore, the nature of the sediment and the organic matter composition determines the structure of before benthic community in such water (Adesuyi *et al*., 2016).

Conclusions

This study evaluated the physicochemical quality of sediment from Sagbama creek in Bayelsa state, Niger Delta region of Nigeria. The results found that the sediment of the creek is moderately rich in nutrient such as anion (including phosphate, sulphate and nitrate) and cation (calcium, magnesium, potassium and sodium). Slight high organic carbon suggests the effect of runoff in the water leading to nutrient enhancement of the sediment. The paraemters assessed is within the ranged that could enhance life for bethic organisms.

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