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Iron Contamination of Shallow Wells in Makurdi Urban Area, Benue State, Nigeria

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ABSTRACT
This study examines iron contamination of well water within Makurdi urban area. Water samples were collected from 15 wells and analysed for iron concentration as it affect the quality of drinking water. The analyses were done according to standard method of water examination. The results of the analyses show that 40% of wells studied exhibit elevated iron concentrations above the WHO limits for drinking water. The presence of iron in shallow wells of the study area may be traced to the local environment of the wells. These include: the geology, dissolution of iron minerals from rocks and soil, precipitation and run off, construction and agricultural activities. Although iron concentrations at objectionable levels were noted in some of the shallow wells, most residents were found using them for drinking and other domestic purposes, since the public water supply is generally inadequate and in most cases inaccessible. To reduce health risk some form of treatment like filtering and or reverse osmosis may be applied before use.

Keywords: iron, contamination, shallow wells, ground water

1. INTRODUCTION
High concentration of iron in ground water are wildspread and some times underrated constraints on water supply. Iron can cause colour change in water which may lead to a consumer rejecting such water. This kind of water when used can cause staining of cloth, utensils, food and has bitter taste. All natural water contains some dissolved iron in traces. Iron is present in all rocks, soils and sand. Water which contains iron on exposure to air becomes reddish brown due to the ferric hydroxide. Long term consumption of drinking water with high iron concentration can lead to Liver Disease Morris,1952 ; Lee and stump, 1960;Okagbue, 1988; Ocheri 2010; Hen 1970. In Ghana 20 to 30 % of wells drilled for water supplies contain excessive iron concentration. Water from these wells have been rejected by consumers on the account of coloration effect (peligba etal, 1991).

In Nigeria, several studies have been carried out in urban areas on ground water contamination, with less emphasis on Iron (Adesiyun etal, 1980; Akinotola, Ayaode 1980; Iwugo, 1986; dada etal, 1988; Awalla, 2002; Akpabio etal, 2004; Egbulem, 2003; alhmed , 2003; Andrew,2000. Adebo and Adetoyinbo, 2009).

In this study, attempt is made to assess Iron concentration in shallow wells (hand- dug wells) in Makurdi urban area. Shallow wells have become very important source of water supply for drinking and domestic use, due to the general inadequacy and unreliability of pipe borne water.
The implication is family health is endangered, if water from these wells are used for drinking.

2. THE STUDY AREA
The study area is Makurdi town, the capital of Benue State. It lies between Lat.7^0 44^N and Long. $8^0 54^N$. It occupies a low- lying terrain of the flood Plain of lower Benue trough, averaging about 165m above sea level. The drainage system is dominated by the River Benue which traverses the town into Makurdi North and Makurdi South banks. The geology of Makurdi is of cretaceous sediments with well bedded sandstones. The water table is relatively high as such well tapping is successful between 3-7m dept. (kogbe etal 1978).

Makurdi town which started as a small river port in 1920 has grown to a population 0f 297,393 people (NPC, 2006).

3. MATERIALS AND METHODS
Water samples analysed for this study were collected from 15 shallow wells across the residential area of Makurdi town. The water samples were analysed for Iron concentrations as it effect quality of drinking water according to the standard method for water examination (APHA- AWWA- PCWF, 1995).

This is done in line with the WHO recommended guide value for drinking water. The iron concentrations in water were analysed using Atomic Absorption Spectrophotometric technique. (AAS) UNICAM solar 32 model was used. The method is based on the absorption of radiation by free atoms in vapour state. The atoms of element whose lamp or hemp is being absorbed at precisely the same wave length as that emitted by its high source. The amount of energy at the characteristic wave length absorbed by the flame is proportional to the concentration of the element in the sample over a limited concentration range.
The result of AAS analyses is shown in table 1 below.

4. RESULTS AND DISCUSSION
The results of analyses of Iron concentration shown in table 1 revealed that out of 15 wells studied 6 have high iron level above the WHO prescribed limit of 1.0mg/L for drinking water. This translates into 40% of the wells having iron

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concentrations above WHO guide limit. The wells are W2 (North bank) 1.13mg/L, W6 (wadata) 1.81mg/L, W7 (wadata) 1.53mg/L, W8 (wadata) 1.16mg/L, W12 (Ankp) 1.10mg/L and W13 (Ankpa) 1.33mg/L.

From the analyses the rest of the wells had iron concentrations below WHO guide limit for drinking water. The concentration level of iron was also noted to vary among the wells.

Table-1: Iron Concentration in urban ground water of Makurdi town, Benue State.[mg/l]

	Well Location	Well Code	Iron concentration (Mg/L)	WHO maximum Allowable Limit (Mg/L)
1	North Bank	w1	0.22	1.0
2		w2	1.13	1.0
3		w3	0.09	1.0
4		w4	0.05	1.0
5		w5	0.02	1.0
6	Wadata	w6	1.81	1.0
7		w7	1.53	1.0
8		w8	1.16	1.0
9		w9	0.41	1.0
10	Ankpa	w10	0.03	1.0
11		w11	0.11	1.0
12		w12	1.10	1.0
13	Wailomayo	w13	1.33	1.0
14		w14	0.45	1.0
15		w15	0.36	1.0

From Table-2, iron level in the study area ranged between 0.02mg/L- 1.8mg/L, with a mean value of 0.71mg/L. concentration.

Table-2: Descriptive Characteristics of Iron in Urban Ground Water of Makurdi Town, Benue State

Min. conc.	Max.conc.	Mean Concentrate
0.02mg/L	1.81mg/L	0.71mg/L

The presence of Iron in these wells can be attributed to the environment surrounding these wells. These include geology of the environment, precipitation and run off, infiltration, dissolution of iron mineral from rocks, soil and sands, Land use activities and use of iron sheet as well casings. Waters from these wells are generally of poor quality and therefore continuous ingestion of water from these sources may pose health implications. The distribution of iron in urban area of makurdi town is shown in fig-1.

5. CONCLUSION

The study has aptly shown that most shallow wells in makurdi urban area are contaminated with high Iron concentrations. This exposes consumers of water from these wells to high risk of Liver disease. Treatment may be required to reduce such health risk. Reverse osmosis, though expensive is effective in Iron treatment in water.

Urban water supply Agencies should make provision of good quality a top priority and not just making water available.

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