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Research Paper

Microbiological analysis and water demand population forecast in Idanre community from Arun stream

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The microbiological studies and water demand population forecast in Idanre community from Arun stream were analyses and the following results were obtained. Total coliform was present with value of 2.00±0.01 while others (E coli, Faecal Streptococci, Yeast / Mould) were absent. The results from the evaluation of Arun stream from the stipulated forecasting revealed that if quantity supply (Qs) is greater than Water demand (Qp) then the water can supply the population but if the Qs is not greater than Qp then the water cannot supply the population. The quantity supply (Qs) is 47,439,648 l/day while water demand is 36,704,443 l/day. This revealed that Qs is greater than Qp in the calculation of the Arun stream in Idanre Hill, then the stream can supply the population in Idanre Township without scarcity in the raining season at the stipulated period.

Key words: Arun stream, Water, microbiological, capacity, supply

INTRODUCTION

Water is essential for life. In addition, water is essential for ensuring the integrity and sustainability of the earth's ecosystems. The availability of water is taken for granted as if there existed and abundance of the resources. This assumption of water is taken for granted and found to be untenable. In recent years, the availability and access to freshwater have been highlighted as among the most critical natural resource issues facing the world. The United Nation (UN) environmental report (GEO, 2000) states that global water shortage represents a full scale emergency, where the world water cycle seems unlikely to be able to adapt to the demand that will be made of it in the next fifty years (UNEP, 1999).

A study of the history of civilization has revealed that the provision of fresh clean safe drinking water is the bedrock of any developed society. The growth of urbanized civilization has been sustained since ancient times by water supply systems (Gill, 2008). Sufficient provisions of clean, safe drinking water are a necessity for buildings and their occupants, including both commercial and residential structures and facilities. Even though the necessity of water is acknowledged by everyone only those who do not have it in acceptable quantity and quality will appreciate it the more (Treado *et al.,* 2008). A great majority of the people living in African Continent and some in Asia fall into this category. The basis for drinking water assessment and improvement is the concern over public health to which little attention has been given by the way of effort in the provision of safe drinking water. However, some encouragement could be derived by stakeholders in public health when efforts are made to ascertain the public health benefits expected from involvement in the provision of clean safe drinking water.

Origin of water

There is no consensus on the origin of water in the terrestrial planets. Suggested sources include comets, hydrous asteroids, phyllosilicates migrating from the asteroid belt, and hydrous minerals forming in the inner solar system and accreting directly to the terrestrial planets. Each hypothesis is examined below. There are potential problem with all of these sources.

Sources of water

The Origin of water in the terrestrial planets is intimately associated with the nature of their "building blocks." There are two ends – member possibilities. One possibility is that temperature was too high in the inner solar system for hydrous phases to exist in the accretion disk, so the terrestrial planets accreted "dry" (Boss, 1998). Water and probably organics were delivered from exogenous sources (e.g. comets, meteorites) after the terrestrial planets had formed. In this case, all terrestrial planets should have had the same source of water, unless the delivery process was stochastic and dominated by one or a few large impacts of a hydrous object.

Comets

Comets were long considered the leading candidate for the origin of water in the terrestrial planets. This hypothesis was attractive for two reasons. First, it is widely believed that the inner solar system was too hot for hydrous phases to be thermodynamically stable (Boss, 1998). Thus an exogenous source of water was needed. The Earth and other terrestrial planets underwent one or more magma ocean events (Righter and Drake, 1996; Li and Agee, 1996; Righter and Drake, 1997; Walter *et al.,* 2000) that some authors believed would effectively degas the planets of any existing water. We now know that there are elemental and isotopic reasons why at best 50% and most probably a very small percentage of water accreted to Earth from commentary impacts (Drake and Righter, 2002).

Asteroids

Asteroid are a plausible source of water based on dynamical arguments (Mobidelli *et al.,* 2000) have shown that up to 15% of the mass of the earth could be accreted late in Earth's growth by collision of one or a few asteroids originating in the main belt. However, there are strong geochemical arguments against a significant contribution of water from asteroids unless one postulates that Earth was hit by a hydrous asteroid unlike any falling to Earth today, as sampled by meterorites. One cannot prove this hypothesis wrong, as it could involve a single, unique event of current meteorite falls, only carbonaceous chondrites have significant amount of water (Drake and Righter, 2002).

Phyllosilicates

Ciesla *et al*. (2004) have proposed that the terrestrial planets received their water by inward migration of phyllosilicates from the asteroid belt, where they clearly exist. This hypothesis accepts that the region of the accretion disk where the terrestrial planets reside was too hot for hydrous phases to exist. This hypothesis appears subject to the same objection as other asteroidal sources of water.

SCOPE OF THE STUDY

This research work focused on the Arun stream at Idanre as a source of suitable portable water quality of Idanre community. To achieve this aim, the microbiological studies and estimation of water demand to the population were determined in relation to the velocity (rate of flow) of the river according to WHO / UNICEF, (2000). The results obtained from the velocity were used to determine the cross sectional area of the stream and the estimated stream discharge. It is important to state that this research work does not pretend to test for every known drinking water quality parameters in Idanre, but efforts will be made soonest to address the physical and chemical constituents of the stream, which are peculiar to every drinking water according to WHO / UNICEF, (2000) when this source of drinking water according to the capacity of the stream for Idanre population and its microbiological activity has been certified.

MATERIALS AND METHODS

Survey of the study Area

A survey was carried out on Idanre community in order to know the water source that can serve as the major source of drinking water in the area. A tour to 'Oke-Idanre' axis in Idanre Township in Idanre Local Government Area, Ondo state, (the first settlement area at the hills by the ancient people) reveals that there is a stream water called ARUN STREAM (Groundwater) in the community, a prime source of drinking water in the ancient days. The assessment was done during wet/rain season at the stream. The reason for this period is due to the seasonal attribute to the sample, because it may be

Figure1. Idanre Geographical Location.

Figure 2. Location of Arun stream.

undesirable during the dry season. The width of the source of this sample was found to be 3.75 ft and the depth of 3.40 ft. The measurement was done in the distinctive period of day in morning time (10:00 am) in situ to get a homogenous undisturbed stream for the investigation. Random sampling method was adopted for the collection of the water sample for microbiological investigation (Figures 1 and 2).

Microbiological analysis

Preparation of culture media

The culture media used were N Nutrient Agar (N.a.), Web sphere Message Broker agar (W.M.B.), Monitol Salt Agar (M.S.A) and Malt Extract Agar (M.E.A.). All the culture media were prepared according to the manufacturer's instructions and then sterilized in the autoclave at temperature of 120 °C for 15 min.

Microbial isolation

The sample was serially diluted, 1 ml of 10.4 dilution protocol of each of the diluted sample was pipetted aseptically into approximately labeled sterile petric dishes and the prepared media was poured on the petric dishes aseptically. It was allowed to solidify and inoculated at the temperature of 37 °C for 24 h for bacterial and 17 °C for 72 h for fungi respectively.

Bacterial count

The number of colony forming per unit of bacterial was

Table 1. The results of the microbiological properties analyzed from Arun stream.

Parameters (Cfu /100ml)	Results
Total coliform	2.00±0.01
E-coli	Nil
Faecal Streptococci	Nil
Yeast / mould	Nil

± Std of triplicate result.

Table 2. The estimation of water demand population forecasting.

Time (s)	Distance (m)	Velocity (m/s)
21.93	10	0.46
18.42	10	0.54
16.71	10	0.60
12.89	10	0.78
6.45	10	1.55

done with the aid of colony counter to know the qualitative analysis of the bacterial.

RESULTS AND DISCUSSION

The microbiological studies carried out on Arun stream is as shown in (Table 1). Total coliform was present with value of 2.00±0.01 while others (E coli, Faecal Streptococci, Yeast / Mould) were absent. The results from the evaluation of Arun stream from the stipulated forecasting in (Table 2) revealed that if Qs is greater than Qp then the water can supply the population but if the Qs is not greater than Qp then the water cannot supply the population. The quantity supply (Qs) is 47,439,648 l/day while water demand is 36,704,443 l/day. This revealed that Qs is greater than Qp in the calculation of the Arun stream in Idanre Hill, then the stream can supply the population in Idanre Township without scarcity in the raining season at the stipulated period.

$$\text{Velocity (m/s)} = \frac{\text{Distance (m)}}{\text{Time (s)}}$$

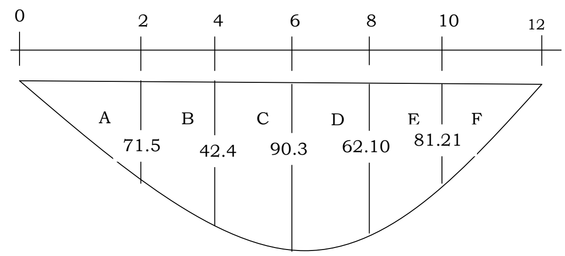
1. $\frac{10}{21.93} = 0.455996 = 0.46\text{m/s}$
2. $\frac{10}{18.42} = 0.5429 = 0.54\text{m/s}$
3. $\frac{10}{16.71} = 0.59844 = 0.60\text{m/s}$
4. $\frac{10}{12.89} = 0.775795 = 0.78\text{m/s}$
5. $\frac{10}{6.45} = 1.55039 = 1.55\text{m/s}$

$$\text{Total Velocity} = \frac{0.45 + 0.54 + 0.60 + 0.78 + 1.55\ \text{(m/s)}}{5} = 0.786\text{m/s} = 0.79\text{m/s}$$

Using Trapezoidal Rule Method

Trapezoidal Rule = ½(a + b) h

A. = ½(0+71.5)2 = 143/2 =71.5m^2
B. = ½(71.5 + 42.4)2 =227.8/2 = 113.9m^2
C. = ½(42.4 + 90.3)2 =265.4/2= 132.7m^2
D. = ½(90.3 + 62.10) 2=304.8/2= 152.4m^2
E. = ½(62.10 + 81.21)2=286.62/2 = 143.31m^2
F. = ½(81.21 + 0)2=162.42/2= 81.21m^2



Cross sectional area of the stream

Total Area = 71.5 + 113.9 + 132.7 + 152.4 +143.31 + 81.21 (m^2) = 695.02 m^2

The stream discharge estimation

Discharge (Q) = Total Velocity x Total Area = 0.79m/s x 695.02m^2 = 549.0658m^3/s = 549.07m^3/s

The liters per seconds discharge.
The Discharge (Q) multiply by 1000
Qs=549.07 m^3/s x 1000= 549070 liters per seconds.
To convert it to liters per day
Qs=549070 x 24 x 60 x 60
Qs=47,439.648, 000 liters per day.
$P_f = P_p (1 + 3/100)^n$
Where, P_f = ?, P_p = 129,795, and n = 9years
P_f=129,795 (1 + 3/100)^9 =129,795 (1 + 0.03)^9 =129,795 (1.03)^9 = 129,795 (1.30477318383) =169353.035395215
P_f=169353.04
Where; P_f =?, P_p =169353.04 and n =20years
P_f=169,353 (1 + 3/100)^{20} =169,353 (1 + 0.03)^{20} =169,353 (1.03)^{20}
P_f = 169,353 (1.80611123467) = 305870.355925069
P_f = 305870.36
New population in the next 20 years from 2015
Water demand by people
Water demand (Qp) = Population x 120 liters capacity per day.
Qp = 305870.36 x 120 liters capacity per day.
Qp = 36,704,443 liters capacity per day.
Qp = 36,704,445 liters capacity per day.
Qp = 36, 704,443 liters capacity per day.
Qs = 47,439,648, 000 liters per day

Conclusion

Arun stream can sufficiently supply the demand of Idanre community due to the quantity / volume of water at the period stipulated. Coliform is undesirable in water consumption. It can cause stomach poisoning and must be getting rid of before consumption.

Recommendation

Water is needed throughout the year, due to this fact, the stream can be dammed in the capacity of the quantity supplied (47,439,648,000L/day) to meet the demand of the community during dry season. Also required treatment must be done to provide water free from microorganisms.

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