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Adaptability of River Omi as a Source of Water Supply to Idi-Osan, Egbeda Local Government of Oyo State, Nigeria

Adediran, Hazzan Abioye and Abdulsalam, MayowaBasit
Department of Civil Engineering Ladoke Akintola
University of Technology Ogbomoso,
Nigeria

Abstract:- Idi-osan community is a fast-growing settlement that deserves provision of the needed social amenities that will make life worth living for the residents, potable water inclusive. This research assesses the visibility of the use of the Omi River to alleviate water supply within the Idi-Osan community, it determines the water quality of the river and comparison to Surface-water standards. Samples collected across the section of the river where it cut across the community were subjected to tests to ascertain the potability ofthe Omi River for domestic use.The results demonstrate that the dissolved oxygen and pH are following both the World Health Organization and the Federal Environmental Protection Agency regulations, however, the alkalinity is not.

Keywords:- *River, Surfacewater standard, Water quality.*

I. INTRODUCTION

Water is a necessary occurrence in a man's life. His survival is primarily dependent on this material, which may be regarded as the most significant liquid ever created, having the chemical formula H_2O. Freshwater availability is one of the world's key issues, with surface sources such as rivers, dams, lakes, and canals providing around one-third of the world's drinking water requirements[12]. The most danger to Africa's sustainable water supply is the pollution of accessible water resources[6]. Many African communities still rely on untreated or inadequately treated water from surface resources like rivers and lakes for their daily supplies. They have little or limited access to basic sanitary facilities, putting them in danger of waterborne infections[9].

[15]The bulk of Nigeria's water supply comes from surface water, but groundwater is significant as well. However, Nigeria's geography makes developing aquifers problematic. Because the majority of the country's bedrock is igneous or metamorphic, porosity is extremely low due to small and disconnected pore spaces[4]. Humans have used surface water for a variety of reasons. It serves as a supply of drinkable water after treatment as well as a source of household water without treatment, particularly in poor nations' rural regions[1].

The paucity of water in the Idi-osan community and its surroundings is increasing at an alarming rate. The pursuit of water at any cost and from any source inevitably results in health issues such as an outbreak of diseases such as cholera, schistosomiasis, diarrhoea, and typhoid, among others. Despite the existence of the Omi River, there is still a paucity ofwater inside the Idi-osan community. This study investigates the River Omi to alleviate water scarcity in the neighbourhood.

A. Location

The village of Idi-osan is located in the local government area of Egbeda. It is located at latitude 7º 25' 19" North and longitude 4º1' 9" East. It is easily accessible after Kumapayi village via the Olodo garage. This community is flanked by other villages like Idi-Oro, Okuoseju village, Ogundipe, Akindele, Koloko, and Eleriko.

Previously, this settlement was one of 20 units under the general administration known as the zone Kumapayi Community Development Association, but due to recent developments, the settlement now stands on its own as a community development association. Figure 1 is an Oyo state map showing Egbeda local government, where the research region is located.

River Omi, the focus of this project, is a large river that originates near Odo Oba in the Iwo Local Government Area of the State of Osun and flows through villages and towns, including Gbenku, Lalupon, Ile Igbon, Arikuyeri, Arubiewe, Gbaga, Kasumu, Idi-iroko, Ejitolu, Akindele, Eleriko, Olojuoro, and Latunde. Historically, the River Omi's sadness was caused by a human being (a hunter) who, through his magical abilities, transformed himself into a river. This river's water is still superstitiously thought to be medicinal for certain diseases.

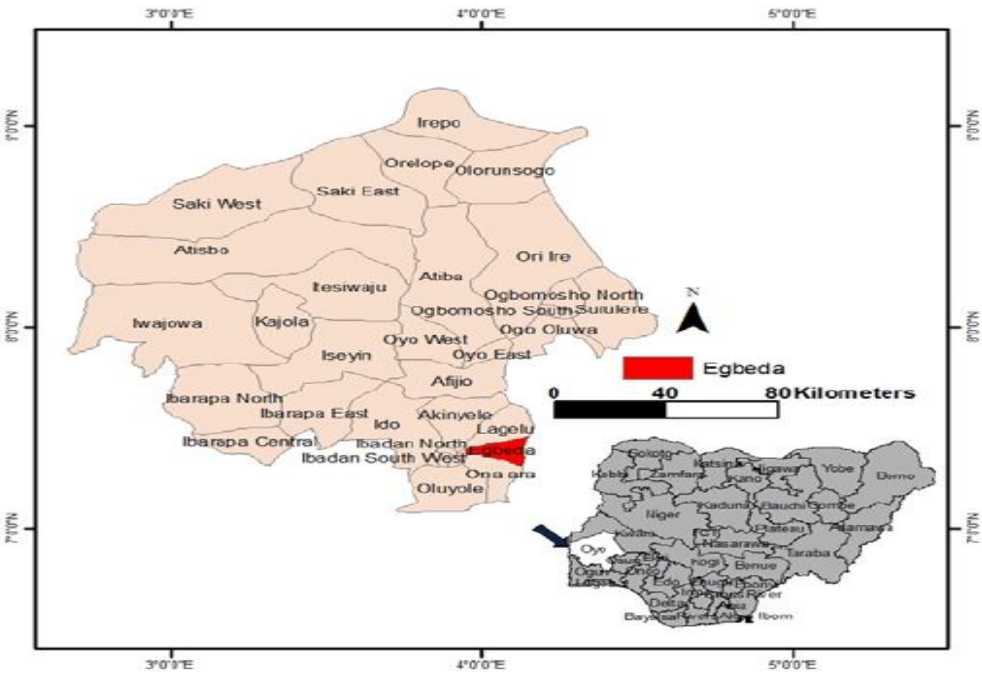

Fig. 1: Map of Oyo State showing Egbeda local Government where the study area is located. Inset Map of Nigeria.
Source: Federal Ministry of Water Resources Roadmap for the Nigeria Water Sector[10]

According to the survey done for five consecutive days the polluting activities seen on and around the river includes laundry, motorcycle washing, bed sand dregdging, fishing, drawing of water for concrete mixing and swimming by children of the community.

Fig. 2 :River Omi being polluted by users activities

B. Water Supply in Nigeria

In Nigeria, the responsibility for water delivery is shared by three levels of government: federal, state, and municipal. The federal government is in charge of water resource management; state governments are in charge of urban water delivery; and local governments, in collaboration with communities, are in charge of rural water supply. [10]The country's water resources potential is 267 and 92 billion m3 of surface and groundwater, respectively. [3]It also puts the coverage of water supply and sanitation services at 58 per cent (87 million) and 32 per cent (54 million), respectively.

In 2015, 67 per cent of the global population had access to basic drinking water[13,18]. This represented 82% of the urban population and 54% of the rural population. In 2015, around 60 million people lacked access to basic water. In terms of sanitation, just 33% of the whole population had access to basic sanitation. This represented 39% of the urban population and 27% of the rural population. Approximately 122 million people still lack access to adequate sanitation[13,18]

C. Surface Water as Source of Water Supply

[16]Rivers, lakes, streams, brooks, and swamps are examples of surface water, which may be defined as any naturally occurring body of freshwater that is exposed to the atmosphere. A watershed, drainage basin, or catchment area is the entire land area that produces surface runoff into a river or lake. [5]The volume of water available for municipal delivery is mostly determined by the quantity of rainfall. It is also affected by the size of the watershed, the ground's

slope, the kind of soil and vegetation, and the type of land use.

A river's flow rate, or discharge, changes with time. Higher flow rates are normal in the spring, whereas lower flow rates are typical in the winter. [5]A conservation reservoir may be created when the average discharge of a river is insufficient to provide a reliable supply of water. A dam prevents the flow of water, allowing an artificial lake to form. Conservation reservoirs collect water during wet seasons and store it for use during droughts and low stream flow. Within the reservoir, a water intake structure with inlet ports and valves at various depths is constructed. Because the quality of water in a reservoir changes seasonally with depth, a multilevel intake allows the best quality water to be extracted. For economic reasons, it is sometimes preferable to create a multifunctional reservoir[5]. A multifunctional reservoir is intended to meet a variety of community water demands. The reservoir may offer flood control, hydroelectric electricity, and recreation in addition to drinking water.

II. RESEARCH METHODOLOGY

A. Data Collection

Three sampling stations were chosen along with the breadth of the river at 7º 24' 41" N and 4 º1' 4" E, where the river cut over the village, and three grab samples were taken for analysis. Bottles used in the collection of water samples were rinsed with soap and water three times before being autoclaved at a temperature of 60ºC for three hours to prevent germs. 2 litres of each water sample were taken for physiochemical analysis[2]. The samples were promptly transferred in ice packs to the water resources laboratory, Civil Engineering Department, LAUTECH Ogbomoso, Oyo State, Nigeria, where they were analysed.

B. Population and their Water Demand

Questionnaires were presented to the representatives of each house in the community to fill out the population they have in their respective houses as well as their thoughts on using the river as a source of water supply. Getting these figures summarised together was difficult as some of the representatives were not available. Plan B was sorted by getting the total number of houses in the community and the average population of each house. This figure was then multiplied by the Nigerian average water use, which gave the total volume of water demand per day in the community.

C. Discharge of River Omi

The hydraulic parameters of the River Omi were determined using the float method to know the discharge of the river. The velocity found above was then multiplied by a friction correction factor since the top of a stream flows faster than the bottom due to friction against the stream bed. For rough or rocky bottoms, multiply the velocity by 0.85.

D. Methods of Analyses

- Temperature

This was determined by dipping a mercury-in-glass portable thermometer into the water samples insitu to obtain the reading.

- pH level

A pH metre was used to determine the pH level of a sample (Hanna HI8314). The pH metre was initially calibrated with a pH buffer solution at 6.86 or 7.00, depending on the pH meter's specifications. The probe and container were sterilised by washing them three times in distilled water. The water sample was then used to clean the probe and the container.

- Dissolved oxygen

The glass bottle (60mL) included with the kit was cleaned three times with distilled water before being filled to overflowing with the sample. When the stopper was applied, a little portion of the samples spilt over. More sample was poured to fill the bottle before gently replacing the cork. When the container was inverted numerous times, the sample coloured orange-yellow and a flocculent precipitate developed, indicating the presence of oxygen. Using a titration syringe, steadily add HI-3810-0 Titrant solution until the solution turned from blue to colourless. These procedures were repeated and documented for all of the samples.

- Total Alkalinity

The plastic vessel was washed three times with distilled water before the water sample was added. The plastic vessel was then filled to the 5mL level with the water sample and the cap was reinstalled. A drop of Bromophenol blue indicator was introduced via the cap section and mixed by gently whirling the vessel in a tight circle. The titration syringe was put into HI 3811-0 to draw a syringe full of the solution, then the syringe tip was fitted into the vessel's cap and the titration solution was gently added dropwise and twirled to mix after each drop. The titration solution was gradually added until the solution in the plastic jug became yellow. The syringe scale measurement was converted to millilitres and multiplied by 300 to provide mg/l (ppm) CaCO3.

III. RESULTS AND DISCUSSION

A. Population

From the survey made, the total number of the houses in the community were confirmed to be five hundred and sixteen (516) as house numbering was just earlier concluded and an average of seven persons per house.

Population (P) = 516 x 7 = 3,612 (persons)

According to United Nations Development Program in 2011, the average water use per person per day in Nigeria is thirty-six litres (36 litres). This implies that the total water demanded by the community equals;

Total water demand per day = 3,612 x 36 = 130,032 Lcpd

B. Hydraulic Data

The hydraulic data obtained from the river are given in Table 3.0 below. The data were obtained at the very section where the samples were taken from. This was conducted in November at the beginning of the dry season.

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Day	Discharge (m^3/s)
1	1.252
2	1.260
3	1.350
4	1.284
5	1.292

Table 3.0 - Dischargeof Omi River

$$\text{Average discharge (Q)} = \frac{1.252 + 1.260 + 1.350 + 1.284 + 1.292}{5}$$

$$Q = 1.288 \text{ m}^3/\text{s}$$
$$Q = 1288 \text{ liters/s}$$

Omi River's discharge was found to be 1288 litres per second from the analysis carried out on it and the per capital demand of the community was determined to be 130,032 this is a volume of water which Omi River can produce in 100.95 seconds of its discharge.

C. Water Quality Parameters of Omi River

The results of the analysis of the physicochemical parameters performed in the laboratory under close supervision and monitoring on the water samples obtained from the Omi River are given below in Table 3.1

	Results			Standard Limits	
Parameters	**S1**	**S2**	**S3**	**FEPA[12]**	**WHO[18]**
Dissolved oxy.(mg/L)	5	5	5	5.0 – 9.0	6
Alkalinity (mg/L)	285	300	300	__	100
Temperature (° C)	29.5	30.3	30.5	__	__
pH	7.92	7.88	7.86	6.0 – 9.0	6.5 – 8.5

Table 3.1Physiochemical Parameters of the water samples from River Omi

- **Temperature**
  The temperature of samples varies slightly, with Sample 1 having a temperature of 29.5ºC, it slightly increases in Sample 2 to 30.3ºC, and further increases in Sample 3 (30.5 ºC), as shown in Table 3.1. High water temperatures enhance the growth of microorganisms, and this may cause increased taste, odour, and corrosion problems. There is no guideline value recommended for drinking water temperature since its control is usually impracticable WHO. High water temperatures in surface water can also affect aquatic life. Therefore, the temperature should not be too high.
- **pH**
  The pH values were 7.92, 7.88, and 7.86 for the three samples collected and analyzed, which are within the limited standards for both the Federal Environmental Protection Agency (FEPA) 6.0–9.0 and the World Health Organization 6.5–8.5 as recommended for drinking and other domestic uses and also for agricultural purposes.
- **Dissolved Oxygen:**
  As shown in Table 3.1, the dissolved oxygen in the water samples was found to be the same. This could be because the samples were taken along the same section of the river. All the samples collected have dissolved oxygen below 6 mg/litres and therefore do not meet the guideline value recommended for dissolved oxygen WHO, but satisfy the FEPA limit for aquatic life.
- **Total Alkalinity**
  The three samples were found to have a high value of alkalinity exceeding the standard limit specified by WHO, which is 100mg/L. Hence, the water is not safe for domestic use.

IV. CONCLUSION

The Omi River is being contaminated by the activity around it, as evidenced by laboratory examination findings when compared to the standard limits. The river may feed the entire town with surplus water during the rainy season since the river's flow is at its greatest, but when the discharge decreases during the dry season, it can still serve as a source of relief for the community's water supply.

V. RECOMMENDATION

To prevent river pollution, environmental regulations should be implemented and enforced by the community. Knowledge of water treatment procedures should be adopted by the community to eliminate contaminants from the water and make it safe for residential use. Other criteria should be evaluated for additional research, as well as the discharge during the dry season, and treatment of river water might be considered.

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