CORE
Metadata, citation and similar papers at core.ac.uk
Provided by Federal University of Agriculture, Abeokuta: FUNAAB Journal

ISSN:
Print - 2277 - 0593
Online - 2315 - 7461
© FUNAAB 2014

Journal of Natural Science, Engineering and Technology

THE EFFECT OF ENVIRONMENTAL WASTE DISCHARGE ON THE HYDROCHEMISTRY OF AGBOYI CREEK, LAGOS STATE

O. O. OLAWUSI-PETERS

Department of Fisheries and Aquaculture Technology,
Federal University of Technology, Akure.
***Corresponding author**: olaolaronke@yahoo.com **Tel**: +234

ABSTRACT

The natural aquatic systems are extensively contaminated with heavy metals released from domestic, industrial and other man-made activities and this may have devastating effects on the ecological balance of the recipient environment and a diversity of aquatic organisms. This study therefore, investigated the presence of heavy metals in relation to environmental waste discharge in Agboyi creek and other physico-chemical parameters in order to draw a good management plan for the water body. Water samples were collected from December 2005 to June 2007, within a depth of 30cm, at 9 points using sampling bottles (2L). Some parameters such as Temperature, Transparency, Total Dissolved Solid (TDS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Iron (Fe), Zinc (Zn), Cadmium (Cd), and Lead (Pb) were determined in triplicates as described by APHA (1998). The result revealed that temperature was fairly constant during the dry (28^{o}C ±0.01) and wet (29^{o}C±0.02) seasons, TDS range between 94.00 mgL^{-1} ±2.02 in dry season and 92.00±1.06 in wet season. Dissolved oxygen was 5.20±0.21 and 5.40±0.32 for dry and wet season respectively. Transparency was higher during the dry season (1.20m ± 0.07) than the wet season (1.10±0.03). All water quality parameters analyzed vary insignificantly (P>0.05). The concentration of Fe (2.35±0.04 and 3.90±0.09) and Cd (0.06±0.01 and 0.09±0.02) were higher during the dry season than the wet season respectively. Zinc is negatively correlated with lead (r = -0.6532) and Cadium (r = -0.1361). The physico-chemical status of Agboyi creek can be attributed to unregulated human activities whose resultant effect on the aquatic organisms may be devastating if not controlled.

Key words: Industrial waste, Hydrochemistry, Agboyi creek, man-made activities.

INTRODUCTION

Nigeria environment is depleted daily due to ignorance and lack of good comprehensive management plans. Over 200 industrial establishments are located in the coastal regions of Nigeria, Lagos alone habours 75% of the manufacturing industries which generate effluents which are discharged into the environment especially land and water. These effluents are complex and varied and include various classes of pollutants including organic, inorganic and microbial contaminants/pollutants which are known to cause various environmental problems (Oyewo *et al*,. 1999). Apart from liquid effluents, industrial wastes have also been shown to be sources of heavy metal contaminants in aquatic and terrestrial environments including ground water. In urban runoffs, metals such as copper, zinc, lead and cadmium have

been reported with high level concentration. These heavy metals may have gained access to the runoffs through natural and anthropogenic sources (Duzgoren-Aydin *et al.*, 2006; Florea and Busselberg, 2006). The continuous increase in heavy metal contamination of estuaries and coastal waters is a cause for concern as these metals have the ability to bio-accumulate in tissues of various biotas and may also affect the distribution and density of benthic organisms (Griggs et al., 1977). Since the physical and chemical parts of aquatic environment are very important factors affecting the biological life in the aquatic system, adequate knowledge of these in relations to aquatic life is necessary (Olawusi-Peters, 2008). This study will determine the presence of heavy metals in relation to industrial waste discharge in Agboyi creek and other physico -chemical parameters in order to draw a good management plan for the water body.

MATERIALS AND METHODS

Agboyi creek is on the latitude N6^{0}33/ and longitude E3^{0}24/, it is one of the adjoining creek to Lagos lagoon on the east. Therefore, it receives influx from both Lagos lagoon and River Ogun. In-addition, effluents from the immediate community and a canal that carries waste from slaughter houses, industries and domestic waste are channeled into the creek. Water samples were collected from December 2005 to June 2007, within a depth of 30cm, at 9 points using sampling bottles (2L). After collection, the water samples were tightly covered, labeled, and immediately kept in a vacuum thermoflask filled with crushed ice on board for preservation. All collected water samples were transported to the Chemistry department, University of Agriculture, Abeokuta and samples were kept in the refrigerator at 4 ^{0}C until needed. The period between sampling and analysis were however kept between the recommended times by standard methods APHA, (1998). Parameters tested were; pH, Total Dissolved Solids (TDS mg/l), Biochemical Oxygen Demand (BOD mg/l), Zinc (Zn), Iron (Fe), Lead (Pb), Cadmium (Cd). All the analysis was carried out in triplicates as described by APHA (1998). Water samples for the determination of dissolved oxygen (DO mg/l) were collected into narrow-mouthed glass bottles and fixed immediately on the field with Winkler's reagent. The samples collected were filled to the brim to prevent atmospheric oxygen from the surface of the water. Reagents to prevent loss of dissolved oxygen in the water were added immediately. Analysis was done immediately at the laboratory using method described by Boyd (1999). Physical parameters such as transparency and temperature were determined in-situ; mercury-in-glass thermometer (^{o}C) was used to determine the temperature while Secchi disc was used in determining transparency as described by Boyd (1999).

RESULT

The concentration of heavy metals determined in the water samples from Agboyi creek are shown in Table 1 and the monthly values of the water parameters for the period of study (Dec. 2005 – June 2007) are represented in figures 1-4. Lead (1.03±0.08 and 0.59±0.06), Iron (2.35 ± 0.04 and 3.90±0.09), Zinc (0.52±0.01 and 0.40±0.01) and Cadmium (0.06±0.01 and 0.09±0.02) were detected in the samples during the dry and wet season respectively with iron having the highest concentration (as shown in Fig. 4). Zinc was negatively correlated with both lead and iron. The high content of iron in the water samples may be because of the clayey material that forms the river bed which has been exposed as a result of sand mining activities that has occurred before the

study. Also, the high concentration recorded may be attributed to human activities such as the discharge of untreated sewage and uses of metals and industrial materials that contain metals. It has also been reported that iron occurs at high concentration in most Nigeria soils and this may find its way into the water body through erosion (Olowu et al., 2009). Olowu et. al., (2010), observed that the concentration of Zinc in water samples collected from Epe and Badagry lagoon are 0.5mg/L and 0.40mg/L respectively; an average values far less than the United States Environmental Protection Agency in Marine Water. Although, zinc is not a human carcinogen but excessive intake through contaminated food chain could lead to vomiting, dehydration, abdominal pain, lethargy and dizziness (ATSDR, 1994). This also agrees with Adeniyi *et al.,* (2007) that Agboyi creek near the lagoon with high surrounding human population density recorded high levels of heavy metals in sediments and water sample. Udousoro, (1997) also stated that the effluent from Ikeja industrial estate enters into Lagos lagoon near Agboyi creek, predominantly without any form of waste treatment, a contributing factor to the presence of heavy metals especially lead.

Fig 3 shows that the total dissolved solid obtained during the study period were low (31.75 mgL^{-1} ± 0.62), an indication that solids in this environment were more of suspended solids. The low total dissolved solid (31.75 mgL^{-1} ± 0.62), low dissolved oxygen content (3.50 mgL^{-1} ± 0.02) and low transparency (0.78m ± 0.01) recorded could be an indication of the deteriorating water quality and probably from the discharges of industrial and domestic wastes into the creek through influxes from the lagoon, river and other anthropogenic inputs. This agrees with the observation of Chukwu and Nwankwo, (2003) in the study of land based pollution on the hydrochemistry and macrobenthic community of Porto Novo creek, Lagos.

The biochemical oxygen demand obtained was high (25.56mgL^{-1}±0.14), this could be attributed to high level of organic substances from the effluent discharge into the lagoon; where the creek receives its influxes. Ajibola *et al.,* (2005) in the pollution studies of some water bodies in Lagos, Nigeria, observed that the lagoon showed the highest biochemical oxygen demand and chemical oxygen demand values. These high values were attributed to waste water from the canal, runoffs and domestic sewage from various parts of the city.

Temperature is an important ecological factor which influences distribution of organisms in the aquatic environment. The slight variation in the values of water temperature (28.00 – 27.00^{o}C) may be linked with the shallowness of the creek and regular tidal motions, which ensured the complete mixing of the water (see fig 3). This observation agrees with Ajao (1990); Oyewo (1998) and Ajani (2001) on the temperature of Lagos Lagoon. Ajao (1996) further stated that in the last decade, temperature at various sampling points in the lagoon were high and fluctuated only narrowly throughout the year. The lower temperature (25.00^{o}C) recorded in August and October, 2006 (as shown in Figure 2) influence the distribution of fishes within the creek. According to Olawusi-Peter (2010), 3480 fishes were collected during the wet season while 2,400 fishes were recorded during the dry season. This is an advantage because some species cannot tolerate increased warmth during critical parts of their life cycle and their abun-

dance can be expected to decline (Everett *et. al.*, 1995).

Table 1: Physico-Chemical parameters of Agboyi creek (Dec.2005 – June 2007)

Parameters	Dry Season			Wet Season		
	Max	Min	Std (±)	Max	Min	Std (±)
Temp oC	28.00	27.00	0.01	29.00	25.00	0.02
Transp. (m)	1.20	0.40	0.07	1.10	0.30	0.03
TDS	94.00	10.00	2.02	92.00	10.00	1.06
BOD	38.00	13.00	0.18	34.10	2.00	0.14
DO	5.20	1.75	0.21	5.40	1.40	0.32
Pb	1.03	0.10	0.08	0.59	0.02	0.06
Fe	2.35	0.10	0.04	3.90	0.07	0.09
Zn	0.52	0.01	0.01	0.40	0.09	0.01
Cd	0.06	0.01	0.01	0.09	0.01	0.02

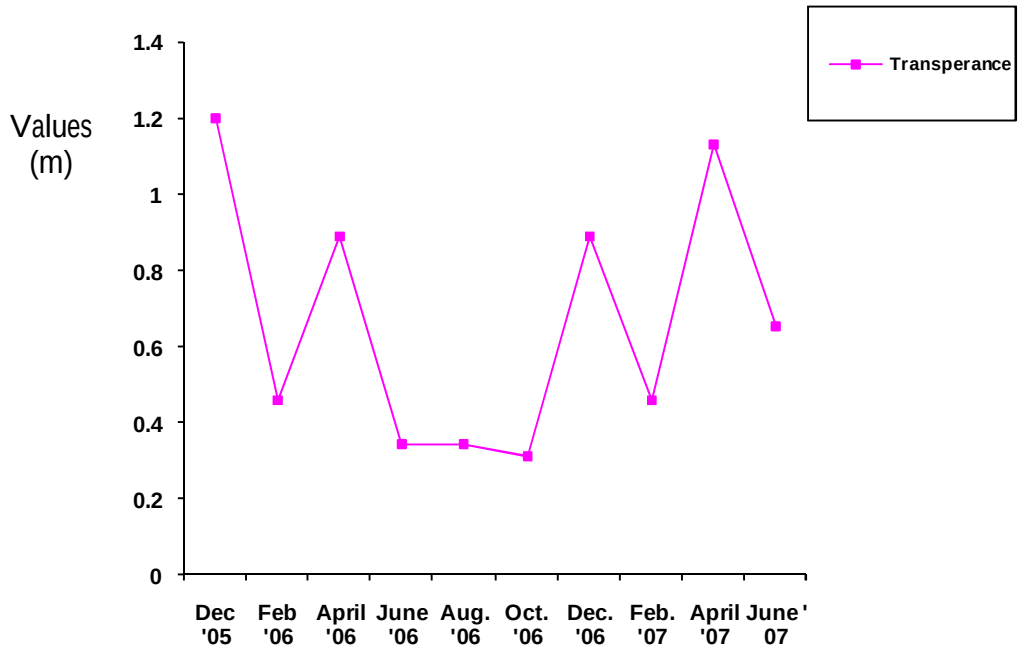

Fig. 1: Plot of Transparency values of Agboyi Creek (Dec. 2005 – June 2007)

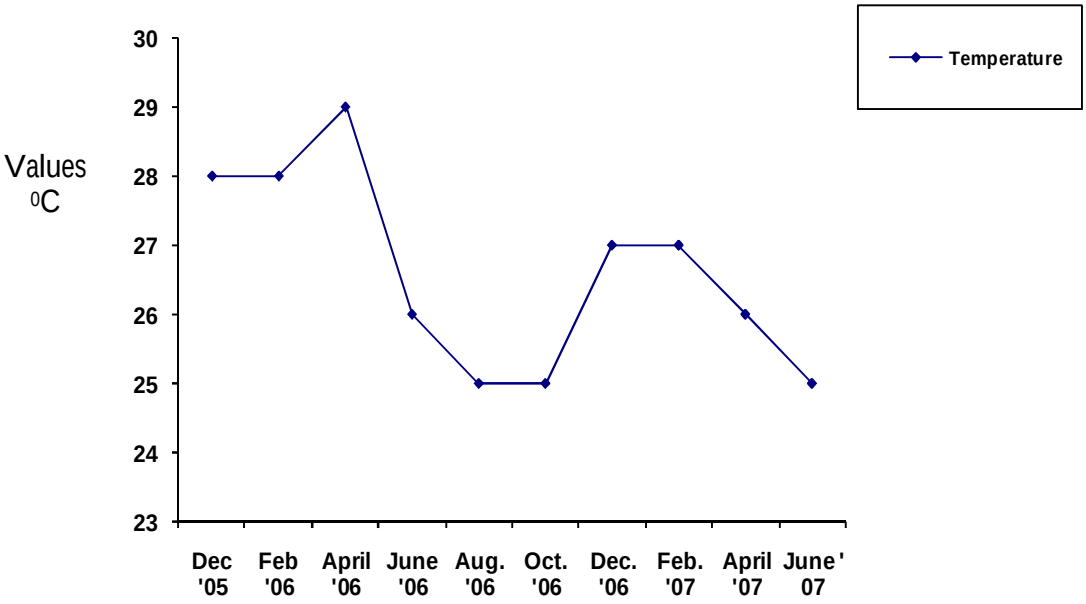

Fig. 2: Plot Temperature values of Agboyi Creek (Dec. 2005 – June 2007)

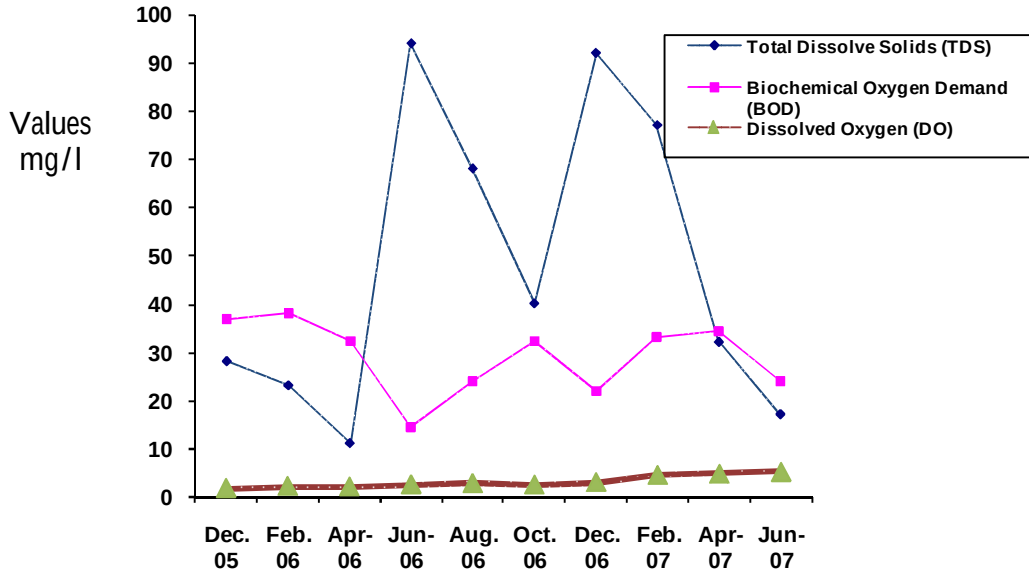

Fig. 3: Plot of TDS, BOD and DO values of Agboyi Creek (Dec. 2005 – June 2007)

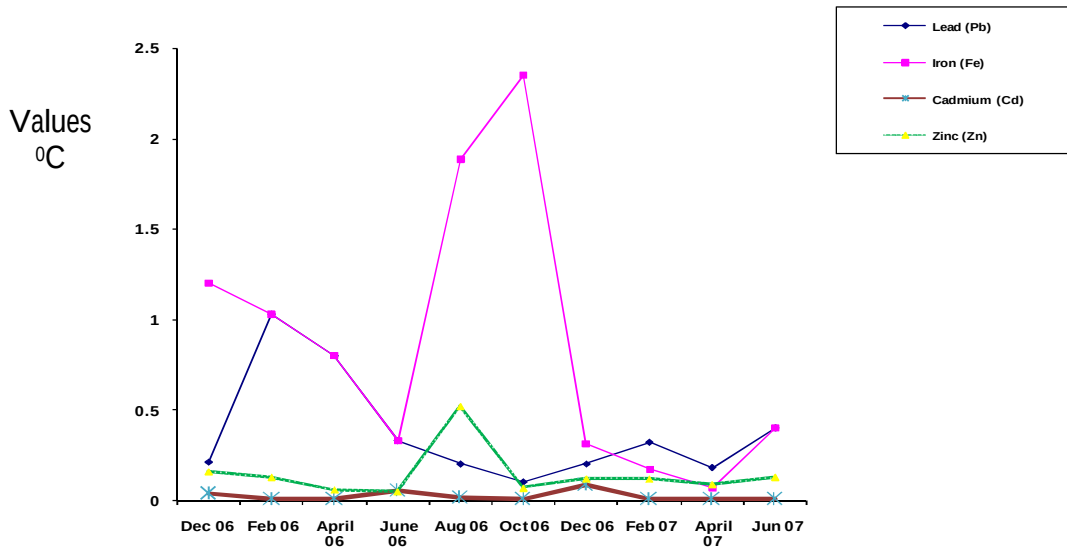

Fig. 4: Plot of Pb, Fe, Cd and Zn values of Agboyi creek (Dec. 2005 – June 2007)

REFERENCES

Adeniyi A. A., Yusuf K. A., Okedeyi O.O. 2007. Assessment of the exposure of two fish species to metals pollution in the Ogun river catchments Ketu, Lagos, Nigeria . Journal of Environmental Monitoring and Assessment (Online publication). Publisher: Springer Netherlands. 1-6p

Ajani E. K 2001. Effects of biotic and abiotic components of the habitat on fish productivity in Lagos Lagoon, Nigeria. A Ph. D thesis, University of Ibadan. Pp 8-71.

Ajao, E. A 1990. The influence of domestic and industrial effluents on population of sessile and benthic organisms in Lagos lagoon. Ph.D thesis, University of Ibadan. 413p.

Ajao, E. A 1996. Review of the state of pollution of the Lagos lagoon. NIOMR Tech. paper No. 106, ISSBN 978-2345-112, 20p.

Ajibola, V. O., Funtua I. I., Unuaworho, A. E. 2005. Pollution studies of some water bodies in Lagos, Nigeria. Caspain J. Env. Sci. Vol. 3 No. 1; pp. 49-54.

APHA (American Public Health Association) 1998. Standard methods for examination of water and waste water 13th ed. APHA, Washington, D.C. 87pp

ATSDR 1994. Toxicological profile for zinc. US Department of Health and Human Services, Public Health services, 205-88-0608.

Boyd, E. C. 1999. Water quality; An introduction. The Netherlands; Kluwer Academic Publishers Group. ISBN 0 -7923-7853-9

Chukwu, L. O., Nwankwo D. L 2003. The impacts of land based pollution on the hydrochemistry and macro-benthic community of a tropical West African creek. Diffuse

Pollution Conference, Dublin. ECSA 4; 6-67.

Everett, J.T., Okemwa, E., Regier, H.A., Troadec, J.P., Krovnin, A., Lluch-Belda, D. 1995**.** Fisheries. *In: The IPCC Second Assessment Report, Volume 2*: Scientific-Technical Analyses of Impacts, Adaptations, and Mitigation of Climate Change (Watson, R.T., M.C. Zinyowera, and R.H. Moss (eds.)]. Cambridge University Press, Cambridge and New York, 31 pp

Olawusi-Peters, O. O. 2008. Ecological evaluation of the effect of anthropogenic activities on sustainable fish production in Agboyi creek, Lagos State, Nigeria. A Ph.D thesis, University of Ibadan, pp 120-135

Olawusi-Peters, O. O. 2010. Physico-chemical parameters and fish richness in Agboyi Creek, Lagos State, Nigeria. *Applied Tropical. Agriculture*, Vol. 15 (1&2); 111-119

Olowu, R. A., Ayejuyo, O. O., Adewuyi, G. O., Adejoro, I. A., Denloye, A. A. B., Babatunde A. O., Ogundajo A. L. 2009. Determination of Heavy Metals in Fish Tissues, Water and Sediment from Epe and Badagry Lagoons, Lagos, Nigeria. E-Journal of Chemistry, 2010, **7(1),** 215-221. http://www.e-journals.net.

Oyewo, E. O. 1998. Industrial sources and Distribution of heavy metals in Lagos lagoon and their biological effects on Estuarine Animals. Ph.D Thesis, University of Lagos. 279pp.

Oyewo, E. O., Ajayi, T. O., Dublin - Green, G. O., Ajao, E. A., Awosika, L. F. 1999 Impact of pollution on Aquatic living Resources in Africa, Proceedings of the 5th session of the inter-African committee oceanography, sea and inland fisheries.

Udousoro, I. I. 1997. Chemical quality assessment of Ogun River and the environmental impact of the Lagos Lagoon. Ph.D thesis, University of Ibadan. 368p.

Ademoroti, C.M.A 1996a. Environmental Chemistry and Toxicology, Foludex Press Ltd., Ibadan pp. 171- 204.

Ademoroti, C.M.A 1996b. Standard Methods for water and effluents Analysis, Foludex press Ltd, pp. 111-120.

Duzgoren-Aydin, N.C., Wong, Z., Song A., Aydin X, Li You, M. 2006. Fate of heavy metal contamination in road dusts and gully sediments in Guangzhou, SE China: A chemical and mineralogical assessment.Human Ecol. Risk Assess. 12: 374-389.

Florea A, Busselberg D 2006. Occurrence, use and potential toxic effects of metal and metal compounds. Biometals 19: 419-427.

Forner, U.A., Wittman, G.W. 1993. Metal Pollution in Aquatic Environment, Springer Verlag: Berlin, 486 pp.

Griggs. G.B, Grimanis, A.P, Grimani, M.V. 1977. Bottom sediments in a polluted marine environment, Upper Saronikos Gulf, Greece. Environ. Geol. 2(2): 97-106.

(Manuscript received: 20th September, 2013; accepted: 26th January, 2015)