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Determination of Some Selected Ions in Borehole Water and Its Implication: A Case Study of Bolewa 'A' Ward in Potiskum Town of Yobe State

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Abstract

Sources of water used in Potiskum town directly used for domestic purposes without prior treatment. For the fact that this water is underground sometimes contaminated by dissolved mineral and other substances. Excess of some of such substances in drinking water may be injuries to human health or an economic menace to domestic utensils. The objective of this study is to analyse the different physicochemical parameters in selected water sources and compared to World Health Organisation Guideline Value (WHO GLV). The analysis of various parameters was carried out using Spectrophotometric DR 2000 HACH MACHE and Methods of Ademoroti,1996. The parameters determined are; P^H, elemental ions, Conductivity and Total dissolved solid. The result of physicochemical analysis revealed that all the ions present in samples were within the (WHO) limits; Iron, Fluorine, Magnesium, Chromium hexavalent. Except Manganese1.6 mg/l that has a high content of sample C. The research work bears some recommendations for society and suggested further research work.

Keywords

Mineral Elements, WHO GLV, Manganese, Untreated Water, Potiskum

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1. Introduction

Water is the most abundant liquid on Earth; it covers three-quarters of the earth surface. Human activities and settlements lied on the availability of water. In man, three-quarters of the body fluid are made of water, water forms the essential medium in which the chemical reaction of living cells proceed. Water is required as a medium for all metabolic reactions taking place in the cell (Doughari et al., 2007, Brock and Madigan, 1991). It transports the electrically charged ions that generate nerve signals and makes the human brain's functions possible. The World Health Organisation (WHO) and the United Nations Children Fund (UNICEF), Estimate that nearly 1.1 billion people lack access to improved water supplies. About 2.4 billion people do not have access to approved sanitation facilities, with the vast majority of these individuals living in the developing countries. To achieve the international development target the percentage of people without access to improved water supply or sanitation by the year 2015. An additional 1.6 billion people will require access to water supply, and 2.2 billion will require access to sanitation facilities by 2015, given the projected population increases (Brike and Bredro, 2003).The first concerted global effort to meet this target was the international drinking water supply and sanitation decade(1981-1990).Evaluations of water supply project during the water decade showed that non-sustainability of water supply project and facilities left the majority of the target population, without access to adequate water supplies or sanitation facilities (Livingstone, and McPherson, 1993. Diamant, 1992, Rotival, 1991).One global response to the non- sustainability of the water decade was to promote the

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evolution of participatory approaches. That began to involve the local population as 'participant' rather than beneficiaries as was previously the case (Carter, et al.; 1999 and 1993). These participatory program typical focused on transferring ownership, responsibility and management to the local level by creating village water communities. Requiring the community to contribute financially to the project involving women in the management scheme, training local technicians, ensuring local available of spare, part, e.t.c. This integrated into most current water supply development projects, yet sustainability rates of these projects continue to remain small.

Evaluation of these programs typically attributes the continue non-sustainability to maintain external control of development project due to institution rigidity and a reluctance to allow community participation. In the initial planning and design phases (Mangin1991, Macraejr & Whittington,1988).Studies have shown that sustainability of water supply projects improves when community are allowed to take a central role during all stages of the project, including design and planning(Williams 1998, Bah 1992 and Mangin 1991). As long as choice of technology decisions are made by an outside agency, community demands cannot be met, even such claims have been duly assessed (Narayan, 1995).Ideally the role of implementing agency during the planning and decision-making phase should be to provide interested communities with all relevant information such as the short- and long-term cost benefits trade-offs of several available alternatives.The technology to be offered must show benefits in terms of the community values, not just water quality improvements that the donors typically stress, but also convenience, time-saving, improved access, e.t.c (Carter 1993, Kendie 1992, Mu 1990). An informed choice of technology and level of service decision can then be made by the community, consolidating their role as the primary partner in a project. This local choice can be supported by the implementing agency by creating the needed supporting infrastructure (e.g. hygiene education, pump repair training, well maintenance and store keeping) for the community chosen type of technology. This type of substantial participation between the two involved partners has a higher potential of leading to a more sustainable water supply project (Narayan, 1995). It has been proved successful in most parts of Nigeria where community were asked to contribute ten percent 10% of the project execution cost.

Beyond improving the structure sustainability of the water supply infrastructure, is a more important issue of multiplying the impact that these improved facilities have on the general health of local populations. Research and experience continually confirm that a safe water supply is not sufficient and that adequate sanitation facilities and hygiene practice are essential to improving the health of the local population (Brikke and Bredro, 2003, Gasana;2002, Vanderslice and Brisco 1995,).Water quality from the source to the point of use (Trevett; 2004, Wright; 2004 Genthe; 1997). Studies have also shown that ready access to water and the resulting increase in the quality use for hygiene can have a greater impact on health than water quality improvements (Cairncross 2003, Nyong and Kanaroglou, 2001). In summary water supply development project need by external agents requires that the scope that beyond simply the provision of sustainable water supply infrastructure. To have the greatest beneficial on the health of the local population, it will require an integrated multidisciplinary approach that works in close collaboration with the local population. The aim of this study is to analyse the different physicochemical parameters in selected well water sources and compared with WHO GLV.

2. Experimental

The water sample was collected in three locations (A, B, C).The tap was allowed to run for five minutes before samples were collected into sterilized plastic bottle and transferred to the laboratory for analysis. The various parameters were determined using standard methods under standard laboratory conditions. Physical parameters; P^H, Temperature, Conductivity, total dissolved solid (TDS), total hardness as well as elemental analysis; Iron (Fe), Nitrate, Fluorine, Sulphate, Magnesium, Calcium, Manganese, Chloride, and Chromium hexavalent (Spectrophotometric DR 2000 HACH MACHE, and Ademoroti, 1996).

3. Results

Table 1. Showing Physico-chemical parameters of water samples from three boreholes in Bolewa: A ward Potiskum Town.

S/NO	Parameters	Sample Values			WHO GLV
		A	B	C	
1	Iron (Fe) (mg/l)	0.07	0.04	0.05	0.3
2	Nitrate (mg/l)	1.9	13.3	50	50
3	Fluorine (mg/l)	0.00	0.00	1.5	1.5
4	Sulphate (mg/l)	8.0	0.00	0.00	400
5	Magnesium (mg/l)	1.01	1.01	8.00	50
6	Calcium (mg/l)	0.00	1.6	1.01	250
7	Manganese (mg/l)	0.4	0.47	1.6	0.5
8	Chloride (mg/l)	0.1	6.9	0.6	250
9	Chromium hexavalent (mg/l)	0.00	0.00	0.00	0.05
10	P^H	6.5	6.5	6.5	6.5-8.5
11	Total hardness (mg/l mg)	0.243	0.7011	0.63	60.00
12	Total dissolve solid (mg/L)	23.9	89.9	32.5	100mg/l
13	Temperature (^{O}C)	23.7	24.3	24.6	----
14	Conductivity (mg/l)	47.9	79.9	65.2	----

LEGEND: WHO: World health organisation. GLV: Guideline value. A: Kara borehole.B: Tukur mamu borehole. C: Lamba shaibu borehole

4. Discussion

The result obtained for the analysis shows that for the physical parameter like conductivity no any report from the WHO (GLV) for its effect either above or below the standard. But from the three (3) samples the result for sample B has higher value when compared with the other values, as well as in TDS, for the colour and temperature both are within the WHO standard value. All chemical parameters obtained are within the WHO except manganese for sample C Lamba Shayibu borehole water which may have an effect on human health, when accumulating beyond tolerable concentration in living tissue. But below the GLV it causes Anaemia and bone changes in children. P^H value is an important overall measure of water quality, P^H can alter corrosivity and solubility of contaminants. Low P^H will cause pitting of pipes and fixtures or metallic taste. This may indicate that metal are being dissolved. At high $P^{H,}$ the water will have a slippery feel or soda taste. Total dissolved solids (TDS) dissolved minerals like iron of manganese. High TDS also can indicate hardness (scaly deposits) or cause staining, or a salty, bitter taste. Chlorides were known to cause Salty or brackish taste, corrosive, blackens and pits stainless steel. Iron Metallic taste, this discoloured beverages, yellowish stains and stains laundry. Manganese on the order hand causes Black specks on fixtures, bitter taste. Sulphate have a Bitter, medicinal taste and sometimes corrosive. Fluorides result in mottling of teeth, and Process also used bones. Nitrates Soil by-product of agricultural caused Methemoglobinemia known as a blue baby disease, its affect fertilization; human and animal, a threat to children and adults (WHO, 2011).

5. Conclusion

The samples collected were analysed for physicochemical parameters, the results obtained are in conformity with word health organization (WHO) Guideline value except Manganese, which was slightly higher in all the samples. Manganese was common metallic element found in the earth crust, water percolation through soil and rock can dissolve minerals containing manganese and hold them in solution. In deep wells were oxygen content was low, the manganese bearing water was clear and colourless, i.e., the manganese in dissolve state. Water from the tap may be clear, but when exposed to air, manganese oxidized and change from colourless to coloured water, some shallow wells too contains manganese (black tint). These precipitates or sediments may be severe enough to cause browning of teeth and also block water pipes.

However, manganese will cause a brownish black stain and when soaps and detergents are used, they do not remove these stains and use of chlorine bleach and alkali builders (such as sodium and carbonate) may intensify the stains. A problem that frequently results from manganese in water was manganese bacteria. From manganese non-pathogenic bacteria occur in some surface water. The bacteria feed on manganese in the water. These bacteria are responsible for these changes of colour to black-brown (manganese). Although manganese presence in drinking water not considered health hazards according to the guideline standard for drinking quality water by WHO. The government should try and introduce methods for treating water containing the basic elements, using any of these standard methods: Ion-exchange softener treatment. Oxidizing filter treatment, using phosphate compounds, Aeration, Pressure type followed by filtration treatments, Chemical oxidization followed by filtration treatment. All these above methods depend on many factors including the concentrations and form of manganese in the water, if the manganese bacteria are present and how much water you need to treat. All these above characteristics are exhibited by ion the only different is the colour. Finally, there is a need for extensive research work with a multiple approaches off analysis, especially for microbiological examination.

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