IJAAR PUBLISHING® DOI: 10.46654

Scholarly Journal of Science and Technology Research & Development | ISSN: **2955-0807**
Vol. 1, Issue 6 (November, 2022) | www.ijaar.org/sjstrd

DETERMINATION OF WATER QUALITY INDEX (WQI) OF JODA DAM IN GABASAWA LOCAL GOVERNMENT KANO STATE, NIGERIA

A.M. SULEIMAN[1], A. UMAR[2], A.A. SADIQ[3] & N. USMAN[4]
[1.] DEPARTMENT OF PHYSICAL SCIENCES, KANO STATE POLYTECHNIC
[2.] DEPARTMENT OF PERMACEUTICAL SCIENCE TECHNOLOGY, KANO STATE POLYTECHNIC
[3.] DEPARTMENT OF FISHERIES TECHNOLOGY, AUDU BAKO COLLEGE OF AGRICULTURE, DAMBATTA, KANO STATE
[4]BIOLOGGY DEPARTMENT SCHOOL OF SCONDARY EDUCATION SCIENCE FEDERALCOLLEGE EDUCATION KATSINA
CORRESPONDING AUTHOR: amsul33@gmail.com

Abstract

Water quality index (WQI) is a mathematical expression used to transform large quantities of water quality into a single number which present water quality level. This research titled "Determination of water quality index of Joda dam in Gabasawa local government area of Kano State Nigeria" aims at determining the water quality index of Joda dam in Gabasawa local government area of Kano state. This is to ascertain its suitability for human consumptions. The samples collected were assessed for thirteen (13) different parameters. These parameters were PH, electrical conductivity, total hardeners', nitrate sulphate, chloride, calcium, magnesium, dissolved oxygen turbidity chemical oxygen demand, total dissolved solid and sodium. The calculation of water quality index (WQI) was done based on weighted arithmetic index method (WAI). The value of WQI was found to be 51056. The people of the area that depend on the water for their daily lives should treat the water by boiling, sedimentation before use.

Key word: Joda Dam, water quality index (WQI), pH, Turbidity

Introduction

Portable water is a basic requirement for maintaining good health. It is important to assess the quality of water bodies and develop strategies to improve water quality for human consumptions and other activities (Pradhan, 2012).

Natural processes and anthropogenic activities influence water quality, causing degradation in surface and groundwater and affect their potential of use for human and animal consumption, agriculture, recreation, industry and others.

The quality of water bodies like dams are strongly influenced by chemical compounds that are carried into the dams by water shed and hydrological and biological cycles.

Physical and chemical parameters can be used to evaluate the water quality and are directly associated with water use. However, studying these parameters separately does not clearly define water quality. In any case, the parameters must meet pre-established standard for water use in a particular region or country, otherwise, treatment before use will be required if the water does not meet the standards.

A good alternative is to integrate a set of physical and chemical variable to develop a water quality index (WQI). In this case large number of water parameters result into a single number that represents the level of water quality.

A water quality index (WQI) is a means of summarizing large amount of water quality data into simple terms (e.g good) for reporting to the management and the public in consistent manner (Shaikh et al, 2004).

Joda Dam

Joda mini reservoir is located in Gabasawa local government in Kano Nigeria. It is about 37.8km^2. It is surrounded by over 50 villages and hamlets. Some of these villages are Maraya, BakinYiyu, Wajayal and Fantaki. The people leaving in these villages depend directly on the water of this research without it going through piping process.

Materials and method

Sample collection

The sample was collected on Sunday 27th March, 2022. The time was chosen, because at this time there is high demand of water, because of water wells of villages have been drained. All necessary precaution to avoid contamination during sampling and treatment had been taken.

Determination: the sample was analyzed for 13 physicochemical parameters. The PH, electrical conductivity and dissolved oxygen were monitor at the sampling site, total calamity and total hardeners' total suspended solids, calcium, magnesium, chloride, nitrate and biological oxygen demand were analyzed in the laboratory as per the standard procedures of RPHA (1995).

In this study, for the determination of water quality index 13 different physicochemical parameters were chosen. The WQI has been calculated using the standards of drinking water quality recommended by the World Health Organization (WHO) and Indian Council of Medical Research (ICMR).

Arithmetic water quality index proposed by Horton in 1972 will be used to calculate the WQI in this study.

WQIA = $\sum_{j}^{n} = 1$ WIqi / $\sum_{j-1}^{n} wi$

Where n = the number of variables or parameters, wi is the relative weight of the 1th parameter and Qi is the water quality. The overall water quality was collected using Brown et al (1972) equation.

qi = 100 [(vi-vid)/Si-vid]

Where Vi is the observed value of the 1st parameter, Si is the standard permissible value of 1st parameter an Vid is the ideal value of 1st parameter.

Table 1: Expression of water Quality Index (WQL) and status of Water Quality (Chatteeji and Raziuddin 2002)

Water quality index	Water quality states
0.-25	Excellent quality
26-50	Good status
51-75	Poor status
76-100	Very poor status
100 above	Unstable to drink

Results

Table 2: The standard parameters of drinking water given by ICMR and WHO

S/N	Parameters	Standard	Recommended	Unit weight
1.	PH	6.5-8.0	ICMR/WHO	0.219
2.	Electrical conduction	250 M/CM	1CMR/WHO	0.3710
3.	Chemical oxygen demand	5.0 Mg/L	1CMR/WHO	0.01
4.	Total hardness	300 Mg/L	1CMR/WHO	0.0062
5.	Tubidity	50Mg/L	1CMR/WHO	0.08
6.	Nitrite	50 Mg/L	1CMR/WHO	0.412
7.	Sulphate	150Mg/L	1CMR/WHO	0.01236
8.	Chloride	250Mg/L	1CMR/WHO	0.0074
9.	Calcium	75Mg/L	1CMR/WHO	0.025
10.	Magnesium	30Mgl/L	1CMR/WHO	0.061
11.	Dissolve oxygen	50Mg/L	1CMR/WHO	0.3723
12.	Sodium	200Mg/L	1CMR/WHO	0.0698
13.	Total dissolved solid	500Mg/L	1CMR/WHO	0.0037

Table 3: Comparison of standard value with observed value

S/N	Parameters	Observed value (Vi)	Standard values Si	Unit weight	Quality rating	Wiqi
1.	pH	6.67Mg/L	6.5-85	0.219	46.67	10.2207
2.	Electrical conductivity	176Mg/L	65-85	0.2190	46.67	10.220
3.	Chemical oxygen	0.7Mg/L	5.0Mg/L	0.01	0.14	0.0014
4.	Total hardness	4.21Mg/L	300Mg/L	0.0057	1.5	0.0075
5.	Turbidity	22.35Mg/L	50Mg/L	0.075	45	3.75
6.	Nitrate	4.25Mg/L	50Mg/L	0.0412	8.3	0.3708
7.	Sulphate	57.5Mg/L	150Mg/L	0.0231	45	0.5438
8.	Chloride	8.0Mg/L	250Mg/L	0.0074	3.2	0.0236
9.	Calcium	1.75Mg/L	73Mg/L	0.031	2.06	0.0520
10.	Magnesium	2.54Mg/L	30Mg/L	0.053	8.365	0.5891
11.	Dissolved oxygen	4.2Mg/L	5.00Mg/L	0.3751	52	22.051
12.	Godiu	40.01Mg/L	200Mg/L	0.546	16	1.251
13.	Total dissolved solid	82Mg/L	500Mg/L	0.0025	18.7	0.0574

Calculation of WQI

The WQI of Joda dam was calculated using weighted arithmetic index formular as follows:

$$\text{WQI} = \sum \frac{WIQI}{\sum Wi} = 65.9464/1.27896$$

= 51.56

This value in table 1 falls within the range of 51-75 which indicates poor quality, according to WHO standard.

Discussion

Among all the physicochemical parameters selected for the water quality index calculation, the importance of Electrical Conductivity (EC) is due to its measure of cations which greatly affects the taste and thus has significant impact on the user acceptance of the water as potable (WHO, 2004 & Pradeep, 1998). It is an indirect measure of total dissolved salts. High conductivity may arise through natural weathering of certain sedimentary rocks or may have an anthropogenic source, e.g. industrial and sewage effluent (WHO, 2004). The results showed that EC values were slightly higher than the permissible level recommended by the WHO for drinking water.

The Total Hardness (TH) is also an important parameter of water quality whether to be used for domestic, industrial or agricultural purposes. The results obtained by water surveys conducted in this investigation showed that TH values were often high than the minimal permissible level recommended by the WHO for drinking water (WHO, 2004). The maximum calcium and magnesium concentrations were 78g/l and 40.55mg/L respectively. Lake's hardness is affected by the type of minerals in the soil and watershed bedrock and by the amount of lake water coming into contact with these minerals. If a lake gets groundwater

from aquifers containing limestone minerals such as calcite ($CaCO_3$) and dolomite ($CaMgCO_3$), hardness and alkalinity shall be high and, higher degree of hardness in the study area may be attributed to the disposal of untreated or improperly treated sewage and industrial waste (Yalçın, 2005). The mean values of DO have never reached critical values in the most times of the study period, indicating good water quality conditions. The minimum value of dissolved oxygen was 4.2mg/L complies with WHO standards and is considered good to sufficient for human consumption and most aquatic biota (Wilcock, 1995).

The pH of Joda dam was found to be 6.67. This indicates that the water is slightly alkaline, within permissible limit given WHO (2004). The pH for drinking water range from 6.5-8.5 for domestic use and living organism. The sulphate of Joda dam was found to be 66mg/L. This indicates that sulphur found in the water, that is caused by the breakdown of leaves that falls in a stream sulphate (Puri, 2015). Nitrates occur in Joda water is 4.50mg/L, high level of nitrates is found in rural areas because of extensive application of nitrogenous fertilizer in agriculture. In urban areas water rich in nitrate contaminate surface thus increase the nitrates amount. Nitrate stimulates the growth of hydrophytes and phytoplankton that consequently increase the nutrient in water body leading to eutrophication (Puri 2015). The total dissolved solid of Joda Dam was found to be 93mg/L indicate the lowest of dissolving oxygen in the water (WHO, 2015). The Sodium value of Joda dam was found to be 36mg/L. this indicates the low value of sodium dissolve in the water. From the result, the total water quality index (WQI) calculated was 51.99. When this value is compared with the values in Table 1, it indicates that the quality of water is poor especially at the period of conducting research, thatis around March to June. The research recommends that water should be treated before drinking.

References

Horton R.K (1965). An index number for rating water quality, *journal of water pollution control federation, 37 (3), pp 300-306/*

Pradhan V, Mohsin M, Gaikwad (2012). "Assessment of physic-chemical parameters of Chilika Lake Water", *International Journal of Research in Environmental Science and Technology, 2 (4): 101-103.*

Puri P.J, Yenkie M.K.N, Sangal S.P Gandhare O.G.B. Sarote and D.B. Dhanorkar (2005). "Surface water (Lakes) quality assessment in Nagpur city (India) based on Water quality index (WQI)", Vol 4, No. 1, 43-48.

Sheikh, N., Yeragi, S.G. (2004). Some Physico-chemical aspects of Tansa River of Thane District, Maharashitra. J. Aqua. Biol. 19(1): pp.99-102.

WHO (2015). International Standards for Drinking water. World Health Organization, Geneva, Switzerlands