EFFECT OF SOAK-AWAY ON GROUND WATER QUALITIES IN ONITSHA NORTH LOCAL GOVERNMENT AREA OF ANAMBRA STATE

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ABSTRACT
Soak-away are increasingly in use in the country due to absence of proper waste water sewage system. The effluent from soak – away may contribute greatly to ground water pollution. This study was undertaken to test some physical, chemical and biological characteristics of ground water (borehole) at random selected houses at Onitsha North Local Government Area of Anambra State. To access the quality of ground water, each parameter tested for was compared with the result obtained from testing for each parameter in the sample. Most of the parameter tested for where within the World Health Organization (WHO) standard except for the total viable bacteria of the samples. The conclusion will then show if the ground water in Onitsha is fit for domestic and drinking purposes and to know if it still need treatment to minimize the concentration especially the acidity and total coliform, if the need be. Suitable recommendation will be made at the end to improve the quality of ground water at Onitsha North Local Government Area of Anambra State mainly for Ozomagala, D.M.G.S, Oboli-lane, Egbuna and Anionwu and if it is suitable for drinking and domestic purposes.

Keywords: Soak-away, Properties, Ground Water, Parameter.

1.0 INTRODUCTION

Water is very essential to man, is of great necessity, since it is used for several purposes to sustain human life, animals and plants. Today water is being polluted by different people in different ways even though efforts are being made to prevent pollution. This stands as a serious problem facing man all over the world. Water pollution could be said to be the contamination of water by introducing toxic substances or energy directly or indirectly into water bodies. It could be harmful to human, plant and animal life and interfered with amenities and other legitimate uses of environment, ground water causes can be the recharge source for most water bodies and supply source for domestic and industrial purposes hence care must be taken to protect it from contamination. Ground water is one of the basic sources of water, it plays an essential role in the maintenance of system by providing as source of recharge to wet the design and usage of soak-away is the potential of polluting the ground water, hence effect of soak-away on the quality of ground water is a major problem. The pollution of ground supplies is a problem and particularly serve for communities on low-lying island. Problem with septic system are worse when communities that rely on subsurface disposal system also depend on private well, for drinking water. Some problem like water-borne diseases (cholera, typhoid, internal heimith and diarrhea), transmission of pathogens, gastro intestinal disorder, blue body syndrome e.t.c) are obtained as a result of groundnut pollution by soak-away (septic tank) and by the end of the day it will cause depletion of resources inform of money to treat these diseases which could have been avoided.

2.0 LITERATURE REVIEW

Water in nature seems to be abundant but only few of it is available for use. If the content of water does not affect our body metabolism when we drink it, the water is said to be pure, ground water supplies have mineral content than surface water in the same area. This is as a result of longer exposure to rock formation. The quality of ground water is seldom comparable to canal supplies and is generally bad when the soil depth is increased.

In our society today, effect of soak-away on ground water quality has become a very big especially in the urban areas. These problems are when the community depends on private well or bore hole for drinking water. Hence the need to purify water and improve its quality becomes very much pronounced with time as many sources of water are getting polluted from commercial effluent discharged and during construction (Foster, 1990).

2.1 GROUND WATER

Ground water could be said to be water that flows or stays under the surface of the land or the water that occupies the pores or crevices of soil or rock. In tropical region, ground water is of great importance, also in the humid parts of the

tropics, ground water plays an important role. Since much surface water is polluted. As a result of surface water pollution is several parts of the country, most domestic supply agriculture works and industries depend on ground water resource. Groundwater that is fresh to be used for water supply may contain up to 1500 milligram per liter total dissolved, salts. Groundwater discharges into streams and rivers.

The quality of groundwater available for use as water supply source on a sustainable basis without damaging the environment is much less, hence the importance to protect this source from pollution is important.

Table 1: W.H.O Standard for Drinking Water

Parameters for water Quality	**WHO Standard**
Temperature	20-30
PH	6.5-8.5
Conductivity (us/cm)	100
TDS(mg/c)	250
Colour pt-co	15
TSS(mg/c)	50
Appearance	Clear
Taste	Tasteless
Turbidity(NTU)	50
Odour	Odourless
Nitrate(mg/l)	40
Sulphate (mg/l)	250
Iron (mh/l)	0.3

Sources: Guidelines for drinking water quality (WHO) Geneva (1998)

2.1 Collections of Sample for Physiochemical

The sampling bottles were washed and rinsed thoroughly to prevent contamination. Before the sample are collected from the sources.

Table 2: The bottle were allowed to dry and then labeled.

Samples	**Streets**
A-	Ozomagala
B-	D.M.G.S
C-	Obili-lane
D-	Egbuna
E-	Anionwu

Source: Clydsester Constant (2003)

Also, the borehole location, distance between borehole and soak away and the depth of the borehole was collected.

3.0 METHOD OF PHYSIOCHEMICAL ANALYSIS

TEMPERATURE

For temperature measurements, a mercury thermometer (0^0 – 100^0c) was used to read the temperature of the sample and was left some time so as to obtain equilibrium. All temperature was fixed at 25^0c in laboratory.

PH (POTENTIAL OF HYDROGEN)

The pH measurements of the samples were taken in the laboratory with an already standardized pH meter with glass electrode. All samples were adjusted to a constant temperature before the pH was measured.

TOTAL DISSOLVED SOLIDS

100_{ml} of the sample was used and the evaporating dish was let to cool in desiccators before the weighing is done. The filtered sample was allowed to evaporate and dried in weighing dish at 105^0c to constant weight. The increase in weight over the empty dish represents the dissolved solids content. The result was expressed in milligrams per liter.

TURBIDITY

The turbidity of the water samples was measured in the laboratory using the LABTECH DIGITAL TURBIDITY METER. After the instrument has been standardized using prepared standards the values was read out directly in nephelometer units (NTU).

MANGANESE

The wavelength and program number was selected and entered respectively. The blank sample (de-ionized water) in a 25_{ml} cell bottle was put into the light cell to zero the spectrophotometer.

After the manganese reagent (per sulphate) was added to the sample and the sample was left for 20mins and was put into the instrument and the reading taken.

NITRATE

A hatch DR/2010 spectro-photometer was used on this analysis. The spectrophotometer was switched on and the wavelength for nitrate was selected using the knob and the program number for the wavelength was entered. Afterward, the ENTER was button was pressed and the system allowed to boot. The de-ionized water was filled into the 25_{ml} cell bottle as the blank sample and other samples to be analyzed filled into the other cell bottles. The blank was placed in the light cell and the zero buttons on the instrument was pressed so as to zero the spectrometer. After zeroing the blank sample was removed and the nitrate reagent power pillow was now added to the sample to be analyzed and shaken properly for 1min. The sample was left for 5mins for amber colar to develop indicating the presence of nitrate nitrogen. After the reaction, the sample was put into the light cell and the READ button on the instrument was pressed to give the value for nitrate. The routine operation continues by selecting the wavelength for each of the parameters to be analyzed and entering the program number. The de-ionized water was used as blank samples unless for some parameters like sulphate, iron, phosphate e.t.c where their individual samples were used as blkank samples and some pillow reagents like sulphate, ferrover powder pillow, Rhosphet powder e.t.c respectively were added to the individual sample to be analyzed. The stuff + timer button was pressed before zeroing.

3.1 Bacteriological Test

10_{ml} of the (membrane enrichment tripol broth) was collected and poured into a round bottom flask. 100_{ml} of distilled water was poured into the flask and shaken properly to dilute the media. The tip of the flask was covered with a cotton wool and then put into the autoclave containing water to sterilize until repair come out from the tip of the autoclave. Then the autoclave was set 121^0c for 15mins and the media was brought out and put into the freezer to cool.

3.2 Collection of Samples

For this, a sterilized pirex sampling bottle placed in the cooler containing a coolant was taken to the place of sample collection. At the point of collection, the tip of the tap was sterilized by applying methylated spirit and then ignited with a lighter to prevent bacterial. The tap was opened and water was allowed to flow for some time and then pressure of the water was reduced and the sample was collected with the sterilized pirex sampling bottle and put into a cooler.

3.3. Laboratory Test

The table for the test was sterilized by pairing the methylated spirit on it and then cleaned up with a cotton wool. The media and every other material used to carry out the test were brought and placed on the table. A pad soaked with the media was placed in a glass cell and then covered. The suction pump was placed in a glass cell and then covered. The section pump was fixed and the filter membrane was place on the tip of the water. 100_{ml} of the water sample to be tested

was poured in the funnel and the suction pump was on to the suck the water. After filtering the water the funnel was removed and the filter membrane collected with a forceps and was placed on the pad inside down in the incubator at a temperature of 37^0c for 4 hours. After 4 hours, the temperature was changed to 48^0c for about (16-18) hours and then the result was checked.

4.0 RESULTS AND ANALYSIS

The location of boreholes, distance between soak – away and boreholes and the depths of the boreholes are presented in table

4.1. The distance represent the distance between the boreholes and soak – away.

Table 3: Boreholes depths and distance from soak – away.

Samples	Location of borehole	Distance (m)	Depth of borehole(m)
A	Ozomagala	10.2	56
B	D.M.G.S	7.0	81
C	Oboli Lane	11.1	73
D	Egbuna	8.0	94
E	Anionwu	9.2	80

The result of the physical, chemical and bacteriological analysis of the ground water sample A to E, collected from different locations in Onitsha North Local Government Area of Anambra State is shown in Table 3 and sample parameters are in table 4.

Table 4: Sample Parameters

S/N	PARAMETER	SPA	SPB	SPC	SPD	SPE	FEPA STD	WHO STD
1	Total solid mg/l	19.00	35.012	67.01	14.142	32.027	250	500
2	Total dissolved solid mg/l	120.20	117.0	47.271	97.271	80.352	200	250
3	Total suspended solid mg/l	14.100	40.273	16.792	43.37	32.49		50
4	Acidity	40.00	41.00	39.00	34.127	38.321	200	-
5	Alkalinity	60.132	25.091	79.049	32.142	80.42	-	30-500
6	Dissolved oxygen mg/l	2.951	0.421	1.793	3.4347	7.341	-	-
7	Chemical oxygen demand	35.195	50.00	17.892	14.170	14.15	-	-
8	Biochemical oxygen demand	29.087	28.17	35.00	193.00	126.00	-	250
9	Chloride mg/l	30.017	35.198	50.00	67.00	76.121	-	5
10	Phosphate mg/l	2.946	2.72	3.473	1.097	2.498	5	50
11	Nitrate mg/l	0.392	0.421	1.234	0.379	2.731	20	20
12	Sulphate	45.10	32.129	50.073	67.934	80.148	-	250
13	Total hardness M_g Ca CO_3/l	6.100	6.7	9.342	4.321	5.40	70	200
14	pH	6.5	6.0	6.5	6.0	6.0	6.0-9.0	6.5-8.5

4.1 Nutrients

The principal nutrient, nitrogen and phosphorus are potential indicator of ground – water, septic – tank contaminated by effluents.

The sampling in the study was focused to determine concentration of the principal species of nitrogen (organic and orthophosphate). From the result, concentration for these water – quality constitution were not noticeably elevated in the sample.

4.2 Major in Organic Constitutions

Sample collected during the study did not exhibit concentration of any water – quality constituents that decisively indicated effects of septic – tank effluent. Concentrations of ions such as sulphate, calcium, chloride and sodium, which are commonly used as indicators of sewage, contaminated ground water.

4.3 Bacteria

Both faecal coil form and faecal streptococci bacteria are present in the gastro intestinal tract of humans and other warm blooded animals.

The presence of the bacteria in natural water indicates degradation by human or animal waste may be related to septic tank – waste though bacteriology analysis was not done on the sample because of some feasibility and logistic reasons, it can be said that most of the effect of contamination of ground water are biological since the physiological properties are approximately the same with those of the uncontaminated water; majority being manifested by the rate Onitsha people contact water borne diseases caused by contaminated water.

4.4 Total Solid and Dissolved Solids

The WHO standard for desirable limit of dissolved solid is 250mg/l; hence the sample is within limit is high, because analysis done on some samples from bore holes located at safe distance from septic tanks show that their average dissolve solid content was 30mg/l which is by far smaller than what is obtained from A and some other ones.

4.5 pH (Potential of hydrogen), Acidity and Alkalinity

Low pH favors virus adsorption; high pH in elution of adsorbed viruses. The pH of the sample was determine as a general indicator of the corrosion potential to correlate to lead contamination. In general, low pH water (below 7.0) tends to be "corrosive" which means it can dissolve metals, such as copper and lead from pipes, solder or fixtures from the pH of the sample is 6.0 and some 6.5 which is favorable with the limit by FEPA. This shows that the water may be corrosive. pH is also considered an important ecological factor and provides information for many types of ecological equilibrium or solubility calculation. It is an important parameter in water since most organisms and individuals are adapted to an average pH and do not withstand abrupt changes.

From the test result above, it is noticed that the average acidity value of sample and the alkalinity falls with 30 – 80 which is within the WHO standard.

4.6 Turbidity and Suspended Solids (Ss)

In water source (like borehole C) subjected to significant level of faecal pollution, some correlation is expected between turbidity and faecal indicators or pathogens. The strength of this correlation is variable and though some approximations were made, its value in decision making was site – specific (empirical). Turbidity in groundwater does not always indicate pathogen presence but provides information on general water quality and is an indicator of surface influence in ground water quality. Turbidity is caused by presence of suspended solid in water, these solids makes water to appear cloudy or turbid.

The main impact of turbidity is aesthetic; nobody likes the look for dirty cloudy water talks more of consuming it.

Turbidity over 5NTU can affect water appearance, even if higher values are still acceptable to consume. The measurement of turbidity level in drinking water quality if high increases the risk of people developing gastrointestinal diseases. This is problematic for immune compromised people like Onitsha who are in most cases inopportune to get immunization due to poor government policies, because contaminants like viruses or bacteria are most times attached to the suspended solids.

4.7 Nitrate

Nitrate are considered significant as a health for water quality for 3 reason, high levels are directly associated which is most frequently found among bottle – fed infants of less than 3 months age.

- Nitrate and nitrate are possible carcinogens
- Nitrate can be used as crude indicator of faecal pollution where microbiology data are unavailable.

The WHO Drinking water guideline (WHO, 1993) suggest an upper unit of 10mg/l

As nitrogen or 50mg/l WHO notes that "the epidemiological evidence for an associate between dietary nitrate and cancer is insufficient and the guideline value for nitrate in drinking water is established solely to prevent methaemologlobinaemia, which depends upon the conversion of nitrate.
The nitrate concentration of the sample SPA is 0.392mg/l shows that the sample has nitrate concentration that is of acceptable value. The causes of high nitrate concentration include domestic sewage. The WHO standard for nitrate concentration is 5.0mg/l therefore the sample's nitrate concentration is within the range.
Nitrate poisoning is one of the two main health risks commonly associated with quality degradation form concentration by soak – away effluents. Nitrate standard maybe violated from latrine leachate, especially in the areas where dilution of nitrogen loading is consequently limited.
Nitrate content of more than 5.0mg/l impacts bitters taste and may cause physiological problem. It also fouls the water system. High concentration of nitrate in ground water used for consumption is toxic especially to young children, high nitrate lead to methaemoglobinaemia , also known as "blue baby" syndrome.) This condition, in which oxygen cannot be affectively transported or released by the blood stream, occurs mostly in children under 3months of age. It causes increased susceptibility to illness in children and may even result to death. Methaemo (e.g by non – pathogenic organisms commonly found in the mouth, pharynx and colon.) when this occurs, hemoglobin may be oxidized to meathamoglobin, thus preventing the transport and release of oxygen. If the rate of methaemoglobin production exceeds the rate of its reduction, and the proportion of methaemoglobin exceeds the rate of its reduction, and the proportion of methaemoglobin rises to about 10%, cyanosis becomes apparent. Methaemoglobinaemia is a rare condition unlike diarrhea diseases the second main health risk associated with contaminated ground water) which causes up to 3 million deaths annually. Methaemoglobin is also less of a risk where breast – feeding is common, as breastfed children area less to ingest high – nitrate water.

4.8 Total Hardness

These are no health effects or drinking water standard for hardness but hard water can cause numerous aesthetic problems, especially when water is heated. Because hardness reduces corrosion of household plumbing, a level of 90 to 100mg/l is often considered optimum to reduce corrosion while also preventing unwanted aesthetic effects. Total hardness is usually reported in one of four categories as follows: soft water has hardness concentration of 0 to 60mg/l; moderately hard water has hardness concentration of 121 to 180mg/l; and very hard water has a hardness concentration greater than 180mg/l.
The hardness of sample A was be 6.100 implies that the water is not too hard.

4.9 Sulphate, Phosphate and Chloride

Sulphate: this occurs naturally in drinking water. The maximum contaminant level of 250mg/l is based on aesthetic effect (i.e. taste, color and others). The sulphate level of the sample is relatively low and it agrees with the stipulated concentration level of 1250mg/l. from table 4.2 above, the sulphate concentration level of sample a is 45.10mg/l.
Phosphate: The WHO requirement for phosphate is 8mg/l. phosphate found in natural water mainly exists as orthophosphate. The sample meets the WHO stipulated limit for drinking water. From table 4.2 it was seen that the phosphate content of the sample is 2.946mg/l.
Chloride: The chloride content of the sample A is 30.017mg/l; hence it is within WHO limit of 250mg/l.

4.10 **Biochemical Oxygen Demand, Chemical Oxygen Demand and Dissolved Oxygen:**

Biochemical oxygen demand which is the mass of oxygen consumed by organic matter during aerobic decomposition under standard conditions is usually measured in milligrams per liter. This measure is of environmental significance for aquatic species, but it is not a direct measure of public health hazard. The BOD of the sample A is 29.087 and it is within the WHO stipulated limit of 2500mg/l. BOD is determine as below:
BOD = (OD + COD) mg/l
Chemical oxygen Demand (COD) of sample A is 35.192 and it is within the WHO stipulated standard of 250mg/l.
Dissolved oxygen of the sample A is 2.95mg/l and it is also within the WHO standard for drinking water.

4.11 Temperature

With the help of thermometer (clinical), the temperature of the sample was obtained before taking it to the laboratory for analysis. Temperature determines water suitability for consumption. An aesthetic objective of 15^0c has been established reaction decrease with decreasing temperature. Cool drinking water is perfectly warm; a temperature of 10^0c is usually satisfactory. Consumers complain when the temperature of drinking water is above 19^0C. Increase in temperature increase the vapour pressure of trace volatiles in drinking water and could thus lead to increased odour. Temperature does not bear a direct relationship to health. Its effect on chlorination and survival of micro – organisms are the most important to health.

The important of temperature as to determine the water quality is derived mainly from its relationship have a water parameter. Most of these relationship have a bearing on the aesthetic aspects of water quality; some are indirectly related to health palatability of drinking water from these source is some extent on temperature.

4.12: Temperature Coliform (Tc) Bacteria: E.Coli Bacteria

E.coli bacteria should be absent from drinking water for the water to be safe to drink. EC bacteria represent a more serious contamination issue is from human or animal waste. In this study, following some documented survey done previously. EC-bacteria is greatly suspended to be contained in the sample. The result showed that most EC-colonies were more closely related to human sources. This suggests that most contamination occurs by water from nearby septic tanks or latrines as the case may be.

I carried out some interview with some health practitioners during the survey, it was noticed that mostly diseases suffered by the people of Onitsha are caused by contaminated water and they are either viral or bacterial. Also it was found out that about 300 frankaleme people suffers from this contaminated borehole yearly. Table 4.4 below is a synopsis of the diseases and their agents. Also table 4.4b below shows the disinfection efficiency for microbial pathogens using chloride and monochloramine as disinfectants.

4.13: Other Effects Of Contaminated Water

Contaminated water not only cause diseases for Onitsha people but have made some lose their loved ones; creating memories that are ever soberly when remembered. Some unfortunate ones have also been condemned to live on drugs for the greater part if not the rest of their lives. Economically, the effects of contaminated water have not been friendly. This is because people now suffer sickness caused by it. The hard water consumes soap and also develops scales in boilers. Also some of those that use their boreholes for commercial purposes can no longer count their loses; since, some through the help of some health specialist have one becomes aware of the dangers of contaminated thus have resulted in using other source of water other than the contaminated boreholes. Below is a chart showing the diseases suffered by Onitsha people and their rates.

CONCLUSION

The analysis of water quality shows that the level of concentration of parameters like temperature, total dissolved solides (TDS) conductivity, Total suspended solid, nitrate , sulphate , copper , iron , phosphate , manganese and total coli form when compared to World Health Organization (WHO) standard were within the limits and total coli form. The low value of pH (sample B, D, E) shows acidity trend in the samples when compared to the pH nature of drinking water. Proper control in the acidic nature of the ground water in Onitsha north Local Government Area of Anambra state is safer for consumption.

The quality of groundwater in Onitsha North Local Government Area of Anambra State was analyzed in the report. This project deals extensively on the portability of water. The analysis of groundwater quality as based on some factors such as distance between the boreholes and the soak-away and the depth of the boreholes. The analysis was done by comparing the results obtained with the world health organization (WHO) standard for table water. From the result obtained after the analysis, considering some parameters like pH, turbidity and total coliform, it is safer to construct the boreholes at least 15meters away from soak – away. The distance can also be for 13 – 20meters away at least.

In conclusion the result of the present study shows that the ground water at Odoakpu Onitsha North is fit for domestic and drinking purposes but still need treatment to minimize the contamination specifically the acidity.

RECOMMENDATION

After having investigated the different pollutant affecting groundwater quality, the following recommendations were considered.

- Providing public information on the linkage between sanitation and drinking water quality.
- Developing public health regulations in the design and maintenance of sanitation systems.
- Specifying or providing specific distance between soak – away and boreholes or groundwater source.
- Establishing monitoring procedure for pathogens and contingency plans for occasions where water does not meet the required quality.
- Disinfecting of water supply well on finding that some contamination has occurred (e.g. rain water from roof sheet).
- Establishing centralized water supply system for people living in a very small community where water are easily contaminated.

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