Determination of Water quality index by using physico-chemical Properties of various Lake in Jabalpur (M.P.)

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Abstract -*The fresh water us the vital concern for the mankind, since it is directly linked to human welfare. The surface water bodies which are the most important source of water for human activity are unfortunately under several environmental stresses and are being treat ended as a consequence of development activity. Inadequate water supply & unsafe water drinking is one of the main concerns in developing country. WHO (world health organization) and UNICEF, reports that 783 million people in the world (11%) of total population have no access to safe water The present work highlights the water quality index of some historical lakes of Jabalpur Water quality index (W.Q.I.) of these lakes were calculated by some physicochemical parameters such as - Temperature, Chloride, Alkanity, hardness, pH, conductivity, Total dissolved solid, Fluoride, Iron, Turbidity, Chloride, fluoride , Iron and Sulphate .The analysis shows that the water of Bal sager, Sangram sager, Supatal, Devtal and Ganga sager were polluted due to the sewage water which have been coming from the nearby residential areas. Application of Water Quality Index (WQI) in this study has been found useful in assessing the overall quality of water and to get rid of judgment on quality of the water. This method appears to be more systematic and gives comparative evaluation of the water quality of sampling stations. It is also helpful for public to understand the quality of water as well as being a useful tool in many ways in the field of water quality management.*

Key Words: Water quality index, Physico-chemical parameters, sewage waste , etc

INTRODUCTION-

Jabalpur is situated at a distance of 308 kms from the capital city of Bhopal. It is located at 23°10'57"N and 79°55'54"E. and MSL 410 M Latest archeological excavations have revealed that the city is nearly 4000 years old. Jabalpur is called the city of lake at one time there were 52 lakes in Jabalpur , out of which 13 lakes are dried up. The Supatal Lake is situated in Mahakausal region of Jabalpur. It lays behind the Ramayana Temple Garha Jabalpur. Surrounded by Hanuman-baghTemple nearby, NH-7 road, mountains, and temples. Every living organism needs water to survive. Plants need water to make food. All animals depend on plants for food either directly or indirectly. Therefore without water, all life forms will cease to exist. With the ever increasing population, water is becoming a scarce commodity. To worsen this situation, the few available sources of water for consumption by living organisms are being depleted at an alarming rate. Careless release of wastes into water bodies is also a major problem today.

If nothing is done to reverse the situation, then it is predicted that it will be extremely hard to find clean water in future. The available fresh water to man is hardly 0.3 to 0.5% of the total water available on the earth and therefore its judicious use in Imperative. Lakes are one of the important water resources used for irrigation, drinking, fisheries and flood control purposes. and most importantly the population living around the lake area. The lake shows the marshy vegetation growing at the bank of the lake along with drains and pools that quantify pollution cost by municipal waste. A large part of this contamination is due to the organic material that comes from neighbouring urban sewage, live stock. The water is also infested with water hyacinth which stabilized the water quality and provides substantial support to bacterial density which intern contributes significantly to its growth and nutrient dynamics. Water quality indices are tools to evaluate the Water quality index .determine conditions of water quality and, like any other tool require knowledge about principles and basic concepts of water and related issues. It is a well-known method of expressing water quality that offers a stable and reproducible unit of measure which responds to changes in the principal characteristics of water. WQI is a mechanism for presenting a cumulatively derived numerical expression defining a certain level of water quality. In other words, WQI summarizes large amounts of water quality data into simple terms e.g., excellent, good, bad, etc. for reporting to management and the public in a consistent manner.

1.1 STUDY AREA AND SAMPLING DETAILS

Jabalpur is the district head quarter situated 308 Km from capital Bhopal (M.P.) and located at longitude 23.1815.N and latitude 79.9864.E . And MSL 403 M It is rich in small water bodies. For the present study five historical lakes -Balsagar, Sangram sager, Devtal, Supatal, Ganga sager were selected. There GIS locations were decided. Water samples for the quality testing are taken from the four sampling points around the lake. And the locations of all sampling points are decided by GPS technique. Water samples collected from Five lakes selected for the analysis are Bal sager, Sangarm Sager, Devtal, Supatal, Ganga sager Samples are collected in the month of-November December . Samples for analysis are collected in sterilized bottles using the standard procedure for grab (or) catch samples in accordance with standard methods of APHA (American Public Health Association).The analysis of various physico – chemical parameters namely Temperature, Hardness, Alkalinity, pH, Conductivity, Total Dissolved Solids (TDS), Turbidity, Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) are carried out. All the chemicals and reagents used were of analytical grade.

Table -1: DETAILS OF LAKES

S.NO.	NAME OF LAKE	LOCATION	AREA(HECTARE)	MANAGED BY
1	BAL SAGAR	Latitude- 23° 09'12"N, Longitude- 79° 52'16"E	23.057	MEDICAL COLLAGE JBP.
2	SANGRAM SAGAR	Latitude- 23° 08'26"N, Longitude- 79° 52'57"E	15.855	GOVERNMENT
3	DEVTAL	Latitude - 23° 09'18"N, Longitude- 79° 53'50"E	1.534	J.D.A.
4	SUPATAL	Latitude- 23° 09'20"N, Longitude- 79° 54'04"E	9.58	NAGAR NIGAM JABALPUR
5	GANGA SAGAR	Latitude - 23° 09'28"N, Longitude- 79° 54'41"E	18.636	NAGAR NIGAM JABALPUR

PARAMETERS CALCULATED

(1) TEMPERATURE: Water temperature is a physical property expressing how hot or cold water is. Temperature is an important factor to consider when assessing water quality. In addition to its own effects, temperature influences several other parameters and can alter the physical and chemical properties of water. The temperature of all lakes is within 18-25° C

(2)HARDNESS: Calcium and magnesium dissolved in water are the two most common minerals that make water "hard." The hardness of water is referred to by three types of measurements: grains per gallon, milligrams per liter (mg/L), or parts per million (ppm). The hardness values of the present study were found -200 mg/l at Supatal, 180 mg/l at Ganga sager lake, 156 mg/l at Bal sager lake, 100 mg/l at Devtal and 92 mg/l at Sangram-Sager. Hardness was maximum at Supatal Lake and Ganga sager.

(3) ALKALNITY: Alkalinity is a measure of the capacity of water to neutralize acids. The Predominant chemical system present in natural waters is one where carbonates, bicarbonates and hydroxides are present. The bicarbonate ion is usually prevalent. In the present investigation the total alkalinity of the water samples is found maximum at Bal sager lake (933.6mg/l), Sangram Sager (802 mg/l), Devtal (725 mg/l),Supatal(440 mg/l) , Ganga sager(220 mg/l).

(4) PH: pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. PH is of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. The pH values of the present investigation were between 7.5 – 9.0 all lakes of Jabalpur having the high pH value.

(6) CONDUCTIVITY: Conductivity is used to measure the concentration of dissolved solids which have been ionized in a polar solution such as water. The unit of measurement commonly used is one millionth of a Siemen per centimeter (micro-Siemens per centimeter or µS/cm). The values obtained are in the range 725 to 1032 mhos.

(7) TOTAL DISSOLVED SOLIDS: Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water. Present study shows that the TDS of Supatal, Ganga-Sagar, Balsagar were having maximum.

(8) TURBIDITY: Turbidity is the cloudiness or haziness of a fluid caused by suspended solids that are usually invisible to the naked eye. It is an aggregate optical property of the water and does not identify individual substances; it just says something is there. It is an aggregate optical property of the water and does not identify individual substances; it just says something is there. The turbidity at Ganga Sagar was 5.0 NTU, which is maximum. Turbidity at Supatal Lake is 3.4 NTU, Devtal 2.9 NTU, and Balsagar 1.8 NTU.

(9)FLUORIDE: Fluoride is the simple anion of fluorine. Its salts and minerals are important chemical reagent. In terms of charge and size, the fluoride ion resembles the hydroxide ion. Fluoride ions occur on earth in several minerals, particularly fluorite, but are only present in trace quantities in water. Fluoride contributes a distinctive bitter taste. It contributes no color to fluoride salts. In study it varies in the range of 0.356 to 1.5 mg/l. Supatal Lake having maximum fluoride concentration.

(10) CHLORIDE: Chloride is present in all natural waters, but mostly the concentrations are low. In most surface streams, chloride concentrations are lower than those of sulfate or bicarbonate. Chloride ions may be retained in solution through most of the processes which tend to separate out other ions. Chloride values obtained in the study are found in the range between 33-120mg / lt. Chloride concentration is maximum at Supatal lake (120 mg/l),Bal sagar lake and Ganga-Sagar.

(11)IRON: In present study it is found in the range 0.04 to 0.2 mg/l.

CALCULATION OF W.Q.I.

In this study for the calculation of water quality index twelve important parameters were chosen. The W.Q.I. has been calculated by using the standards of drinking water quality recommended by the World Health Organization (WHO), Bureau of Indian Standards (BIS) and Indian Council for Medical Research (ICMR). The weighted arithmetic index method (Brown et. al.) has been used for the calculation of WQI of the lake. Further quality rating or sub index (qn) was calculated using the following expression.

Quality rating, $Q_i = 100 \, [(V_n - V_i) / (V_s - V_i)]$

Where,

V_n: actual amount of nth parameter

V_i: the ideal value of this parameter

$V_i = 0$,

Except for pH and D.O. Vi = 7.0 for pH;

Vi = 14.6 mg/L for D.O.

Vs: recommended WHO standard of corresponding parameter

Relative weight (Wi) was calculated by a value inversely proportional to the recommended stanard (Si) of the corresponding parameter:

$$Wi = 1/Si$$

Generally, WQI are discussed for a specific and intended use of water. In this study the WQI for human consumption is considered and permissible WQI for the drinking water is taken as 100. The overall WQI was calculated by using Equation:

Water Quality Index

$$(WQI)= \sum Wi \ Qi \ / \sum Wi$$

Table -2:

WATER QUALITY CLASSIFICATION BASED ON WQI VALUE

WATER QUALITY INDEX LEVEL	WATER QUALITY STATUS
0-25	Excellent water quality
26-50	Good water quality
51-75	Poor water
76-100	Very poor water quality
>100	Unsuitable for drinking

RESULT AND DISCUSSION

WATER QUALITY PARAMETERS OF LAKES IN JABALPUR

s. no	Parameter	Balsagar	Sangramsagar	Supatal	Devtal	Gangasagar
1	Temperature	20.5	19.8	20	19	19.5
2	PH	8.0	7.5	9.00	8.0	7.50
3	Total Alkanity	440	802	440	725	220
4	Total Hardness	156	92	200	100	180
5	T.D.S.	606.8	553.8	670.8	471.2	641.5
6	EC	933.6	802	1032	725	987.2
7	Turbidity	1.8	1.6	3.40	2.9	5.0
8	Cl	93	31	120	56	90
9	Fl	0.547	0.747	1.50	0.356	1.39
10	Iron	0.2	0.08	0.06	0.16	0.04
11	Nitrate	8.5	9.8	6.8	5.6	8.8
12	Supphate					

PH VALUES

HARDNESS

E.C.

TURBIDITY

CHLORIDE

FLUORIDE

TOTAL DISSOLVED SOLID

IRON

ALKANITY

SULPHATE

ALKANITY
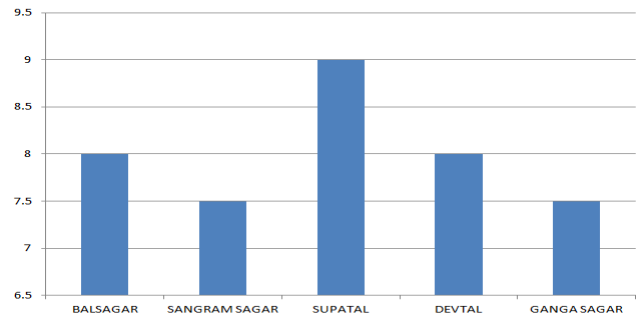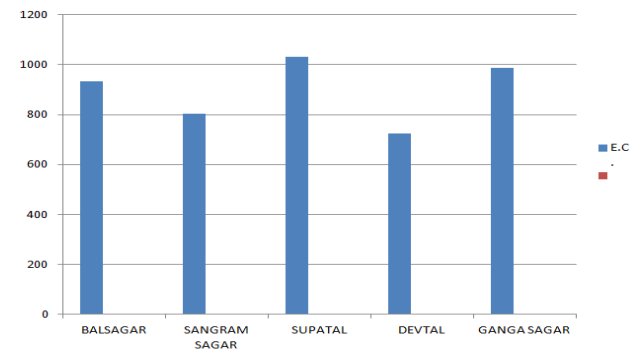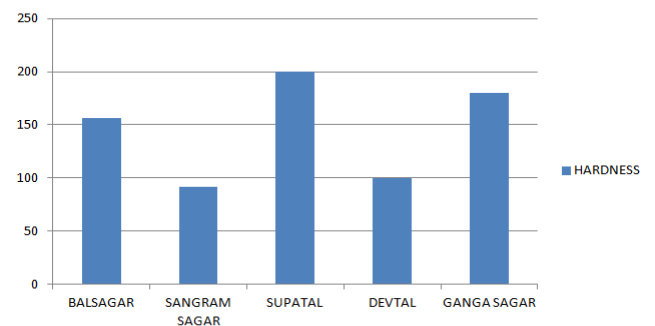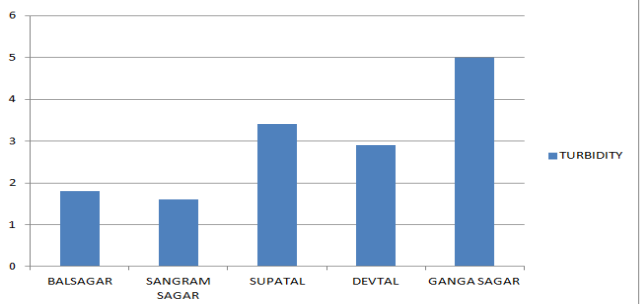
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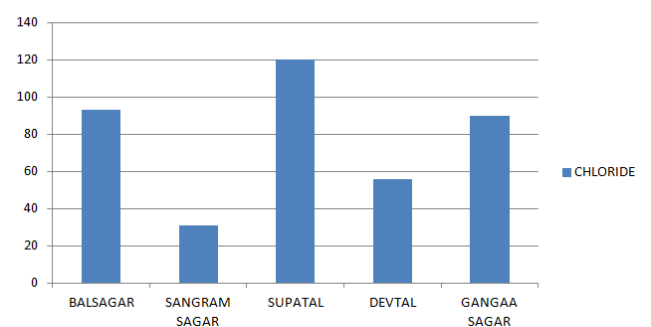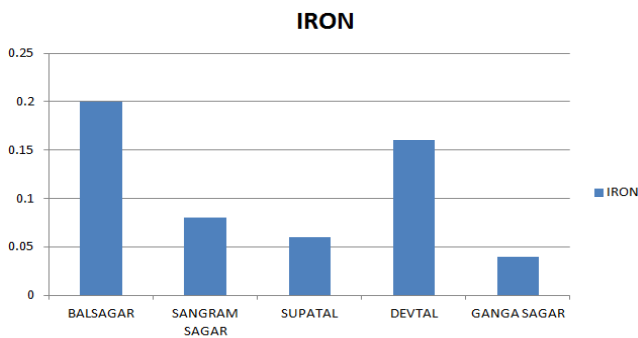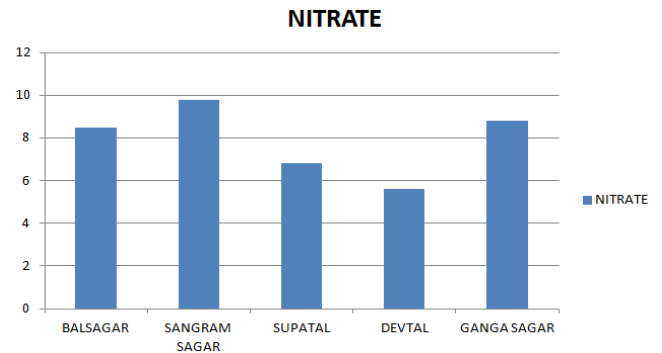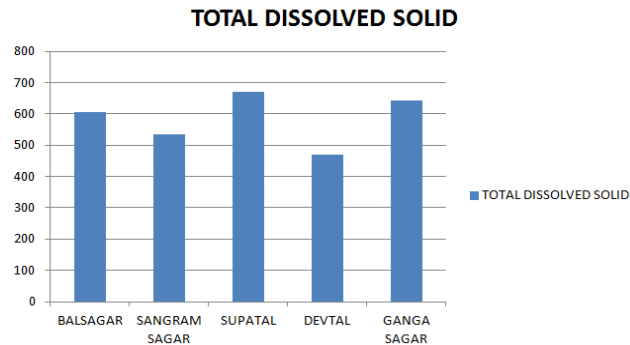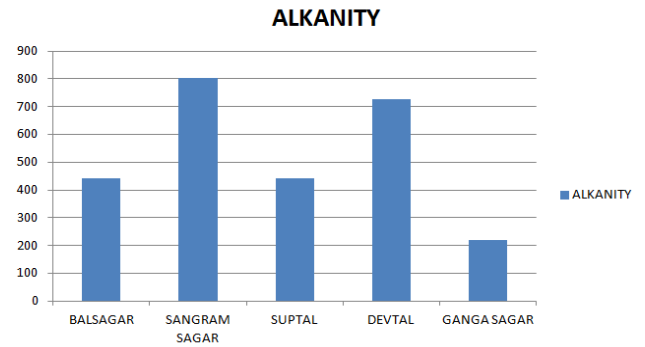
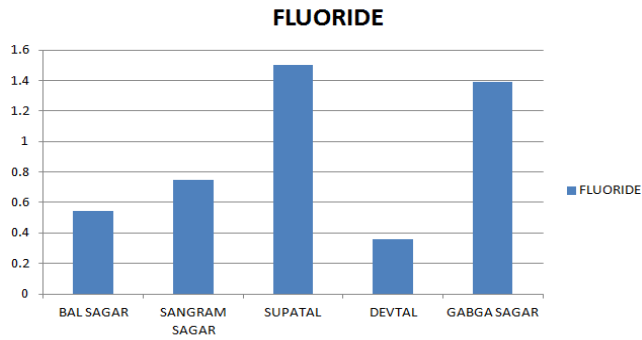## 3. CONCLUSION

Studies carried out in present investigation revealed that one of the most important causes of water pollution is unplanned urban development without adequate attention to suitable management of sewage and waste material. Lake Conservation Authority of Madhya Pradesh has done a survey to measure the quality of water of some lakes of Jabalpur and it is observed that almost all the lakes of Jabalpur are affected with pollution. The present study shows that the Water quality index (W.Q.I.) of lakes of Jabalpur exceeds 100 this water is not suitable for drinking and other purposes and the water of these lakes are suffering from pollution. Supatal Lake & Ganga sager lake is also much polluted due to the sewage waste coming from the surrounding area and due to municipal and sewage. On the basis of results of research civil engineering structure which control the pollution in lake. To control the pollution in lake through major sewers by Intercept and treat all sewage at Intersection of lake by volume. Divert some and Intercept the others. Treat remaining sewage at intersection of lake. Install sewage treatment network upstream at sources and Intercept for final Treatment at Lake. And to control pollution in lake through minor drains by Connect to main sewers as per gradient or lift stations. Cluster drains in pockets and treat before discharge into lake. Connect Drains to points and lift stations for treatment nearby lakes.
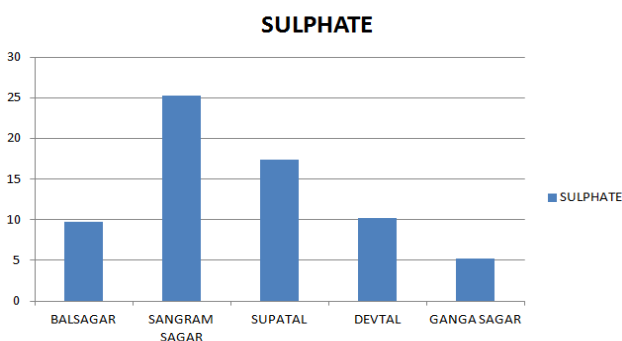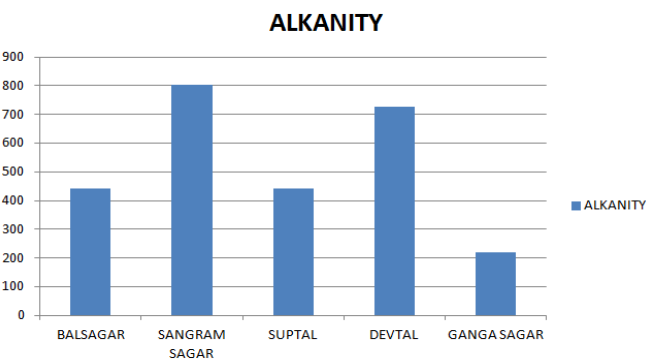
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