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Interrelationships of Some Physico-Chemical Parameters and the Water Quality of Kuramo Lagoon, Lagos, Southwest Nigeria

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ABSTRACT

The changes in physico-chemical parameters of Kuramo Lagoon, Lagos State, Nigeria were studied for a period of six months (February to July 2006). The physico-chemical parameters of water samples collected from seven stations in Kuramo Lagoon, Lagos State, Nigeria were studied for a period of six months (February to July 2006). Results showed that temperature, electrical conductivity, salinity, pH, dissolved oxygen, turbidity and transparency ranged between 29.00-33.02oC, 40-870 ms/cm, 0.1-0.4ppm, 7.27-11.05, 1.05-12.40mg/l, 20-78 and 0.5-2.1ft respectively. It was observed that the season has significant effects on the values of the physico-chemical parameters. The results of the physico-chemical parameters agreed with the results of some previous studies. Generally, the results shows that the Kuramo lagoon is polluted and is not suitable for human use, and may also affect fish culture. It is recommended that the agencies involved in the management of the river should put the right policies in place that will effectively enhance proper exploitation of the water resources. More research should be carried out on the physico-chemical parameters since this work only studied the water for six months. It is also recommended that flora and fauna of the lagoon be studied for further studies as they may have been adapted to the polluted aquatic environment, and such could be used as bio-indicator on aquatic pollution.

Keywords: *Include at least 4 keywords or phrases, must be separated by commas to distinguish them;*

INTRODUCTION

The increased industrial activities and the application of technology to explore and exploit natural resources have resulted in the release of various types and amount of industrial waste materials into the environment.

It is fairly well established that this industrial waste is a complex admixture of several classes of pollutants such as synthetic chemical of various types, hydrocarbons, as well as the classes referred to as trace metals (Van den Heever and Frey, 1994, Oyewo, 2000).

Holgate (1979) defined pollution as the production and or introduction by man of substances or energy into the environment resulting in deleterious effects on human health, other living organisms in the ecosystem and the impairment or interference with amenities and other legitimate uses of the environment while Edwards (1972) defined pollution as "the release of substances or energy into the environment by man in quantities that damage either his health or his resources".

The physico-chemical parameters of water give a good assessment about the quality of water (APHA, 1989). The immediate environment of fish is water and the living community and the assemblage of organisms which live together in a water body is termed the biotic community. The living and non-living units (biotic and abiotic) interact in exchange of energies in various forms therefore forming an ecosystem. The productivity of an aquatic environment has been found to be related to the water quality but Akpata *et al.* (1979) stated that physico-chemical conditions of water like pH, salinity and temperature affect the toxicity of pollutants or chemicals in the water body. Consequently, the need arises of not just stating and investigating the pollutants/chemicals that affect the aquatic environment but also the water quality parameters that affects the toxicity and availability of those harmful substances. Kuramo lagoon is a low brackish closed lagoon located in Victoria Island, south of Lagos State, Nigeria. The Kuramo water, 3°25'E to 3°28'E and 6°25'N to 6°27'N, (Edokpayi *et al.*, 2004) was transformed into the lagoon after the modification of the Kuramo creek that connected it to Five Cowrie creek. It is bounded in the North by Eko Hotel, Aqua Towers and other commercial and residential building in Victoria Island Extension, to the west by Adetokunbo Ademola Road, to the east by Atlantic Ocean and the south by the Bar beach/Kuramo resort including the local settlements. It has also been serving as a receiving basin for waste accompanying runoffs and water coming from the whole of Victoria Island and environs. The lagoon serves as a sink for the discharge of sewage and receives complex mixture of domestic and industrial waste. Water that drains off the streets of Lagos ends up in these bodies of water picks up pollutants as it runs through city streets, gutters and storm drains. The entire aquatic environment has been polluted or contaminated by various materials resulting in deteriorated water quality. The aim of this work was to investigate the physic-chemical parameters and water quality of Kuramo lagoon.

Materials and Method

Based on the peculiarities and features observed around the Kuramo Lagoon area, seven (7) sampling stations (SS) were established for the purpose of this study as shown in figure 1. Each sampling station was approximately 6 meters from the banks and 40 to 60 meters apart from each other. SS1 covers the Kuramo Beach resort area, SS2 is the Eko Hotel area where the domestic waste from their kitchen is emptied into the Lagoon, SS3 is close to the Aqua Towers, SS4 is a drain canal that connected Lagos Lagoon with Kuramo Lagoon, SS5 is located where we have commercial and residential buildings, SS 6 is towards the tail end where the Lagoon enters the Atlantic Ocean, and SS7 is at the middle of the water body and it is also the deepest part of the Kuramo Lagoon.

An open motorized wooden boat with a 75-horse power Yamaha outboard engine was used for sampling. The physico-chemical parameters of the Lagoon were measured *in-situ* in each sampling station according to standard methods (APHA, 1980) for six (6) months starting from February (dry season) to July (wet season). Temperature, pH dissolved oxygen (DO), turbidity, conductivity and transparency were measured *in-situ* in each sampling stations using HORIBA U-10 water quality checker. Turbidity was measured in terms of the "disappearance" of secchi disc. The Beckam electrodless metre (Model R55-3) was used to measure the salinity, pH was measured using ay pH meter.

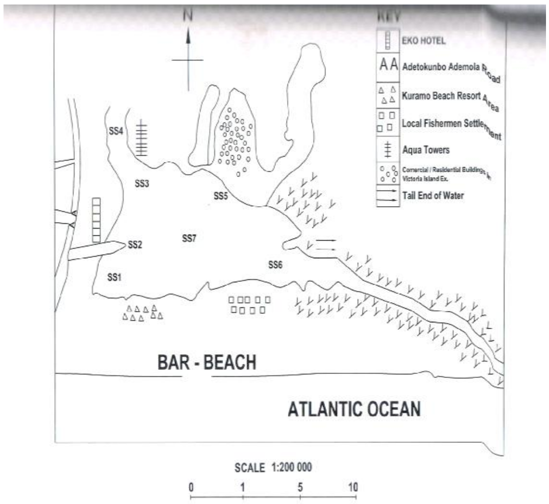

Figure1. *Sketch of Kuramo Lagoon and Environs*

Results and Discussion

The Kuramo Lagoon has been subjected to various contaminating materials capable of initiating the impairment of the water quality. This investigation has revealed the concentration of certain physico-chemical parameters of the water shown in Table 1.

The temperature values ranged from 29°C to 33.02°C. The maximum temperature (33.02°C) was recorded in the month of February while the minimum value (29°C) was recorded in July. The water temperature values of the Lagoon were believed to be influenced by the characteristics of the tropics, increased cloud cover conditions and reduction in solar insolation. Variation of temperature in water bodies attributed to sunlight was reported to occur particularly in estuaries due to their general shallowness, which exposed the water and materials to sunlight (Mulusky, 1974; Alabaster and Lloyd, 1980). Nwankwo and Akinsoji (1989) and Okogwu (2006) reported similar observations for temperature in the Lagos and Ologe Lagoons respectively.

Electrical conductivity which is strongly influenced by the concentration of dissolved constituents, ranged from 40 ms/cm to 870ms/cm. The lowest value of 40 ms/cm was recorded in a rainy month (July) and the highest (870 ms/cm) in a dry month (April) whereas Salinity values fluctuated between 0.10ppm (July) and 0.40ppm (March and April). Both conductivity and salinity are lowest during the rainy season when there is high rainfall and flow of rivers into estuaries is high, while the reverse is the case during the dry season (Egborge, 1994; Kozlowsky-Suzuki and Bozelli, 2004).

The pH of Kuramo Lagoon throughout the study was alkaline (7.25 – 11.05) with the highest value (11.05) recorded in July and lowest (7.25) recorded in March. This range could be considered as being higher than the acceptable range for a brackish water system. Nwankwo and Akinsoji (1992) also reported tidal creeks in south-western Nigeria to be alkaline. According to Olaniyan (1969), the alkaline pH may be due to the buffering effect of the sea and it is an indicator of environmental condition.

Dissolved oxygen levels were between 1.05mg/l in February and 12.40mg/l in July. The low values recorded during the dry season may be due to high temperature, while the high values in the wet season may be as a result of dissolved atmospheric oxygen from rain water and high wind current. Ewusie (1980) stated that the amount of oxygen in water is not as constant as in air but fluctuates markedly depending on depth, temperature, wind and amount of biological activity. Similar result for dissolved oxygen was reported by Okogwu (2006).

The turbidity of the Lagoon ranges from 20 to 78 with the maximum value recorded in July and the lowest value recorded in March. The higher value recorded during the wet season may be as a result of high rainfall and influx of freshwater, which increases suspended particulate matter.

Transparency values ranged from 0.5m in the dry months (February, March and April) to 2.1m recorded in July. Transparency was higher in the dry season than the wet season. This may be linked to the effect of rainfall. Ezra and Nwankwo (2001) are of the view that a low transparency in the Gubi Reservoir is as a result of silt particles brought in by floodwaters. Nwankwo and Akinsoji (1989) and Okogwu (2006) reported similar observations also for transparency in the Lagos and Ologe Lagoons respectively.

Table1. *Monthly variation of physico-chemical parameters of Kuramo Lagoon*

MONTH	FEB	MAR	APRI	MAY	JUN	JUL
TEMP(^{o}C)	30.05-33.02	29.70-31.30	29.97-31.12	29.03-30.85	29.02-30.34	29-30.30
COND (ms/cm)	638-825	737-850	658-870	90-808	50-790	40-685
SAL(ppm)	0.20-0.30	0.30-0.40	0.20-0.40	0.30-0.30	0.28-0.30	0.10-0.30
pH	7.43-9.58	7.27-9.09	7.71-9.03	8.50-10.17	8.40-10.06	9.09-11.05
DO(mgL^{-1})	1.05-11.03	2.81-6.32	5.24-8.82	5.14-9.32	7.25-11.20	8.01-12.40
TURB(ntu)	37-55	20-56	24-42	42-67	52-75	50-78
TRANS(m)	0.5-2.0	0.5-2.0	0.5-1.5	1.0-1.5	1.5-2.0	1.5-2.1

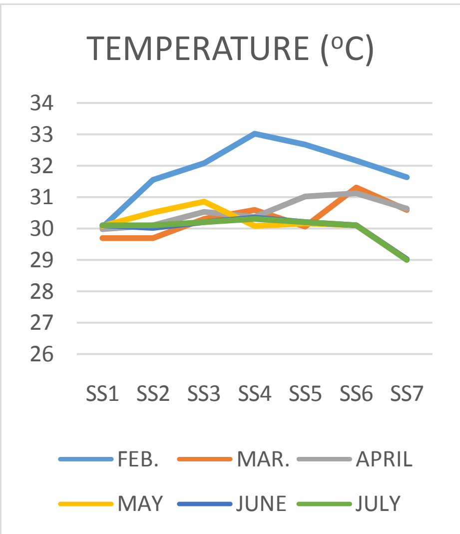

Figure2. *Temperature variations in all the sampling stations (SS) for six (6) months*

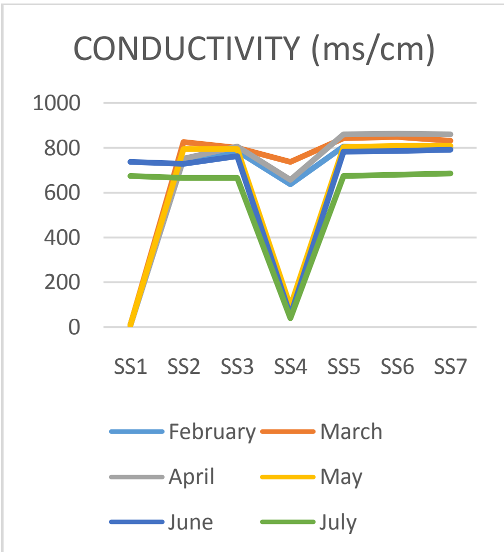

Figure3. *Conductivity variations in all the sampling stations (SS) for six (6) months*

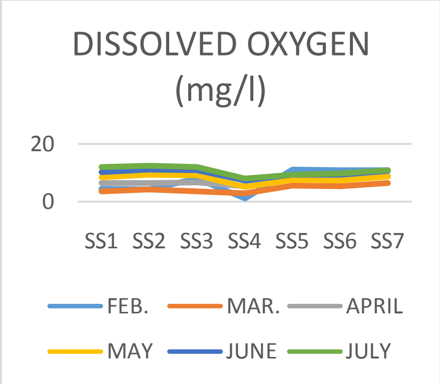

Figure4. *DO variations in all the sampling stations (SS) for six (6) months.*

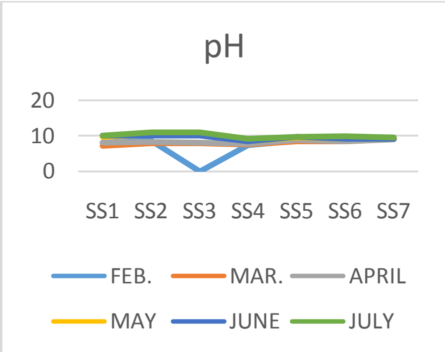

Figure5. *pH variations in all the sampling stations (SS) for six (6) months.*

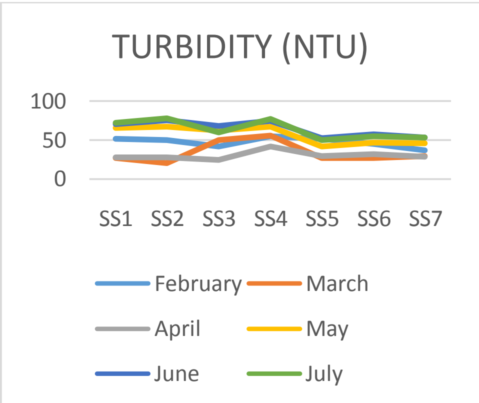

Figure6. *Turbidity variations in all the sampling stations (SS) for six (6) months.*

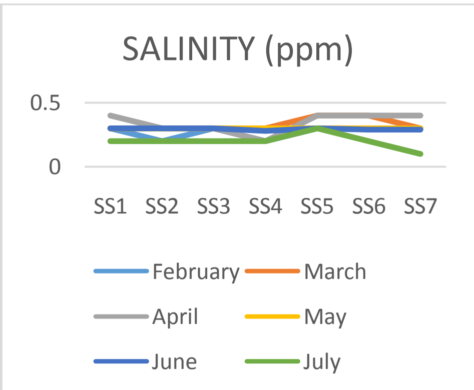

Figure7. *Salinity variations in all the sampling stations (SS) for six (6) months.*

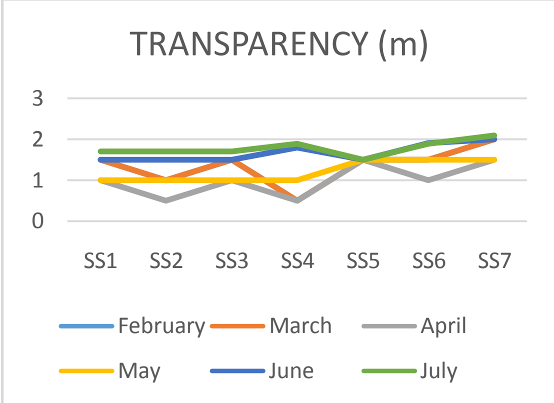

Figure8. *Transparency variations in all the sampling stations (SS) for six (6) months*

Conclusion and Recommendation

No other ecosystem *has* been as significantly *modified* by *human activity* as *have rivers* and streams. Human activities have significantly affected rivers and streams worldwide more than any other type of ecosystems.

According to Allan (1995) rivers and streams ecosystems throughout the world have been modified by human activities, possibly more than any other types of ecosystem. Various discomforting demands are being made on the environment due to industrialization from what has been revealed in recent times, strategies to solve the global food and economic problems must not be developed in isolation, but in full consideration of the web of interdependence that exist with other major problems facing mankind. From the findings, it was observed that the physico-chemical parameters of the lagoon vary with season and values indicated that the water quality is poor and not suitable for human use, and may also affect fish culture.

It is recommended that the agencies involved in the management of the river should put the right policies in place that will effectively enhance proper exploitation of the water resources. More research on the physico-chemical parameters of the lagoon should be carried out as this work only studied the water for six months. It is also recommended that flora and fauna of the lagoon be studied for further studies as they may have been adapted to the polluted aquatic environment, and such could be used as bio-indicator on aquatic pollution.

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