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Determination of Water Quality Index of Drinking Water in Aligarh District, UP, India

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ABSTRACT

Water is perhaps the most precious natural resource after air. Though the surface of the earth is mostly consists of water, only a small part of it is usable, which makes this resource very limited. This precious and limited resource, therefore, must be used with prudence. As water is required for different purposes, the suitability of it must be checked before use. Nowadays fresh water cannot be used directly for drinking purposes due to contamination and pollution. So treatment is used before it is used for drinking or for industrial processes. Also, sources of water must be monitored regularly to determine whether they are in sound health or not. Poor condition of water bodies are not only the indictor of environmental degradation, it is also a threat to the ecosystem. In industries, improper quality of water may cause hazards and severe economic loss. Thus, the quality of water is very important in both environmental and economic aspects. Thus, water quality analysis is essential for using it in any purpose. The quality of water depends upon its source of history. The history of water signifies the terrain through which water is flowing, its origin and most important the extent to which it is contaminated on its way by impurities, sediments and industrial waste. The solubilisation and fragmentation of the terrain through which it flows determines its quality. The extent of dissolved solid materials present in water decides its quality. Such quality is also decided by the solubility of the geological deposits, contact of water with sediments, time of interaction and special factors related to environment. To ascertain suitability of water for consumption, it is necessary to undertake examination of quality of water. . Major information on the quality of water is obtained by physical examination. considered in the present paper for calculating the WQI such as pH, Total alkalinity, Calcium, Magnesium, Chloride, Sulphate, Nitrate and also

calculated the seasonal variations of physio- chemical parameters of water quality of Aligarh District.

Keywords : Water Quality Index, Physico-Chemical Parameters, Water Quality Standards.

I. INTRODUCTION

The total amount of water on surface of earth is 3.5 *1020 gallons of which 97% is found in sea while fresh water is only 37 million km3. Of this 0.8% occurs in polar ice water which percolates in ground is called 'ground water' and it emerges on surface of earth as river or lake water.This situation clarifies the essential need of water even for the most primitive man while it is true that the water is the basis of all life and an absolute necessity for all varied activities like domestic, agricultural and industrial for which no substitute can be devised. One can seldom fully aware of these implications of this truth and of the countless direct and indirect ways in which we have to depend on water even in the modern scientific era (Bilas, 1981). Along with all the intensive activities in promoting hydrology and water resources, there has been a tremendous increase and expansion in the scientific and technological knowledge about water, and there is great need for an authoritative compilation of such knowledge. Since water is related to so many things in nature as well as in human society.

India is endowed with a rich and vast diversity of natural resources, water being one of them. Without food, human can survive for a number of days, but water is such an essential that without it one cannot survive. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. Among the all water sources, the ground water is an important and most reliable source of water supply throughout the world. In some areas of the world, people face serious water shortage because groundwater is used faster than it is naturally replenished. Human development and population growth exert many and diverse pressures on the quality and the quantity of water resources and on the access to them. Water quality monitoring and assessment is the foundation of water quality management; thus, there has been an increasing demand for monitoring water quality of many rivers and ground water by regular measurements of various water quality variables. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems. In recent years, because of continuous growth in population, rapid industrialization and the accompanying technologies involving waste disposals, the rate of discharge of the pollutants into the environment is far higher than the rates of their self-purification capacity.

Table 1 : Water standards and recommending agencies

S.No.	Parameters	Standards
1	pH	6.5-8.5
2	Magnesium (mg/l)	30
3	Calcium (mg/l)	75
4	Sulphate (mg/l)	150
5	Chloride (mg/l)	250
6	Nitrate (mg/l)	45
7	Electrical Conductivity (EC µS/cm at 25°C)	300

Study Area

Aligarh, city, western Uttar Pradesh state, northern India. It lies at the southern edge of the Upper Ganges-Yamuna Doab, about 65 miles (100 km) southeast of Delhi and some 25 miles (40 km) southwest of the Ganges (Ganga) River. The city itself is usually called Koil or Kol; Aligarh is the name of a nearby fort

The district Aligarh belongs to the administrative division Agra, U.P. and lies between 27'-29'11" north' latitude and 77'29'-78'26 east longitude.

Two objective have taken for this present research work:

1. To analyse the status of water quality and their quality index of various stations in Aligarh District.
2. To recognise the causes and source of water deterioration in the study area.

Discussion and Results

WQI is established through the measurement of various important physico-chemical parameters of the drinking water (Table 2). The physico-chemical parameters of sixteen different stations (S1, S2, S3, S4, S5, S6…….S10) are summarized (Table 3). There are some remarkable variations of physico-chemical data are found at all the sixteen sampling sites in study area (District Varanasi). Some hidden forces like temperature changes in season to season which are sometimes more controlling to some parameters like electrical conductivity, pH etc.

Table 2 : Water Quality Status based on WQI.

S. No.	Water Quality Index	Status of Water Quality
1	0 – 25	Excellent Water Quality
2	26 – 50	Good Water Quality
3	51 – 75	Poor Water Quality
4	76 – 100	Very Poor Water Quality
5	> 100	Unfit for Drinking

pH : pH, quantitative measures of the acidity or basicity of aqueous or other liquid solutions.pH is helpful for the determination of acidity and alkalinity of water.pH of pure water is about 7 at 25° C which is known as pH is normal (Bates, 1973). Acidic water pH value is less than pure water. Excessive acidity or alkalinity is not good for drinking water uses. In Varanasi district highest pH value recorded is 8 at S16 (Cholapur block) while lowest is 7.2 at the station S14. There are no direct adverse effects on health of pH, higher values of pH has reduces the scale formation in water heating apparatus and also reduce germicidal potential of chloride.

Table 3 : physico-chemical parameters of Drinking water samples (mg/l) except pH and EC.

Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Potential of Hydrogen (pH)	7.30	7.60	7.50	7.60	7.46	7.50	7.61	7.68	7.24	7.35
Magnesium (Mg)	19.5	43.8	43.8	41.4	31.6	14.6	29.2	51.1	77.8	43.8
Calcium (Ca)	80.2	36.1	52.1	32.1	48.1	56.1	60.0	40.0	68.0	44.0
Sulphate (SO4)	22.0	41.0	58.0	38.0	7.1	2.3	2.0	1.6	95.0	48.0
Chloride	21.3	63.8	70.9	28.4	14.2	7.1	21.3	28.4	113.	120.7

(Cl)									6	
Nitrate (NO3)	39.0	32.0	2.7	0.8	1.7	1.3	2.0	5.6	102	0.6
Electrical Conductivity (EC µS/cm at 25°C)	780	1205	1002	999	610	610	700	780	1550	1180

Magnesium : Magnesium hardness particularlyassociated with the sulphate ion has laxative effect on persons who have unaccustomed to it (Khursid, 1998).Magnesium less than 150 mg/l daily are generally safe for most adult aging population. Very large amounts, magnesium is possibly unsafe for body.The observed average value of the magnesium is43.24 mg/l throughout the city. The highest magnesium concentration is
77.82 mg/l at station S9 and lowest value is 14.592 at station S4.

Calcium : This parameter of drinking water depending upon the types of rocks. Small concentration of calcium is reducing corrosion in water pipes.Calcium is one among the most abandon ions in fresh water and plays a pivotal role in shell construction, bone building and plant precipitation. In Varanasi district highest amount of calcium content in water was recorded 144mg/l at the station S15. Whereas the lowest amount of calcium is 32.064 mg/l at station S4 recorded during the same season due to calcium being absorbed by a large number of organisms.

Sulphate : Low concentration of sulphate does not affect the taste of water. Accepted limitation of sulphate concentration varied between 2 mg/l to 163 mg/l. Average concentration of sulphate ion is 36.9 and highest value has been recorded 102 mg/l at station S10 during the same season. The overall observed value of sulphate is near about equal compared to standard value.

Chloride : The concentration of chloride can be related to purity or impurity of water. The high chloride concentrations indicate the presence of organic matter presumably of animal origin (Tresh, et al., 1944). Average chloride concentrations in Varanasi district is founded 67.799 mg/l. The highest chloride concentration is163mg/ l which is below Nitrate : Nitrogen is important to all life. Nitrogen cycle is the main drawing force for distributing the nitrogen in nature. Nitrogen in the atmosphere or in the soil can go through many complex chemical andbiological changes. It can be combined into living and non- living materials and return back to the soil or air in continuing cycle called the nitrogen cycle. The highest amount of nitrate has been recorded 115 mg/l at S15 stations, due to the possible influx of nitrogen rich water into the lake water from the large amount of contaminated sewage water.

Electrical Conductivity (EC µS/cm at 25°C) : EC help to determine the strength of hydroponic solution. According to ICMR Standard value of EC is 300 µS/cm in drinking water. EC value founded between 610 to 1739µS/cm in study area which are more than standard value which is recommended by ICMR that is 300 µS/cm. Highest value of electrical conductivity 1739µS/cmat S15 station, whereas lowest value is 610µS/cm.Average EC value is 1005µS/cm in Aligarh district.

Conclusion

The WQI method is more methodological and facilitates the comparative evaluation of drinking water quality of several sampling sites. It is found that the drinking water on 55.56 percentsampling stations are good inquality and 22.23 percent has been founded poor water quality. Only 11.12 percent of drinking water is unfit for drinking. It is clearly indicates thatmore than 50 percentwater samples is good and potable in quality. Total number of 7 station'sWQI values indicates that the status of water quality is not appropriate for drinking purposes and therefore prior treatment is required before use. S5 and S6 stations (out of Aligarh city) showing excellent water quality. Most of the part in the study area (hazara nahar) found good water quality. Due to bad sanitation systems, lack of awareness for conservations and cleanliness of water resource in Talanagri Aligarh are of very poor at quality parameter

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