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Investigation of some physico-chemical parameters and determination of heavy metals in selected water samples from Itaogbolu area of Akure, Ondo State, Nigeria

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ABSTRACT

Water samples from selected hand-dug wells and Ona-river in Itaogbolu area of Akure North Local Government, Ondo State Nigeria were collected and physico-chemical parameters and heavy metals were determined using standard analytical procedure. For the physico-chemical analysis the results were obtained as follows: $_{P}$H gave the range (6.59 – 7.68), temperature was found between 21.1 to 27.1°C and conductivity gave the range 300 to 1150 μΩ. The chloride content of all the water samples was found between 78.1 to 1175 mg/l, total hardness gave range 128 to 298 mg/l, the highest was found in Oda river. Suphate level was also the highest in Ona River, which was found in the range 60 to 97 mg/l, Total Dissolved gave range 0.02 to 0.09 mg/l and alkalinity gave range 0.9 to 2.45 mg/. Cadmium was not detected at all in all the water samples, Zinc and iron were found in the ranges 0.7 to 5.5 and 0.1 to 5.3 mg/l respectively. While chromium, lead and copper were found between 0.1 to o.4, 0.1 to 0.2 and 0.1 to 0.4 mg/l respectively. Nickel was only detected in Ona river. These results were said to have agreed with the limits set by World Health Organization for drinking water.

Key words: Ona river, well water, physico-chemical parameters, heavy metals.

INTRODUCTION

The availability of portable water is an indispensable feature for preventing diseases and improving quality of life (Oluduro and Aderiye, 2007). Natural water contains some types of impurities whose nature and amount vary with source of water. Metals are introduced into aquatic system through several ways which includes weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including minning, processing and the use of metal based materials (Ipinmoroti and Oshodi, 1993, Adeyeye, 1994; Asaolu *et al.* 1997). Metals after entering the water may be precipitated, absorbed, suspended in water or may be taken up by fauna and flora and eventually, accumulated in marine organism that are consumed by human being (Asaolu *et al*; 1977).

The increased use of metal – based fertilizer in agricultural revolution of the government could result in continued rise in concentration of metal pollutions in fresh water reservoir due to the water run-off. Also faecal pollution of drinking water causes water-born diseases which has led to the death of millions of people both in cities and villages (Asaolu, 1998). The discharge of these wastes may affect the quality of such river or adversely and alter the chemical composition of the river (Adewoye, 1998).

Ona river and wells are major sources of water supply in Itaogbolu Area of Akure North Local Government, Ondo State Nigeria. Water from these

sources are used for drinking and other domestic applications. It is important that this present study provides information on the level of heavy metals and the physico-chemical parameters in these water sources examined as well as served as baseline data for future studies.

MATERIAL AND METHODS

Sample collection

Water samples were collected from nine different hand-dug wells and Ona river in Itaogbolu, Akure North Local Government Area of Ondo State, Nigeria. All samples were collected same day and kept in 2 litters rubber bottles (for onward transmission to the laboratory), which have been previously washed with detergent solution, rinsed with distilled water and leached with 10% HNO_3 and 1:1 HCl for 48 hours. The water bottles were again rinsed with distilled water and drained to dryness to avoid water contamination of the sample for analysis. The samples coded with number 1-10 were refrigerated prior to analysis while 5ml of concentrated HNO_3 was added per litre of water samples for heavy metals analysis.

Sample treatment

Samples were digested as describe elsewhere (Ademoroti, 1996; Ohor, 1973; AOAC, 1990).

The method used was described by A.O.A.C (2005). Heavy metals were determined in water samples using a Perkin Elmer model 306 Atomic absorption spectrophotometer.

Statistical analysis

All data generated were analyzed statistically (Steel and Torrie, 1960). Standard deviation, mean and coefficient of variation of all data generated from physico-chemical parameters were calculated.

RESULTS AND DISCUSSION

The physico-chemical parameters of the water samples from Ona river and the well under examination are presented in Table 1. The P^H was found in the range 6.59 to 7.68, which are within the maximum permissible level for standard drinking water (WHO, 1982). The temperature was also found in the range (21.1-27.1 C),the highest value was obtained from Ona river.

The conductivity value for the water samples was found in the range (300-1150 μΩ). The variation in conductivity values might be due to differences in concentration of minerals in different water samples. The highest value (1150μΩ) obtained in Ona river showed that minerals are highly concentrated in river than well water.

The water samples show a chloride level range (78.1-1775) mg/l with average of 130.4 + 32.9 mg/L. High chloride level could be due to leaching of the surrounding soil into the water bodies in form of sodium, potassium and calcium chloride (Ipinmoroti and Oshodi, 1993, Vogel, 1970).

The value for total hardness was found in the range (128-298) mg/l with an average of 167.4 + 50.3, the highest value of 298 mg/L was obtained in Ona river. This high be due to high concentration of calcium and magnesium salts of bicarbonate, silicate and sulphate in various well and the river (Salvato, 1982). One of the sources of sulphate could be as a result of washing away of sulphate based fertilizer into rivers and wells. The water samples showed sulphate range (60-97 mg/l) with an average 74.55+11.6mg/l. The highest level of sulphate (97 mg/l) was expected since sulphate salt are washed into river than well.

The values for TDS was found in the range (0.02-0.09) % with an average of 0.04+ 0.02%. The variation might be due to differences in the concentration of calcium silicate and other soluble salts leeched from the sounding soil into the water bodies (Vogel, 1970) Alkalinity level was found in the range (0.9-2.45) mg/l with an average of 1.52 + 0.51mg/l.

The concentration levels of heavy metals in the samples analyzed are shown in Table 2. Sample 1 (Oda river) has the highest concentration of zinc (92 mg/l) while in all water samples concentration range (0.7-5.5) mg/l of zinc was detected. Zinc when available at the acceptable limit is essential for the growth and well being of living

organisms including man (Masood, 1998) but could be toxic to such bodies when in high concentration.

Chromium was only detected in Ona river (0.4 mg/l), Market area ringed well (0.1 mg/L), Alamo street ringed well (0.2 mg/l) and Akomowa street ringed well (0.1 mg/l). This level could not have constituted any threat to the aquatic lives in the River.

Lead was not detected in any of the water samples except in Ona river (0.2 mg/l), market area ringed well (0.1mg/l) and market area unringed well (0.1mg/l). The concentration of lead in these water samples could be as a result dissolution of particulate lead released from can exhaust and it is eventually leached into these wells (Ademoroti, 1996).

Cadmium was not detected at all. Even where copper was detected, the concentration was found in the range (0.1-0.4) mg/l, with average 0.09 + 0.01 mg/l. The highest concentration of (0.4mg/l) in Ona river was due to the release of copper ions. into the river from copper suphate during agricultural practices (Russel, 1996).

Nickel was only detected in Ona river at concentration (0.1) mg/l but iron was found in all water samples at concentration range of (0.1-5.3) mg/l. The high value of iron is expected as the metal has been reported to be naturally abundant at high concentration in Nigeria soil (Ajayi, 1989).

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