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# Impact of Waste Dump on the Sediment and Surface Water Quality of Otamiri River, Nigeria

**[*1]IWUOHA, G N; OSUJI L C; ONWUACHU; U I**

*a. Department Of Pure And Industrial Chemistry, University of Port Harcourt*
*b. Department of Chemistry, Nwafor Orizu Nsugbe, Anambra State College of Education*
*E-mail:* holygodson@yahoo.com

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**ABSTRACT:** Some Physico-Chemical Parameters of surface water and heavy metal level in sediments of Otamiri River at dump site along Aba road were evaluated and correlated with that of control unit upstream. The annual means values showed that acidity(mg/l), alkalinity(mg/l), pH, Electrical conductivity($Scm^{-1}$), $BOD_5$(mg/l), COD(mg/l), DO(mg/l), TSS(mg/l), Total Hardness(mg/l $CaCO_3$) are 2.00, 3.20, 6.45, 24.00, 11.30, 46.50,8.45, 80.85,4.05, 2.20,6.31,21.00,15.63, 41.72, 12.85, 4.53 and 0.035 respectively for the dumpsite, while 4.05, 2.20, 6.31, 21.00, 15.63, 41.72, 12.85, 41.05, 9.06 and 0.035 respectively for the control. The annual values for the heavy metal (mg/kg) indicates that the dumpsite's sediments are a lower than that of control. This shows that organic matter present at benthic region must have adsorbed most of the heavy metals at the surface of benthic region downstream. ©JASEM

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Indiscriminate refuse dumping and its management in Nigeria has become a major source of environmental concern. Some of these waste material especially near Rivers and Stream are transported in one (Chemical) form or another to nearby surface water and finally to the sediments. Certain heavy metals are common contaminant of serious concern in unmitigated leachates flows from such solid waste dumpsites and as such aquatic life may be impacted negatively. The choice of dumpsites in close proximity to rivers and streams are particularly becoming a major environmental concern that demands special attention. (Akhion bare, 2007).

This is essentially because most of these surfaces water bodies still serve as sources of water supply to many urban and rural communities down-stream and are expected to monitor a certain level of quality for their sustainable use by these population (Obeta, 2009: Bu *et al.,* 2010). Physico-chemical parameters of surface water and the levels of heavy metals in the sediment could be altered in a way that renders them useless for the various aquatic life it protest and more so may affect the portability of the surface water.

Information on sediment water quality and pollution sources are important for implementing sustainable water use management strategies (Zhou *et al.,* 2007: Sarkar *et al.,* 2007).

## MATERIALS AND METHODS

Study area: the study was conducted at the dumpsite near Aba road ($7^0$2E,$5^0$27N). Otamiri River originated from Egbu in Owerri north and flows through Nekede in Imo state and Ozuzu in Rivers state and finally joins Atlantic Ocean. The site for reservoir was chosen as Control because there was no waste dump in that area. Sampling and sample storage: for this study two sample stations were established. One at the dumpsite and the other at the control point upstream of the dumpsite, along the Otamiri river channel. Surface water was collected periodically during dry season (DS) and Raining Season (RS), on each occasion samples were taken from triplicate spots at each station to form one composite sample and the mean values noted for the season. Water samples were collected at 30cm below surface using 1 litre polythene bottle with screw caps, sediment samples were dried at about $105^0$C in an oven to constant weight and ground to powder and sieved through 0.5mm sieve to remove coarse materials. One gram of each sample were digested using 1:5:1 mixture of perchloric acid, concentrated $HNO_3$ and $H_2SO_4$ in a fume chamber at $80^0$c until a colourless liquid was obtained each digested sediment was analyzed for the listed heavy metals that their respective resonance line using atomic absorption spectrophotometer, percentage total organic carbon (%TOC) was determined by walkey

Corresponding author *E-mail:* holygodson@yahoo.com

and black method, statistical analysis using student's t-test were applied to study seasonal variation of Physico-chemical parameters and heavy metal with Ms-Excel 2007 and Data analysis software. Some of the result obtained is show below in table A and B.

**RESULT AND DISCUSSION**

The result in table 1 shows the level of heavy metal and percentage total organic carbon in sediments of otamiri at dumpsites and control point during dry and rainy season.

The mean percentage total organic carbon on the sediment at control point is %2.84 while its value at dumpsite is %2.95. There was no significant difference when student's t-test were applied for seasonal variation both at the dumpsite and control points, however, the values during dry season are slightly higher than the rainy season respectively.

Organic matters are reported to play significant role as a controlling factor to the heavy metal distribution in the surface of river sediments. These organic matters might be associated with the trace metals by adsorption to the particle surface and then combing with the trace metals in the solution. Enhance metal-particulate associations might also be attributed to the metal-organic complexes that are able to adsorb to the surfaces (Barry, 1982). The mean annual level of heavy metals (mg/kg) i.e. Cd, Pb, Ni, Zn, Cu, Fe and Cr at control point are 0.001, 0.49, 2.73, 6.91, 0.001, 256.35 and 0.001, respectively, while that of dumpsite are 0.001, 0.175, 0.057.0.053, 0.001, 25.88 and 0.001 respectively. The lower levels at dumpsite is associated with the enhance adsorption of metals into organic particulars at sub-sediment layer at the river bed. From the result of students't-test obtained there was no significant difference in the seasonal variation of heavy metals in the sediment at dumpsite and control points.

When the concentration of these heavy metals in the sediments at dumpsite and at control points, are compared to the Canadian, Dutch and German guild lines, we found out that the levels in both sites are below above (Canadian, Dutch and German) guidelines, Iwuoha *et al.,*(2012). Waste dumping did not affect the turbidity of surface water as then mean annual values of both sites are the same, i.e. 0.035NTU the mean annual of COD and TSS is higher at dumpsite. This is due to the increase in oxygen needed to convert more suspended organic solids to carbon IV oxide and water at dumpsite relative to control points.

This increase in oxygen demand reflects also the depletion of dissolved oxygen at dumpsite relative to the values as the control points, please see Table 2. The higher value of $BOD_5$ at control points as against the value at dumpsite suggest that the chemical environment at dumpsite is not favorable to microbial activity. Acidity and total hardness at control points have values that are twice that of the dumpsite, while alkalinity, pH, and Electrical conductivity values are higher at dumpsites. Application of student test shows no significant difference in the seasonal variation of Physico-chemical parameter at both sites.

*Conclusion And Recommendation:* From the results and discussion so far one can see that increased percentage total organic carbon at the refuse sight only helped to absorb some of the heavy metals by enhance metal-Particulate association, thereby helping the sediment to be cleaner with respect to heavy metals. Poor waste management in otamiri dumpsite like refuse burning etc, contributes to alteration of some important physico-chemical parameters that are essential for the good health of aquatic organism and air pollution. Ibe, (1999).

Refuse burning also increase the levels of phosphate and nitrate stream of dumpsite even though the impact alteration of physicochemical parameter is not significantly different and values are still below acceptable levels by World health organization (WHO) it is necessary that better and more efficient waste management is put in place to avoid the accumulated damage in the near future.

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**Table 1**. Heavy metal levels in sediments of Otamiri at Dumpsite and control points during dry and raining season

| Heavy Metal mg/Kg | Dumpsite | | Annual | Control site | | Annual |
|---|---|---|---|---|---|---|
| | Ds | Rs | Average | Ds | Rs | Average |
| Cd | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Pb | 0.09 | 0.06 | 0.075 | 0.52 | 0.46 | 0.49 |
| Ni | 0.06 | 0.053 | 0.057 | 2.79 | 2.66 | 2.73 |
| Zn | 0.57 | 0.48 | 0.053 | 7.51 | 6.30 | 2.91 |
| Cu | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Fe | 32.14 | 19.61 | 25.88 | 261.17 | 251.52 | 256.35 |
| Cr | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| %TOC | 3.01 | 2.98 | 2.95 | 2.87 | 2.81 | 2.84 |

**Table 2** Some physico chemical parameter of Otamiri surface water at dumpsite and (control) during dry and raining season

| Physico-chemical parameters | Dumpsite Ds | Rs | Annual average | Control Ds | Rs | Annual average |
|---|---|---|---|---|---|---|
| Acidity(mg/l) | 2.00 | 2.00 | 2.00 | 4.00 | 4.10 | 4.05 |
| Alkalinity(mg/l) | 3.30 | 3.10 | 3.20 | 2.00 | 2.40 | 2.20 |
| pH | 6.10 | 6.80 | 6.45 | 6.22 | 6.40 | 6.31 |
| E/conductivity($Scm^{-1}$) | 24.00 | 24.00 | 24.00 | 20 | 22.00 | 21.00 |
| $BOD_5$ (mg/l) | 9.6 | 13.80 | 11.30 | 12.8 | 18.45 | 15.63 |
| COD(mg/l) | 40 | 53 | 46.50 | 39.6 | 43.83 | 41.72 |
| DO(mg/l) | 5.60 | 11.30 | 8.45 | 9.60 | 16.10 | 12.85 |
| TSS(mg/l) | 80 | 81.70 | 80.85 | 40 | 42.10 | 41.05 |
| Total hardness (mg/l $CaCO_3$) | 4.0 | 5.05 | 4.53 | 8.0 | 10.12 | 9.06 |
| Turbidity(NTU) | 0.003 | 0.04 | 0.035 | 0.03 | 0.04 | 0.035 |

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