Effects Of Industrial Effluent On Quality Of Well Water Within Asa Dam Industrial Estate, Ilorin Nigeria.

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ABSTRACT

The effects of industrial effluent on the quality of ground water (well) within an Industrial Estate was studied. The quality was assessed in terms of physicochemical parameters and bacteriological parameter. Three wells within the industrial were examined in the course of the study. Results obtained showed that the turbidity varied between 1.5 to 250 NTU and colour ranged from 211 to 2519 Pt- Co. The total, suspended and dissolved solids content were high. The conductivity ranged from 161 to 731 µs, while pH ranged from 6.9 to 7.3.Calcium and Magnesium ions as well as chloride ion content of the water were high. The dissolved oxygen content ranged from 6 to 9mg/l. Bacteriological indices showed that the well water were highly contaminated having high total bacterial counts (1200- 1375 cfu/ml). The well water showed presence of feacal coliform (*E. coli*) and had high coliform counts (1600 - >1800 MPN/100ml). It was observed that the wells were negatively affected by the effluent discharged within the industrial plant. [Nature and Science. 2009;7(1):39-43]. (ISSN: 1545-0740).

Keywords: Industrial effluent, well, Ground water, Bacterial count.

INTRODUCTION

The importance of water in the control of diseases had long been recognized (Hofkes, 1981; WHO, 1996). Water is a factor of production in virtually all enterprise, including agriculture, industry and the services sector (UNESCO, 2006). The importance of safe drinking water is underlined by the assertion that: "safe drinking water is the birthright of all humankind – as much a birthright as clean air" (TWAS, 2002). It also reported that the majority of the world's population, especially in most parts of Africa and Asia, does not have access to safe drinking water and that as much as 6 million children dies daily as result of waterborne diseases linked to scarcity of safe drinking water or sanitation (TWAS, 2002). WHO (2004) pointed out that diseases related to contamination of drinking-water constitute a major burden on human health: and that interventions to improve the quality of drinking-water provide significant benefits to health.

For most communities the most secure source of safe drinking water is pipe-borne water from municipal water treatment plants. Often, most of water treatment facilities do not deliver or fail to meet the water requirements of the served community; due to corruption, lack of maintenance or increased population. The scarcity of piped water has made communities to find alternative sources of water: ground water sources being a ready source. Wells are a common ground water source readily explored to meet community water requirement or make up the short fall.

Wells are categorized based on the nature of construction: open dug wells are generally considered the worst type of groundwater sources in terms of faecal contamination and bacteriological analysis. Dug wells with windlass or hand pumped or mechanically pumped well are generally regarded to be less prone to contamination (WHO, 2004). WHO (1997) assert that open or poorly covered well heads pose the commonest risk to well-water quality; the possibility of the water being contaminated is further increased by the use of inappropriate water-lifting devices by consumers. The commonest physical defects leading to faecal contamination of dug wells are associated with damage to, or lack of, a concrete plinth, and with breaks in the parapet wall and in the drainage channel (WHO, 1997). The most serious source of pollution of well water is contamination by human waste from latrines and septic tanks resulting in increased levels of microorganisms, including pathogens. Other likely sources of contamination include runoffs, agrochemicals such as pesticides and nitrates used on farm lands and industrial effluents. Contamination of well water due to under seepage has reported in the Niger Delta area of Nigeria (Ibe and Agbamu, 1999). Seepage from effluent bearing surface water would readily contaminate wells located close to the surface water.

Arising from the drive for industrialization, parts of Ilorin town are designated industrial estate/ area to accommodate the industries. One of such industrial estate has the course of River Asa running through its whole length. The river is flows through Ilorin town almost dividing it into two halves

(Olayemi, 1994). This makes it readily prone to abuse as effluent receptacle leading to contamination. Studies have shown that the River's water quality is affected by the discharge of the effluents (Eniola and Olayemi, 1999). This is consistent with the observation of Sangodoyin (1991) that effluents discharge alters the physical, chemical and biological nature of receiving water body. Wells are a vital and common source of water in Ilorin, some of these wells are located along the course of River Asa.

In this study, the effect of the discharge of effluent into river Asa on the quality of water of wells within the immediate catchment of the river was investigated. Water samples from wells within the industrial estate were subjected to physicochemical and bacteriological investigations to ascertain the effect of the effluent on the quality of the well water.

MATERIALS AND METHODS

Open dug well with concrete apron (plinth) around the well head were involved in the study. Water samples from the wells were collected into clean sterile 250ml sampling bottles as described by WHO (1997). The pH, colours (Pt-Co), turbidity, temperature, total Hardness, calcium hardness, magnesium hardness, calcium ion magnesium ion, chloride and conductivity were determined. The suspended, dissolved and total solid contents of the water were determined as described by ASTM (1985). The total heterotrophic bacteria counts were determined using the pour plate method (APHA, 1992). The coliform counts were determined as Most Probable Number (MPN) using the multiple tube fermentation test (APHA, 1992).

RESULTS

The physicochemical characteristics of the well water are shown on Table 1. The bacteriological characteristics are shown on Figure 1. Water from the wells were found to be close to neutral (pH 6.9 to 7.3) with high bacterial count (1200- 1375 cfu/ml). The coliform count was high (1600 - >1800 MPN/100ml) and faecal coliform (*E. coli*) was isolated. The variation in the total suspended and dissolved solids contents of the wells as well as the dissolved oxygen contents of the well water are shown on Figure 2.

Table 1. Physicochemical Characteristics of the water from Wells within Asa Dam Industrial Estate, Ilorin.

Parameters measured	W_1	W_2	W_3
pH	6.9	7.3	6.9
Colour (Pt-Co)	211	2519	240
Turbidity (N.T.U)	1.5	250	4.6
Temperature (^oC)	27	28	28
Total Hardness (mg/l)	149	153	37
Calcium Hardness (mg/l)	102	96	34
Magnesium Hardness (mg/l)	46	57	4
Calcium ion (mg/l)	410	383	135
Magnesium ion(mg/l)	37	46	3
Conductivity (us)	338	731	161
Chloride (mg/l)	155	12	2

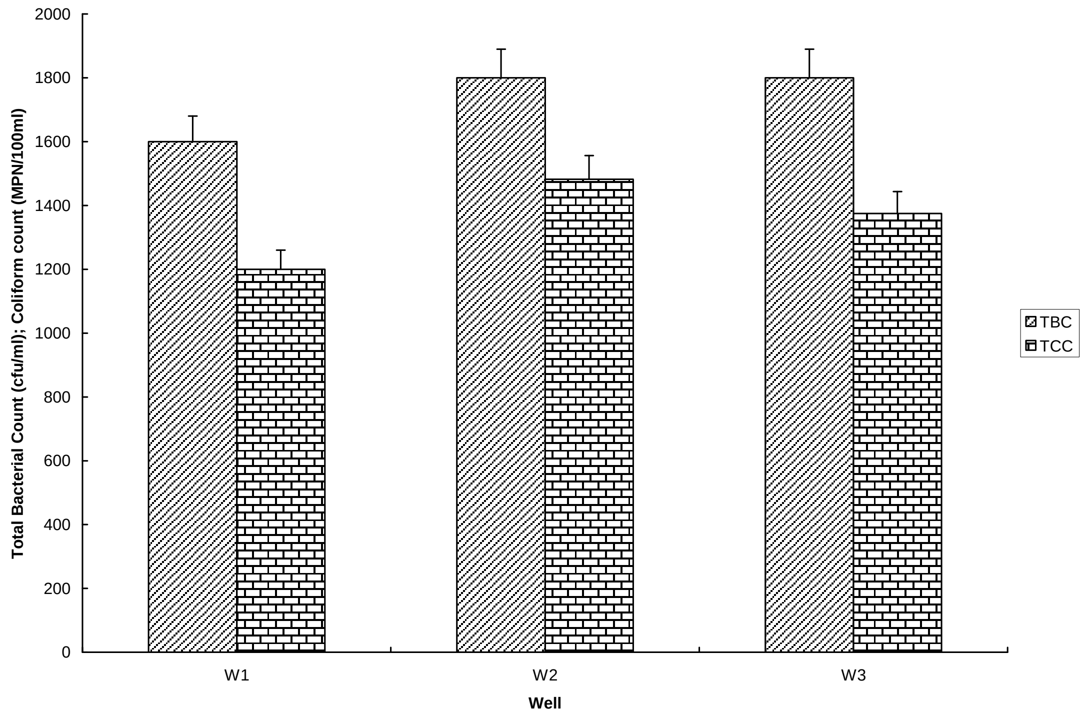

Figure 1: Bacteriological Characteristics of the Water from Wells within Asa Dam Industrial Estate, Ilorin.

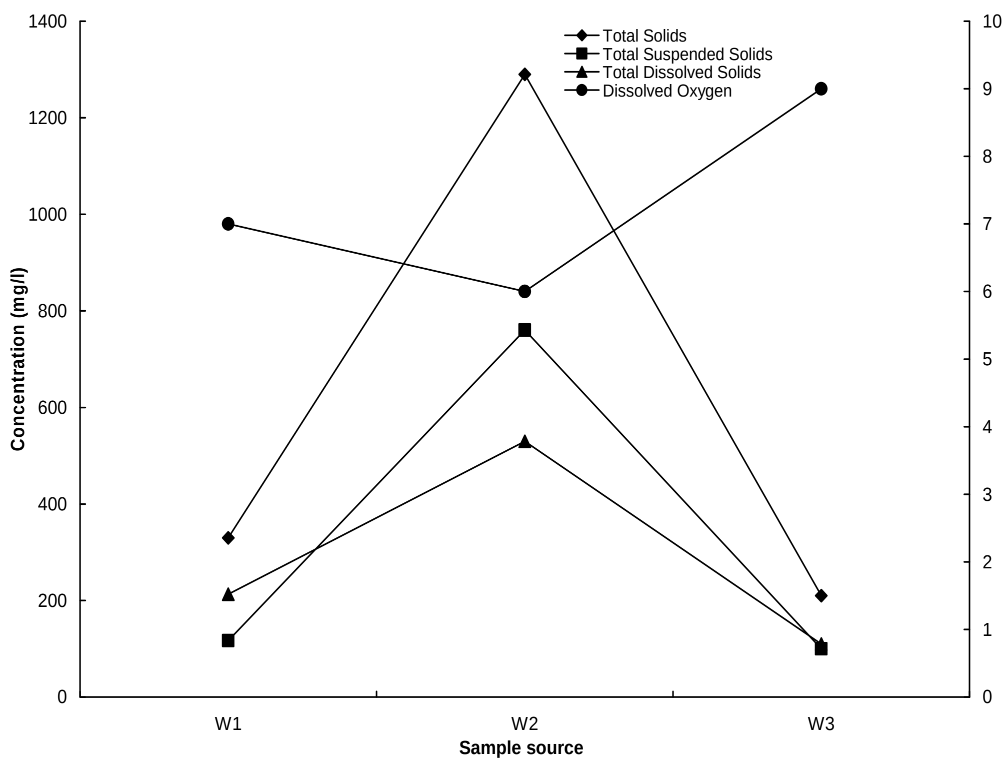

Figure 2. Variation in Total, Suspended and Dissolved Solids Contents of the Wells

Discussion

Water from the wells was observed to be coloured and turbid with the value ranges of 211- 2519 Pt-Co and 1.5 – 250mg/l respectively. Thin films of oil present on the water surface appear to make the value of the colour to be very high. The high turbidity value is as a result of increase in the type and concentration of the suspended matter released by the industry. The content of total solids, suspended and dissolved solids were also high. This is attributable to the industrial waste discharged into the surface water and suggests some of the content of the effluent have found their way into the ground water. Well water containing high total solids, total suspended solids and total dissolved solids are not fit for drinking, laundry work and livestock purpose. The high conductivity values suggest that the dissolved solids are mostly mineral salts. The high chloride is also suggestive of the use of large quantity of Chlorine or its associated compounds in activities within the industrial estate. The high bacterial count is suggestive of presence of organic matter (Gray, 1989, Olayemi, 1994). The values of dissolved oxygen obtained suggest that the water was not overtaxed by the quantity of degradable material in it and also that it was being well re-oxygenated.

Bacteriological speaking water from the wells fall short of the WHO (1997) recommended guideline standard for drinking water. It requires that water intended for drinking should not contain any pathogen or microorganisms indicative of faecal contamination. All the water samples examined contained feacal coliform (*E. coli*) and high population of heterotrophic bacteria, which is consisted with WHO (2004) report that open dug wells are contaminated, with levels of at least 100 faecal coliforms per 100 ml. This is not necessarily a result of the citing of the well along the river course but a reflection of the human activities taking place around the catchment of the wells. The unringed nature of the wells makes contamination by seepage from the soil more likely. The WHO (2004) recommends that wells are ringed and provided with an apron around the head to minimize contamination. The bacteriological quality of the wells requires that they be subjected to treatment if they are to be used for drinking and domestic purpose.

Conclusion

The results obtained showed that the water from the well were not fit for human consumption and their qualities were affected by the presence of the wells within the industrial estate and proximity to river that serves for disposal of industrial effluent.

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