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Study on Quality of Surface Water at Three rivers in Etawah District

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Abstract

Yamuna River is one of the most polluted rivers of the India. It originates from Yamunotri glaciers in the lower Himalayas at an elevation of approximately 6387 meters. River can be divided into five segments on the bases of hydrological and ecological conditions. Water quality of only one segment (Himalayan segment) meets the river water quality standards. Water is the basic unit of life and it is essential element for all living forms and the environment health. Water is the basic unit of life and it is essential element for all living forms and the environment health. Rivers are essential for all living organism on earth. In this study, we screened the point of contamination of pollutants in Chambal river water and their concentration in different season. Present study revealed that water quality parameters (pH, EC, Chloride, Fluoride, TDS, DO, COD, BOD etc) of some sample site showed contamination and depletion in quality of Chambal River in pre monsoon. This chapter deals with in result obtained by conducted the experiment in laboratory on "Quality of surface water" along with physico-chemical properties of surface water and compared with its standard data of different organization. Etawah district is revealed and conducted that all water samples collected and were that compared with WHO standards and Indian standards. The pH, CL^-, Fe^{++}, and F^- are within the permissible limit prescribed by ISI, and WHO. Considering the data shown in the table 4.1, the overall surface water quality of the study area is some suitable for drinking purpose and more suitable for irrigation purpose.

Key word: Surface Water, physico-chemical, contamination, and ecological conditions.

INTRODUCTION

The average annual rainfall of the country is about 119 cm which gives a total volume of rainfall of about 400 million hectare meters over the total geographical area of about 329 million

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hectares. Out of this 70 million hectare meters is last to atmosphere as evaporation. Of the remaining 330 million hectare meters, about 115 million hectare meter flows as surface runoff and the rest 215 million hectare meters infiltrates in to the ground. Out of the infiltrated water, about 165 million hectare meters is retained in the top soil layer as soil moisture and helps in the plant growth. A major portion goes to the atmosphere as evaporation loss and small percentage moves to the surface by capillary action and evaporates. Remaining 50 million hectare meters percolates down and contributes to ground water reservoir.

Without water life of living any beings is not possible (such as animals, flora and funa). Everyday increasing the requirement of freshwater and the availability of freshwater on the earth around **3600Km** which return to the oceans as runoff. Freshwater is the need of human beings as well as animals. The development of human and animals depends upon the quality of water because if plants having the good quality of water then plant gives good yields or vice versa. **97%** water available in the ocean and remaining **3%** is the freshwater, of which **75%** is located at the poles of the earth in the form of ice and glaciers, **24%** lies buried as the groundwater. The water is essence of life and remaining 1% constitutes the freshwater available on the land surface in the form of rivers, lacks, reservoirs, soil moisture and some part of it in the atmosphere and Freshwater availability on the earth 0.72% which not efficient for drinking and irrigation purposes. Day by day freshwater decreased due to pollution. According to **World Health Organization & Indian Standards Institution** gave some various Physico-Chemical increase properties like **pH, Ca^{++}, Mg^{++}, Na^{+}, K^{+}, CO_3^{-}, HCO_3, SAR, TDS, RSC & Turbidity** of surface water for different purposes.

Water is the most abundant substance on the earth. The principle constituent of all living things, and major force constantly shaping the surface of the earth. It is also a factor in air-conditioning the earth for human existence and in influencing the progress of civilization, which treats all phases of the earth's water, is a subject of great importance for people and their environment practical application of hydrology are found in such tasks as the design and operation of hydraulic structures, water supply, wastewater treatment and disposal, irrigation. drainage, hydropower generation, flood, navigation, erosion and sediment control, salinity control, pollution abatement, recreational use of water, fish and wildlife protection. The roll of applied hydrology is to help analyze the problems involved in these tasks and to provide guidance for the planning and management of water resources. The hydro-sciences deal with the water of the earth, Also there distribution and circulation, there physical and chemical properties, and there interaction with the environment, including interaction with living things and in particular, human beings, hydrology may be considered

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to encompass all the Hydro-sciences, or defined more strictly as the study of the hydrologic cycle, that is the endless circulation of water between the earth and its atmosphere. Hydrologic knowledge is applied to the use and control of water resources on the land areas of the earth; ocean water are the domain of ocean engineering and the marine sciences.

Checking the water samples and obtained the physic-chemical properties of water and compare with ISI and WHO. The main objectives of our research work are following.

MATERIALS AND METHODS

The chapter deals with the methodology adopted for the study of "water quality test for human health as well as animals" with the experiment conducted in the laboratory of U.P. Jal Nigam office, Etawah and Indian Institute of soil and water conservation research centre Chhaleser Agra (ICAR). The water analyzer was used to measure the physical and chemical parameters of water and the experimental site and collection of water samples.

Experimental Sites and Geographical Characteristics of the Area These experiments were conducted in the laboratory of U.P. Jal Niagm office Etawah and Indian Institute of soil and water conservation research centre Chhaleser Agra (ICAR). For conducting the research project, we have selected three rivers of Etawah district and place are Bhareh, Udi, Amritpur and Yaseen Nagar.

The **Yamuna** first touches the frontier of the district at the village of **Bawat** in the north-west of tahsil **Etawah** at 24 Km. It forms the boundary between the district **Agra** and then continues in a winding course, with a south-easterly direction, till it describes a remarkable curve near the village of **Harauli** before it unites its waters with those of the **Chambal** at **Bhareh**. Rain forced at this point by the latter stream it turns abruptly to the south and then once more sweeps eastward and then forward its course lies almost due east, and it forms the common boundary of this district and **Jalaun**. The total length of the **Yamuna** in the district is about 112 Km. The bank of one side is unusually steep and precipitous whilst on other it is low and upon to the overflow of the river in the rains. For this reason the river spreads much in times of flood, and the surface velocity being small it covers a large area with a rich alluvial deposit in the rains. This natural tendency of the **Yamuna** to undulate the land along its banks is increased by the action of its tributary, the **Chambal** which rushing into it almost at right angles, throws lack by its greater volume and velocity the waters of the **Yamuna** and acts for the time as a sort of weir which still further retards that river.

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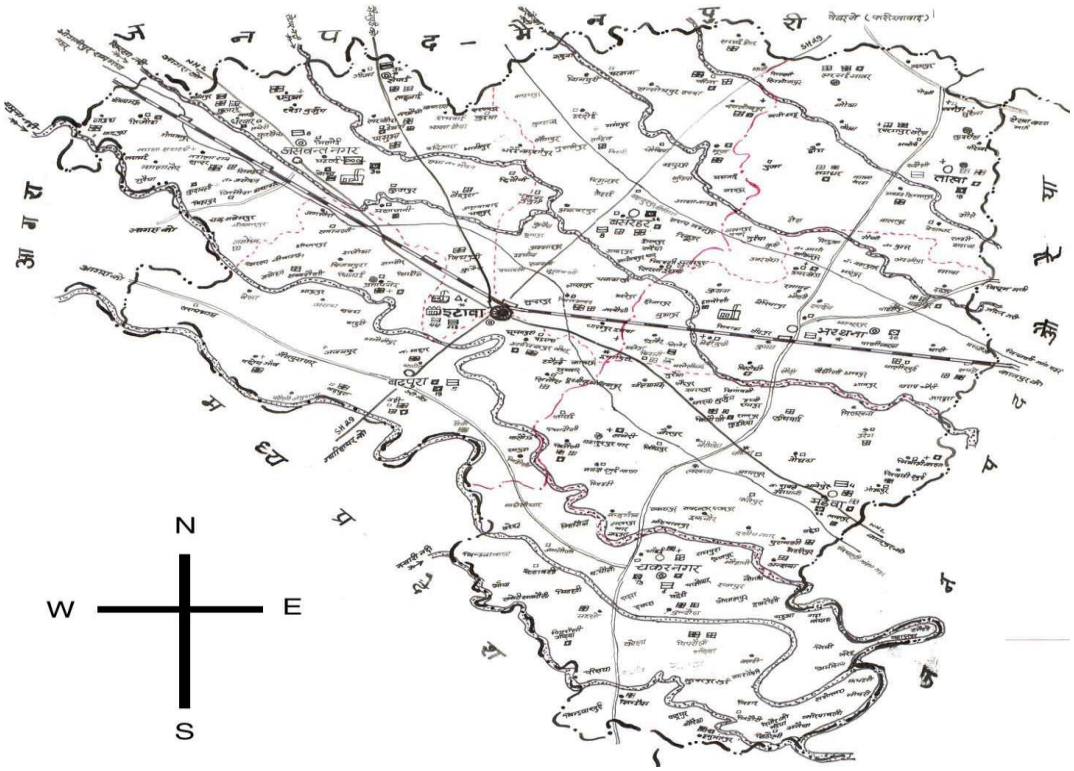

Map Showing the different Villages, Blocks & rivers system of Etawah District

Water Sampling:

The samples were collected at various rivers of Etawah district (Yamuna, Chambal and Sengar) after collecting the sample according to the distance difference. These samples take in two liter plastic bottles with necessary precautions. The sampling and analysis work for this study has been started at July 2016 to finish in December 2016.

Sample Collection:

Before the sampling the bottle has been 2 to 3 times rinsed and sample is examined after the samples were collected from different river of Yamuna, Chambal and Sengar.

The sample collection and analysis for drinking and irrigation purposes. This water collection according to the different distances at the different point of the rivers.

Sample Container:

For sampling use plastic bottle before the sampling this bottle soaked HCL and distilled water whereby control the reaction of sampling water and this bottle.

Determination of Physical parameters

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Colour:

In natural waters, colour may occur due to the presence of humic acids, folic acids, metallic ions, suspended matter, phytoplankton, weeds and industrial effluents. There are two methods, to determine the colour of the water, first one is Platinum-cobalt method and second is Forel-Ule colour scale method.

For the analysis of colour parameters the following mathematical expression has been given below:

$$\text{Colour (unit)} = \text{Estimated colour} \times \text{Dilution factor}$$

Turbidity:

Turbidity can be measured by its effect on the scattering light, which is termed as Nephelometry, Turbidimeter can be used for sample with moderate turbidity and nepelometer for sample with low turbidity. Higher the intensity of scattered lights higher the turbidity

Determination of Chemical parameters

Estimation of pH value:

The pH of a solution is measured as negative logarithm of hydrogen ion concentration. At a given temperature, the intensity of the acidic or basic character of a solution is indicated by pH or hydrogen ion concentration. pH values from 0 to 7 are diminishing acidic, 7 to 14 increasingly alkaline and 7 is neutral.

Estimation of Total Dissolved Solids (TDS):

A large number of salts are found dissolved in natural water, the common ones are carbonate, bicarbonates, chloride, sulphates, phosphorous, etc. A high content of dissolved solids elevates the density of water, influences osmo-regulation of fresh water for drinking, irrigational, and industrial purposes. This factor, having value in such waters, is often expressed as g/l or ppt. For the determination of TDS, the following formula is used as:

$$\text{TDS (g/l)} = \frac{(A-B)}{V} \times 1000$$

Where,

TDS = total dissolved solids,

A = final weight of evaporating dish (g),

B = initial weight of evaporating dish (g),

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V = volume of sample taken (ml).

Biochemical Oxygen Demand (BOD):

BOD is a measure of organic material contamination in water, specified in mg/L. BOD is the amount of dissolved oxygen required for the biochemical decomposition of organic compounds and the oxidation of certain inorganic materials (e.g., iron, sulfites). Typically the test for BOD is conducted over a five-day period (Milacron Marketing Co.)

BOD, mg/1= (D0-D3) X Dilution factor

Where,

DO=Initial DO in the sample.

D3= DO after 3 days.

Total Hardness

Hardness is predominately caused by divalent cations such as calcium, magnesium, alkaline earth metal such as iron, manganese, strontium, etc. The total hardness is defined as the sum of calcium and magnesium concentration, both expressed as CaCO3 in mg/L. Carbonates and bicarbonates of calcium and magnesium cause temporary hardness sulphates and chlorides cause permanent hardness.

Hardness chart (for drinking water):

S.N.	Drinking water	Amount
1	Soft	0-60mg/l
2	Medium	60-120mg/l
3	Hard	120-180mg/l
4	Very Hard	$< 180 mg/l$

Total Hardness as ($CaCo_3$; mg/l) $= \frac{T \times 100}{V}$

Where,

T= Volume of titrant

V= Volume of sample

RESULTS AND DISCUSSION

This chapter deals with in result obtained by conducted the experiment in laboratory on "**Quality of surface water**" along with physico-chemical properties of surface water and compared with its standard data of different organization. The samples are collected from different rivers of different

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place of Etawah district for the evaluation of quality of surface water for irrigation and drinking purpose. The results are discussed under following heads:

Suitability of surface water for irrigation purposes:

Physico-chemical properties of surface water samples from different rivers of different place of Etawah district as shown in table 4.1 to 4.8 and found various parameters of selected samples.

Details Analyzed data are given in following Table:

Table 1 Comparative test data of sample for various rivers (Yamuna, Chambal and Sengar)

S.N.	1	2	3	4	5	6	7	CPH EEO	WHO	I.S.I
Place	Bhareh			Udi		Amritpur	Yaseen nagar			
Source	Y*	Ch*	Y+Ch	Y	Ch	Sengar	Sengar			
Chloride	562.5	237.5	537.5	587.5	225	225	137.5	200-1000	500-1000	500-1000
Total Hardness	307.5	200	427.5	382.5	292.5	405	312.5	200-600 ppm	200-600 ppm	300
Iron	0.06	0.05	0.185	0.20	0.005	0.085	0.058	0.10-1.0	----	----
Nitrate	215	59	240	235	160	68.5	139	< 45	< 46	< 45
Fluoride	0.60	0.80	0.75	1.135	1.2	0.40	0.50	1.0-1.5	1.0-1.5	1.0-2.0
Residual chlorine	0.175	0.05	0.165	0.03	0.1	0.015	0.02	0.2-1.0	0.2-1.1	0.2-1.5
pH	7.7	7.15	7.55	7.75	6.45	8.1	5.45	7.0-8.5	6.5-9.5	6.5-9.5
Turbidity	15	7.5	15.5	15	13.5	6.5	7.5	< 5	< 5	10
Colour	None	None	None	None	None	None	None	None	None	None

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Taste	Non Agreeable	Non agreeable	Non agreeable	Non agreeable	Non agreeable	Non agreeable	Non agreeable	Tasteless	Tasteless	Taste less
Odour	Yes	None	Yes	Yes	None	None	None	None	None	None

All parameters are in mg/l except Ph and Turbidity .Turbidity in N.T.U.Source: U.P Jal Nigam Etawah.

*** Y =Yamuna, Ch=Chambal**

PH:

pH is a measure of the acidity or alkalinity of the water. The pH for irrigation water generally lies between 5.5 and 8.7. Water with a pH less than 7.0 is considered acidic, while pH greater than 7.0 is considered basic (alkaline). When a pH level is 7.0, it is considered neutral and fig. which is indicated below.

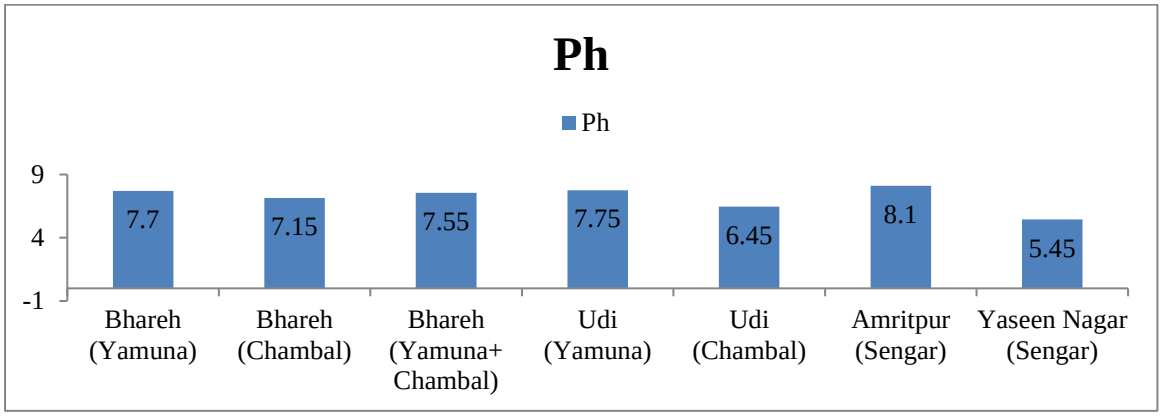

Fig. 1 bar diagram showing the pH value of the different sample.

Chlorine:

Chlorine is widely used to disinfect drinking water as the final step in the water treatment process. Chemical disinfection using chlorine has the benefits of being relatively quick, simple, and inexpensive. It also allows a residual amount of chlorine to remain in the water to provide some protection against subsequent contamination. The Objective of chlorination is to add enough chlorine to leave 0.2 – 0.5 mg/L FRC after half an hour contact time. Factors influencing the effectiveness of chlorine as a disinfectant are concentration, contact time, pH, temperature and the presence of organic matter in the water. All of these factors can vary day to day and in different seasons.

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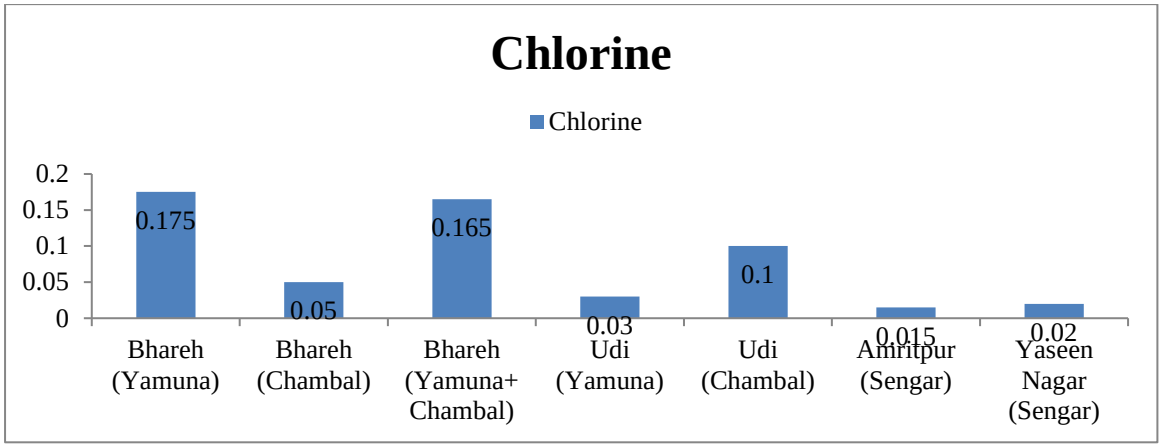

Fig. 2 Bar diagram showing the chlorine value of the different Sample.

Fluoride:

Fluoride can naturally occur in surface water and some surface water. Irrigation water is normally the major source of fluoride exposure, with exposure from diet and from burning high fluoride coal also major contributors in some regions. High levels of fluoride can be found naturally in many areas of the world including, Africa, the Eastern Mediterranean and southern Asia. One of the best known high fluoride areas extends from Turkey through Iraq, Iran, Afghanistan, India, northern Thailand and China.

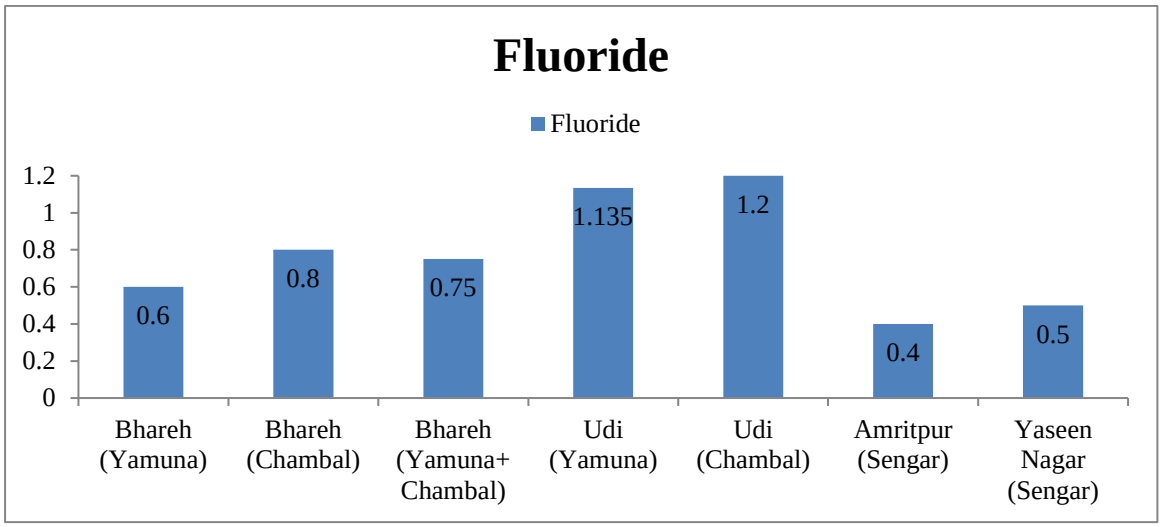

Fig. 3 Bar diagram showing the fluoride value of the different sample.

Turbidity:

Turbidity is the cloudiness of water that is caused by suspended particles. An increase in turbidity means that there is increased cloudiness. Turbidity is usually caused by suspended particles of sand,

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silt and clay. Nephelometers measure the intensity of light scattered by the suspended particles. The result is a measurement of turbidity in nephelometric turbidity units (NTU). The WHO Guideline for turbidity in drinking water is less than 5 NTU. A simple test to measure the turbidity is to use a 2 L clear plastic bottle filled with the sample water. Place this on top of large print such as the CAWST logo on this manual. If you can see this logo looking down through the top of the bottle, the water probably has a turbidity of less than 50 NTU.

Colour:

Colour in drinking water may be due to the presence of coloured organic substances and certain metals such as iron, manganese and copper. In general, colour of a water sample is evaluated by simple visual observation. It can also be measured by visual comparison with a series of standard solutions.

Odour and Taste:

In general, odour and taste are evaluated by observation. When smelling a water sample from an unknown source, do not breathe the odour in directly. Use our hand to gently waft the vapours towards our nose. Never drink a sample from an unknown source. Drinking Water Quality Testing Section 4 Physical Contaminants.

SUMMARY AND CONCLUSION

After analyzing the various water samples collected from various Rivers (Yamuna, Chambal and Sengar) of Etawah district is revealed and conducted that all water samples collected and were that compared with WHO standards and Indian standards. Surface water quality in the three rivers of Etawah district of U.P. has been analyzed in the present study. It is observed that all surface water samples were under the permissible limit of total hardness, Chloride and pH etc. recommended by ISI and WHO. The observed minimum and maximum values of various physico-chemical properties of surface Water Samples are discussed below:

Table 5 Range of physicochemical parameters of surface water samples.

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S.N.	Parameter	Minimum value	Maximum value
1.	Chloride	137.5	587.5
2.	Total hardness	200	427.5
3.	Iron	0.005	0.20
4.	Nitrate	59	240
5.	Fluoride	0.40	1.20
6.	Residual Chlorine	0.015	0.175
7.	Ph	5.45	8.1
8.	Turbidity	6.5	15.5

The pH, CL^{-}, Fe^{++}, and F^{-} are within the permissible limit prescribed by ISI, and WHO. Considering the data shown in the table 4.1, the overall surface water quality of the study area is some suitable for drinking purpose and more suitable for irrigation purpose. The surface water quality does not show any rejection trend in any direction. It is recommended that the surface water may be used for drinking and some other purposes without any suitable treatment.

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