



STUDY OF WATER QUALITY OF PHULWARIA DAM OF RAJAULI SUB-DIVISION, BIHAR

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ABSTRACT

Physico-chemical and biological studies were conducted at Phulwaria dam situated at Haldia village of Rajauli sub division in Nawada district of Bihar, India. This paper aims to study the water quality of Phulwaria dam and the nutrients present in the water with reference to drinking water quality as well as its irrigation purposes. It was obtained also the seasonal variation of related water parameters and identifies the pollutants present in dam water. Physico-chemical parameter were analysed as per APHA. The data revealed that there was fewer variations and the water quality with respect to their physico-chemical, ionic and irrigation characteristics. The overall systematic analysis of the present water quality parameter under taken and result obtained through the entire one year of study which showed that the status of water quality quiet normal and within the permissible limit and maintained with ISI. The entire premises of study area are in the remote tribal area and it is situated at the junction of Bihar and Jharkhand state boarder at Rajauli. This dam is besieged with mountain from three sides and it is very good natural area that is why the pollution loads is minimum. There is no industry in this area and the study deals with the social and other important aspect like drinking, agriculture, irrigation and fishing purposes. This dam is very popular in that area and people flock there to enjoy as picnic spot.

Keywords: Phulwaria dam, Phisico-chemical parameters, ISI, Ionic parameter, Border Junction, Rajauli.

INTRODUCTION

Bihar, with its bountiful natural resources of fertile soil, abundant water, varied climate and rich cultural and historical heritage is one of the most fascinating states of India. The farmers are intelligent and hard working. The district of Nawada does not have any important perennial river. Those, which are worthy to mention are the Tilaiya, Ghaghra, Khuri, Sakri and Dhanarjya. The beds of these rivers are shallow, wide and sandy. They are ephemeral in nature and are virtually in spate during the rainy season.^[1] Its specific name is Phulwaria dam and it was for irrigation purpose and connected with Tilaiya river of Jharkhand state. Phulwaria dam is in Nawada district of Bihar and it was commissioned in year 1988. Its length is 1135 meter and maximum height 25.66 meter.^{[2],[3]}

Water is one of the most precious gifts of the nature to mankind through clean drinking water is essential for the survival of all living organisms.^[4]

Large retention reservoirs are designed to protect us from extreme phenomena such as periodic floods and droughts.^[5] However, their retention capacity is really low. So-called small retention plays an important role in collecting water in small reservoirs by stopping or slowing down the runoff. In lowlands, small retention is mainly focused on increasing retention possibilities and preventing droughts and floods. In mountainous areas, small retention is aimed at counteracting the effects of storm water runoff. Retention reservoirs are most often multipurpose facilities. Their most important functions include water collection for municipal and agricultural purposes or flood protection. They are also used for recreational purposes.^{[6],[7]} The main problem occurring in ecosystems exposed to an uncontrolled accumulation of nutrients from the catchment area is the eutrophication process.^{[8],[9]} Dam reservoirs, which are an integral part of civilization development, have many features that distinguish them from natural lakes or rivers, hence they constitute a different category of surface water reservoirs.^[10]

The aim of the present study deals with to determine the water quality of Phulwaria dam water is to determine the nutrient status of the water with reference to drinking water quality as well as irrigational purpose. It was observed also the seasonal variations of selected water parameters and identifies the pollution sources at this dam. Hence the water quality parameters which focus on the Phulwaria dam have been mentioned in this paper. All the results point out that the Phulwaria dam is out of pollution and is secure for drinking and irrigational purpose. Actually a good number of people have been living around this dam and found suffering with fluorosis, therefore serious attention was focussed in the determination of presence of fluoride in dam water also.

MATERIALS AND METHODS

Study area

The Phulwaria dam is situated at Phulwaria (Hardiya) village of (Latitude 26.456860 and Longitude. 84.219730), Rajauli is a sub-division in the Nawada district of the Indian state of Bihar. It is 28.1 km from the district city Nawada and 144 km from Patna. Rajauli is a sub-division that borders the state of Jharkhand and has an elevation of 135 meter above sea level.

Sampling Methods

Water samples were collected in polythene containers from the dam in 1000 ml pit bottles and carried to the laboratory. The physical and chemical parameters were analyzed as per Standard Methods for the Examination of Water and Waste Water, 17th edition, ^{[11],[12]} and ^[13] Sampling was done three times in the year at morning in April 2019 to March 2020 The pH, temperature, DO, and TDS were determined on the spot rest of the parameters were analyzed in the laboratory by standard methods. ^{[14],[15]}

The water samples of Phulwaria dam of Rajauli sub-division district Nawada Bihar were monitored for physico-chemical parameters during April 2019 to March 2020 in the present study.

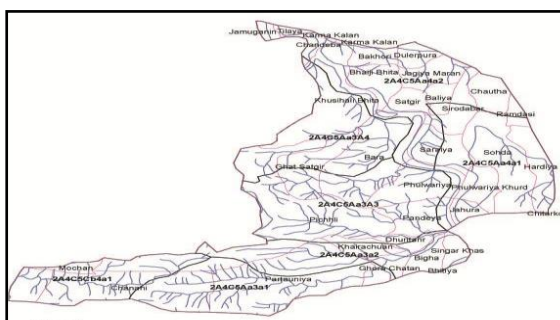


Fig. a: Map of study area Phulwaria dam



Fig. b: Large view of the Phulwaria dam at sampling site.

RESULTS AND DISCUSSION

In this study water samples; in pre-monsoon, in monsoon, and in post-monsoon session were analyzed from Phulwaria dam. The number of physico-chemical, parameters like pH, temperature, total dissolved solids, dissolved oxygen, biochemical oxygen demand, salinity, total hardness, calcium hardness, magnesium hardness, fluoride and iron were performed. In the present study the data revealed that there were fewer variations in the quality with respect to their physico-chemical and characteristics. Water quality assessment of Phulwaria dam water was studied in (April 2019 to March 2020).

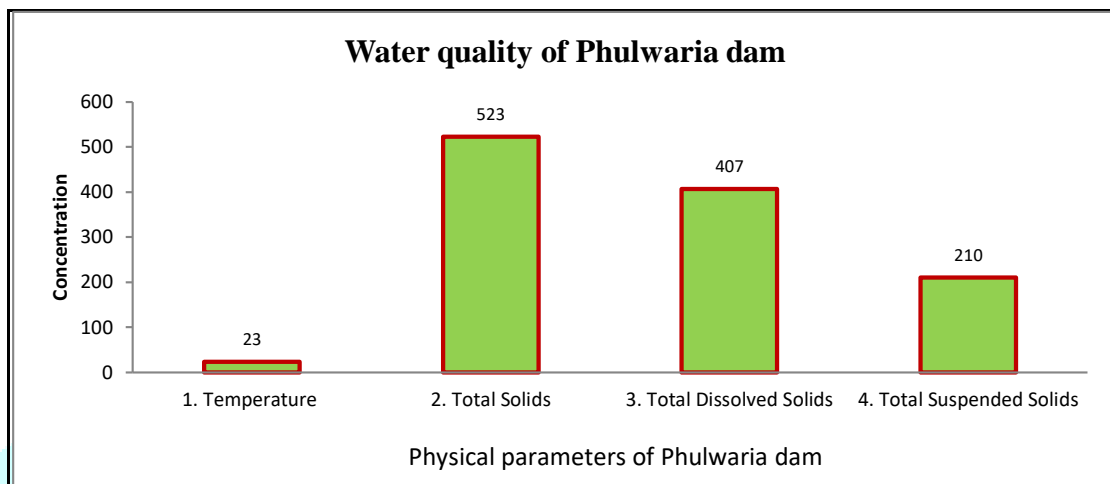
The overall systematic analysis of the present water quality parameters undertaken and results received through the entire one year of study showed that the status of water quality is quite normal and within the permissible limit as mentioned with ISI. Basically this entire premises of the study area is in the remote and tribal also natural area, hence, the pollution load is minimum. The Phulwaria dam in the rural region is relatively clean and similar results are also found to this study area. ^[16] The average value of various water quality parameters had been mentioned in table and represented in graphs.

Annual average values of water quality of Phulwaria dam session April 2019 to March 2020

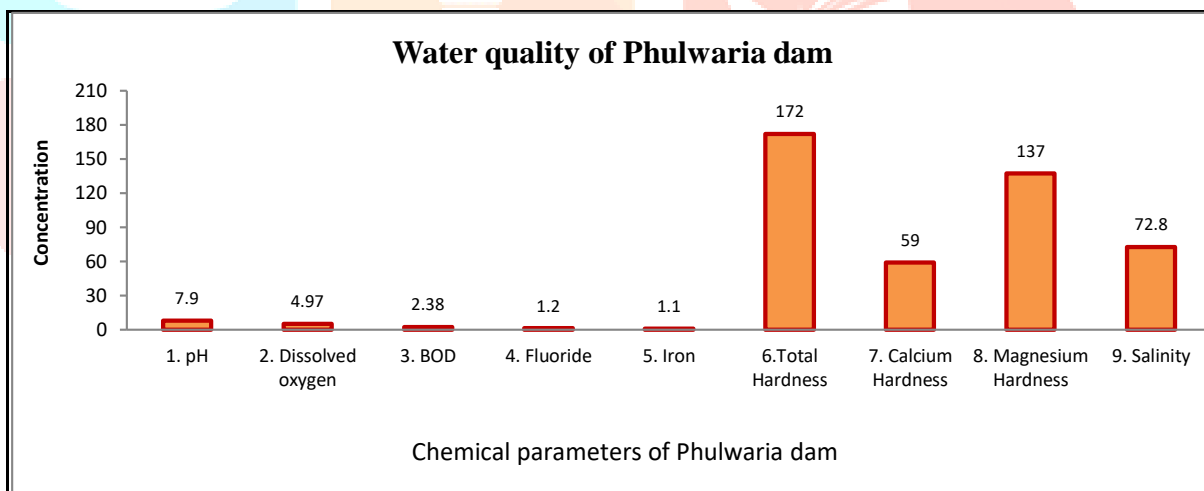
Table-1

Sl. No.	Water Parameters	Methods Used	Phulwaria dam water sample	Standard (WHO)
Physical parameters				
1.	Temperature (°C)	Thermometer	23	--
2.	Total Solids (mgL ⁻¹)	Evaporation method	523	--
3.	Total Dissolved Solids (mgL ⁻¹)	Evaporation method	407	500
4.	Total Suspended Solids (mgL ⁻¹)	Evaporation method	210	--
Chemical parameters				
5.	pH	pH Meter	7.9	6.5-8.5
6.	Dissolved oxygen (mgL ⁻¹)	Winkler's method	4.97	>4
7.	BOD (mgL ⁻¹)	5 day BOD test	2.38	--
8.	Fluoride (mgL ⁻¹)	SPANDS method	1.2	0.6-1.5
9.	Iron (mgL ⁻¹)	Thiocyanate method	1.1	0.3
10.	Total Hardness (mgL ⁻¹)	EDTA method	172	150-500
11.	Calcium Hardness (mgL ⁻¹)	EDTA method	59	--
12.	Magnesium Hardness (mgL ⁻¹)	EDTA method	137	--
13.	Salinity (mgL ⁻¹)	Titrometry	72.8	--
Ionic parameters				
14.	Chloride (mgL ⁻¹)	Argentometric	36.3	250
15.	Phosphate (mgL ⁻¹)	Stannous chloride	0.39	--
16.	Sulphate (mgL ⁻¹)	Turbidometry	149	500
17.	Calcium (mgL ⁻¹)	EDTA method	18.24	75
18.	Magnesium (mgL ⁻¹)	EDTA method	24.7	30
19.	Sodium (mgL ⁻¹)	Flame photometry	8.2	200

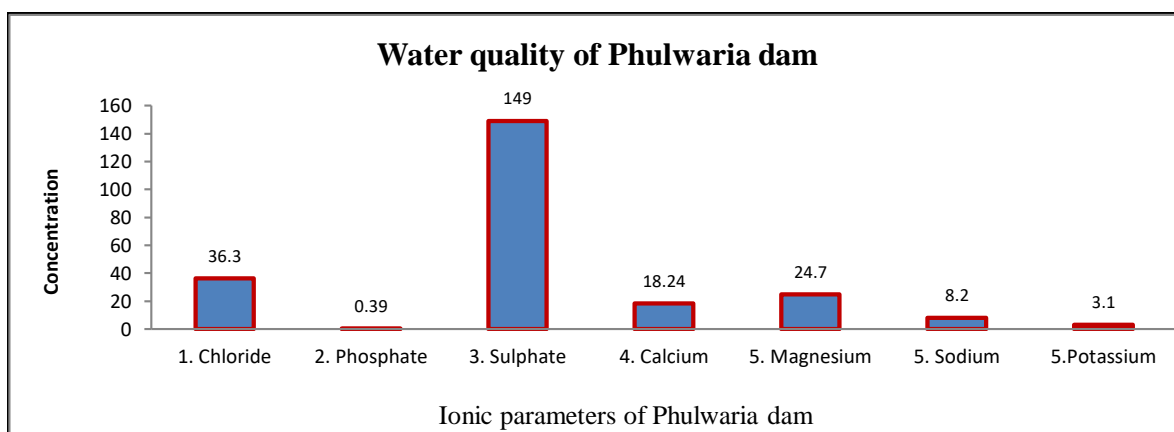
20.	Potassium (mgL ⁻¹)	Flame photometry	3.1	--
Irrigational Parameter				
21	Sodium Absorption Ratio		1.96	<10
22	Magnesium Ratio		63.9	>50
23	Sodium Percentage		19.7 %	--



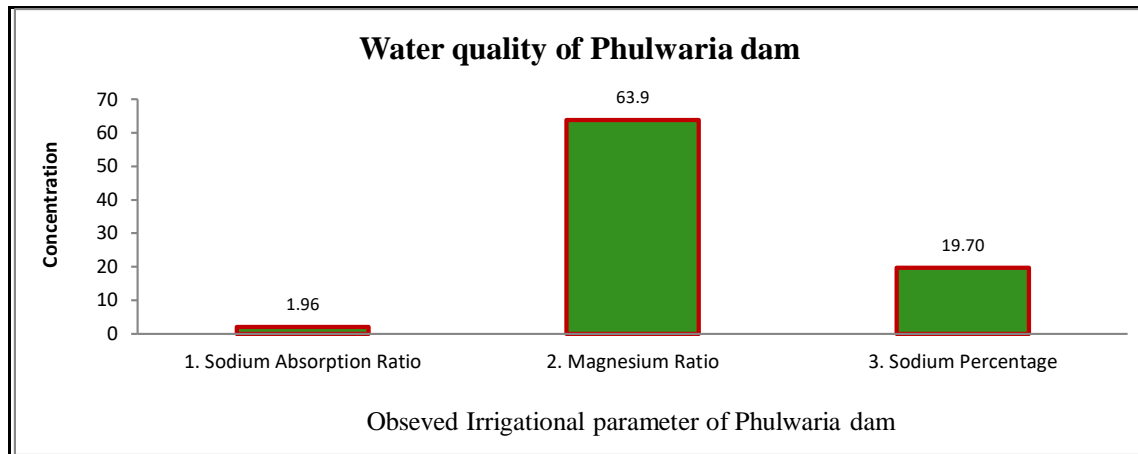
Observed Physical parameters in water of Phulwaria dam, Figure -1,



Detected chemical properties in water of Phulwaria dam, Figure -2



Ionic properties in water of Phulwaria dam, Figure -3



Observed Irrigational parameter of Phulwaria dam, Figure -4

A detailed analysis of the obtained results of selected physico-chemical parameters in April 2019 to March 2020 showed that the quality of water taken from points in these reservoirs Phulwaria dam within the prescribed standard limits.

The result as presented in the table -1 and figure 1- 4 shows annual variation in physico-chemical parameter. Observed Physical parameters in water of Phulwaria dam was Temperature of 23 °C, Total solids of 523 mgL⁻¹, Total dissolved solids of 407 mgL⁻¹ and Total suspended solids of 210 mgL⁻¹ as shown in figure -1. The range of pH of dam water was recorded from 7.9 which was under the presented limit as shown in figure -2. DO content showed a range of 4.97 mgL⁻¹ which was healthy river water, The BOD values as presented in the 2.38 mgL⁻¹ which were under the prescribed limit as shown in figure -2. Detected chemical properties in water of dam was recorded Fluoride of 1.2 mgL⁻¹ which is safe range for drinking and Iron 1.1 mgL⁻¹ as shown in figure -2 and table -1, Total hardness of 172, Calcium hardness of 59 mgL⁻¹, Magnesium hardness of 137 mgL⁻¹ and salinity 72.8 mgL⁻¹ as shown in figure -2. Ionic parameter was shown Chloride 36.3, Phosphate 0.39, Sulphate 149, Calcium 18.24, Magnesium 24.7, Sodium 8.2 and Potassium 3.1 mgL⁻¹ which were under the prescribed limit as shown in figure -3. All parameters are within the prescribed limit except iron as shown in figure-2 and table-1. Irrigational parameter was found Sodium absorption ratio 1.96, Magnesium ratio 63.9 and Sodium Percentage 19.7% which were under the prescribed limit as shown in figure - 4, table -1.

CONCLUSIONS

This entire premises of the study area is in the remote and tribal but also natural area, hence, the pollution load is minimum. The manmade activities are main source of water pollution. There is no industrial pollution in this area. As this study deals with the social and other important aspects like drinking, domestic, agricultural, irrigation and fishing etc. Our study proved up to certain extent for knowing the status of some selected environmental parameters, the present work will be helpful for wide use. All the results point out that the Phulwaria dam is out of pollution and is secure for drinking and irrigational purpose.

The Phulwaria dam medium project mainly constructed for irrigation and aquaculture. But few years before it is reserved for the drinking water supply to Haldia villages.

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