

Integrated Study of Physico-Chemical Quality Parameters of Water at Lucknow

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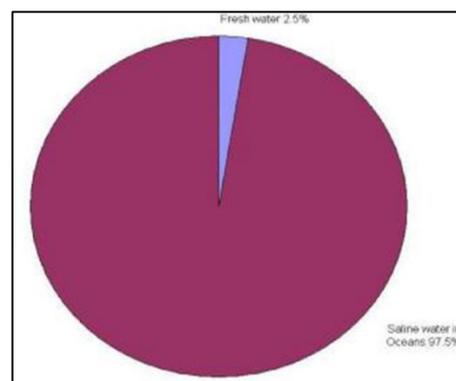
Abstract— This study was aimed to determine the current status of river Gomti along the Lucknow stretch, which includes tests for temperature, pH value, total solids, total suspended solids, hardness, acidity, alkalinity, chloride, chlorine, jar test, BOD and DO. Rourkela is one of the most important industrial complexes in the state of Orissa which has Integrated Rourkela Steel Plant, a number of sponge iron industries, cement manufacturing unit, chemicals, explosives, ceramics and distillery units and large number of small and medium industries. A water quality standard is a rule or law comprised of the uses to be made of a water body or segment and the water quality criteria necessary to protect that uses. The average temperature, concentration of pH, turbidity, TDS (Total Dissolved Solids), TSS (Total Suspended Solids), DO (Dissolved Oxygen), BOD (Biochemical Oxygen Demand), total hardness, alkalinity and chloride are found to be 27.38 °C, 7.37, 2.438 NTU, 156.8 mg/l, 2.653 mg/l, 42.156 mg/l, 3.6 mg/l, 8.65 mg/l, 102.3 mg/l and 21. mg/l respectively. The results obtained from the water quality criteria parameter are within the drinking water standard. (IS: 10500).

Keywords: Water Quality, IS: 10500, pH, Hardness, Total Solids, Total Suspended Solids, Residual Chlorine Alkalinity, Turbidity, BOD, Dissolved Oxygen, Chloride

I. INTRODUCTION

Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70 % of water. But due to increased human population, industrialization, the use of fertilizers in the agriculture and man-made activity, it is highly polluted with different harmful contaminants. Therefore, it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varying of water borne diseases. It is difficult to understand the biological phenomenon fully because the chemistry of water reveals much about the metabolism of the ecosystem and explain the general hydro - biological relationship. Water pollution is a serious problem in India as almost 70 per cent of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs. This shows that degraded water quality can contribute to water scarcity as it limits its availability for both human use and for the ecosystem. Due to growth of population, agriculture, and industries, demand for domestic water has increased many times during the last few years. Improper waste disposal and over exploitation of resources has affected the quality, not only of tap water, but also of ground water, Industrial waste and the municipal solid waste have emerged as one of the leading causes of pollution of surface and

ground water. In many parts of the country available water is rendered non-potable because of the presence of heavy metal in excess. The situation gets worsened during the summer season due to water scarcity and rain water discharge. Contamination of water resources available for household and drinking purposes with heavy elements, metal ions and harmful microorganisms is one of the serious major health problems. Generally, most pollutants are introduced into the environment as sewage, agricultural waste, domestic waste, industrial waste, accidental discharge and as compounds used to protect plants and animals. Pollution occurs when a product added to our natural environment adversely affects nature's ability to dispose it off. A pollutant is something which adversely interferes with health, comfort, property or the environment of the people. Generally, most pollutants are introduced into the environment as sewage, agricultural waste, domestic waste, industrial waste, accidental discharge and as compounds used to protect plants and animals. There are many types of pollution such as air pollution, sound pollution, water pollution, oil pollution and soil pollution. Since last few years, continuously growing population, fast pace of industrialization and the simultaneous techniques of waste disposal have been responsible for the discharge of pollutants into the water bodies, resulting in rapid contamination of water. Moreover, the rate of contamination of water is much faster than the processes of its purification². The analysis of the physicochemical properties of water, assist in analyzing the structure and functions of water bodies³. The physical, chemical and biological characteristics of water are the decisive factor for defining the suitability or non-suitability of water for consumption, irrigation or industrial uses^{4,5}. Considerable number of researches have been made in this direction, which focus on how anthropogenic activities, mainly agricultural and industrial processes, result into the contamination of groundwater^{6,7}. The industrial effluents and disposed sewage water are the main causes of groundwater contamination. Degradation of groundwater quality initiates from a diffuse source and later on covers a larger area. For instance, the percolation of various chemicals from the agricultural fields, septic tanks, dumping areas, etc., can result in contamination of groundwater aquifers of immense size.



Pollutants such as herbicides, pesticides, fertilizers and chemicals can make their way in to the river through drains of the whole city. This situation is really harmful for those areas where river water is the only source of drinking water; like Lucknow city. In present study we did analysis of different samples of water from different sites.

II. STUDY AREA

River Gomti flows through a vast stretch with numerous small and big tributaries and forms a great river before joining the river Ganga at UdyarGhat near Jaunpur district. The water is mainly used for drinking purpose. Irrigation is also an important aspect of this river water. Five water samples from five different locations were selected from upstream to

downstream and analyzed to access the bacteriological pollution in river Gomti, during three seasons and two years. The sampling location description of river Gomti is given below:

- 1) Sample 1- Gomti river water Gomti barrage.
- 2) Sample 2- Gomti river water from Gaughat .
- 3) Sample 3- Gomti river water from Neemsar.
- 4) Sample 4- Gomti river water from Mohan Meankin.

A. Effects of Water Quality Parameter on Human Health

It is essential to ensure that various constituents are within the prescribed limits in drinking water supplies to avoid impact on human health. The main life forms and the domestic animals are affected by alteration in water quality due to natural reasons or anthropogenic reasons.

S.No.	Parameter	Permissible limits	Probable effects
1	PH	7.0-8.5	Indicative of acidic or alkaline waters, affects taste, corrosivity and the water supply system
2	TDS in mg/l	500	It may cause gastro-intestinal irritation in humans. May have laxative effects particularly upon transits and corrosion, and may damage water system.
3	Chloride in mg/l	200	May be injurious to some people suffering from disease of heart or kidneys. Taste, indigestion, corrosion are affected.
4	Sulphaite in mg/l	200	Excess of sulphate in drinking water give rise to gastrointestinal irritation when combined with magnesium or sodium.
5	Nitrate in mg/l	4.5	High levels of nitrate in the drinking water may cause premethoglobinemia blue baby syndrome
6	Fluoride in mg/l	1	Excess dosage of fluoride can lead to bone fluorosis and other skeletal abnormalities
7	calcium in mg/l	75	Causes encrustation in water supply system. While insufficiency causes a severe type of rickets, excess causes concentration in the body such as kidney
8	Magnesium mg/l	30	High concentration may have laxative effect particularly on new users. Its deficiency is associated with structural and functional changes. It is essential as an activator of many enzyme systems.
9	Hardness as CaCo ₃	200	Affects water supply system (Scaling) excessive soap consumption, calcification of arteries.
10	Alkalinity	200	In large quantities it imparts a bitter taste to water.

III. METHODOLOGY

The present study is under taken the residents of the town depend on ground water for their drinking and other domestic and industrial requirements depending upon the water table of the locality. Only those installations are collected for sampling whose water is used for drinking and other household's purposes.

Samples are collected in pre cleaned sterilizes plastic bottles preserved after flushing for about 10 minutes. The samples are brought to the laboratory as soon as possible and analysis is completed within 48 hours to avoid any change in physico - chemical characteristics of the water. All the salts

used for the preparation of reagents and standards are dried at 110°C for 24 hours before use. Distilled water is used to prepare the reagents, dilution standards and as dilution water and borosil glassware are used throughout this study. Physico - chemical analysis is conducted following the Standard methods. The analyzed parameter are color, odor, Turbidity, TDS, Conductivity, pH, Nitrate, Sulphate, Total hardness, Calcium Hardness, Magnesium hardness, Alkalinity, Fluoride, DO, BOD, COD, Arsenic, Potassium.

The parameters are compared with WHO and BIS drinking and household water standards.

IV. RESULTS AND DISCUSSIONS

Sampling station/parameter	Gomti Barrage	Gaughat	Neemsar	Mohan meakin
Temp.	18	19	18	18.6
Colour	Colourless	Colourless	colourless	Colourless
Odour	Odourless	Odourless	odourless	Odourless
pH	7.8	8	7	6.5
Turbidity	23	20	19.8	20

TDS	420	450	623	385
Hardness	160	155	123	161
Chloride	129	135	175	170
DO	1.02	0.6	1.23	0.8
BOD	33	31	19	28
COD	180	155	319	218
MPN	4900	3900	3500	4100

A. Temperature

It is found that the temperature of the water supplied to the hostels, canteens and the institute building are within the permissible limit as per IS:10500. As the result in figure 4.1 shows the temperature of the tap water collected from hall 2, hall 5, HomiBhabha hall of residence, hexagon canteen and institute building during winter.

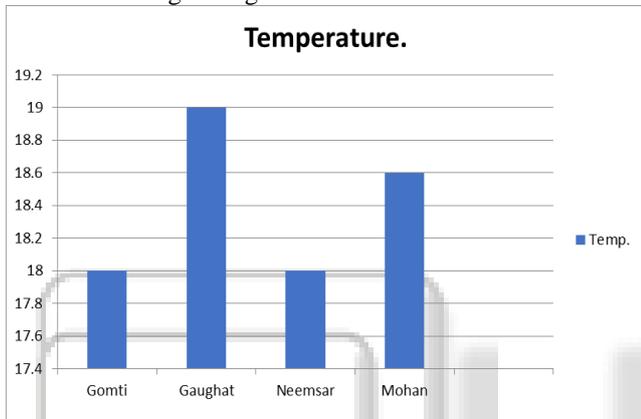


Fig. 4.1: Average Temperature of tap water from different areas during winter

B. pH Value

The pH is a measure of the intensity of acidity or alkalinity and measures the hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples is from 7.32 to 7.53.

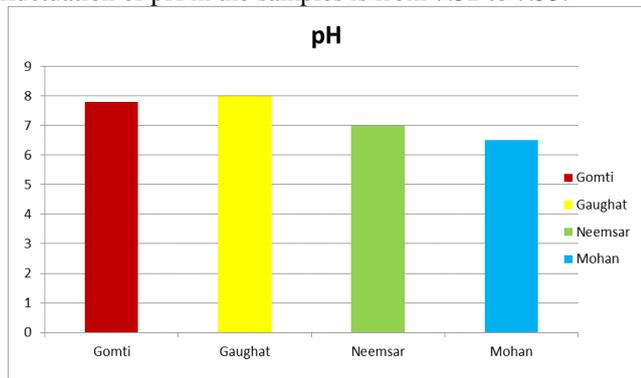


Fig. 4.2: Average pH of the water samples from different areas.

C. Turbidity

Measurement of Turbidity reflects the transparency in water. It is caused by the substances present in water in suspension. In natural water, it is caused by clay, silt, organic matter and

other microscopic organisms. It ranged from 2.31 to 2.56 NTU. However the prescribed limit of Turbidity for drinking water is 5 NTU (IS: 10500). Turbidity was found within the permissible limit in all the water samples.

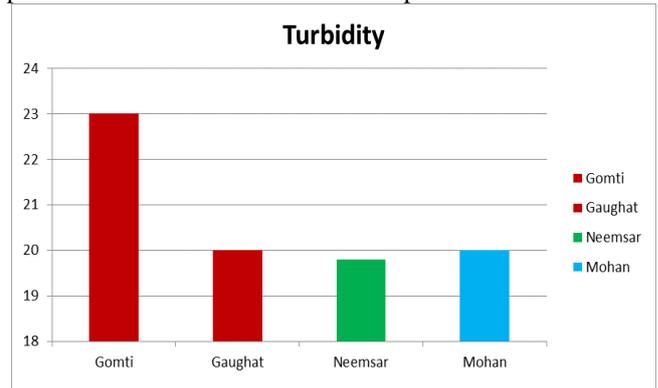


Fig. 4.3: Average Turbidity of the water samples from different areas

D. Total Solids and Total suspended Solids

Total Dissolved Solids may be considered as salinity indicator for classification of groundwater. The TDS in groundwater is due to the presence of Calcium, Magnesium, Sodium, Potassium Bicarbonate, Chloride and Sulphate ions. In the study area TDS varied from 145 to 175 mg/l. As prescribed limit of TDS for drinking water is 500 mg/l, all the water samples have TDS concentration well below the prescribed limit. Total Suspended Solids in the study area varied from 2.419 to 2.863 mg/l.

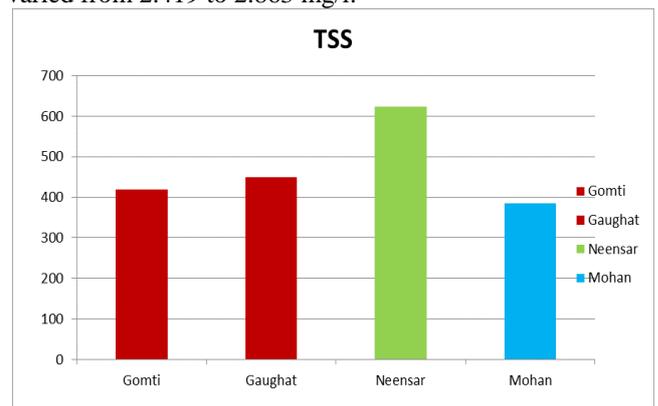


Fig. 4.4: (b) Average Total suspended solids of the samples from the different area

E. Total Hardness

Hardness of water is objectionable from the view point of water use for laundry and purposes since it consumes a large quantity of soap. Based on present investigation, hardness varied from 40.2 to 45.2mg/l. However the permissible limit of Hardness for drinking water is 300 mg/l (IS 10500).

According to Hardness classification (Durfur and Backer, 1964), the no of water samples of the study area can be classified as given in table 4.1. It is found that the water supplied to the hostels, canteens and institute building is soft.

TDS Range	Description
0-60	Soft
61-120	Moderately hard
121-180	Hard
>180	Very hard

Table 4.1: Classification of the water according to hardness.

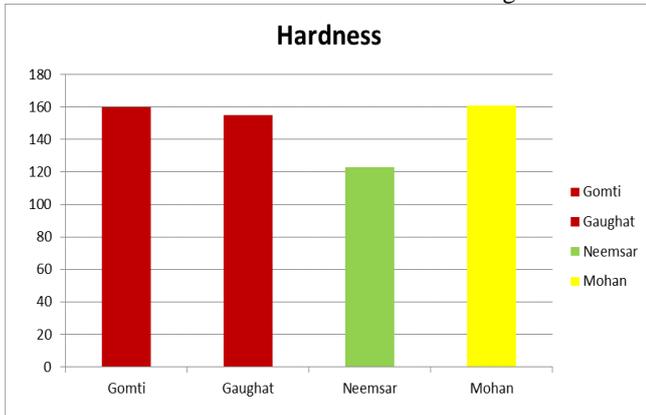


Fig. 4.5: Average hardness of the water samples from different areas.

F. Biochemical Oxygen Demand (BOD)

BOD gives a quantitative index of the degradable organic substances in water and is used as a measure of waste strength. The low BOD value in all samples showed good sanitary condition of the water. It is found that all the water supplied to the institute is within the permissible limit. (ie; 3 to 4 mg/l).

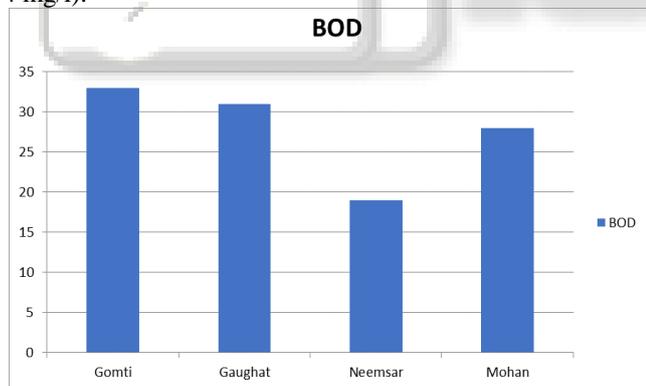


Fig. 4.6: Average BOD of the water samples from different areas.

G. Dissolved Oxygen (DO)

Dissolved oxygen content in water reflects the physical and biological processes prevailing in water and is influenced by aquatic vegetation. Low oxygen content in water is usually associated with organic pollution. DO is ranged from 8.61 to 8.96 mg/l in the study area, where as the prescribed limit for DO is 5.0 mg/l.

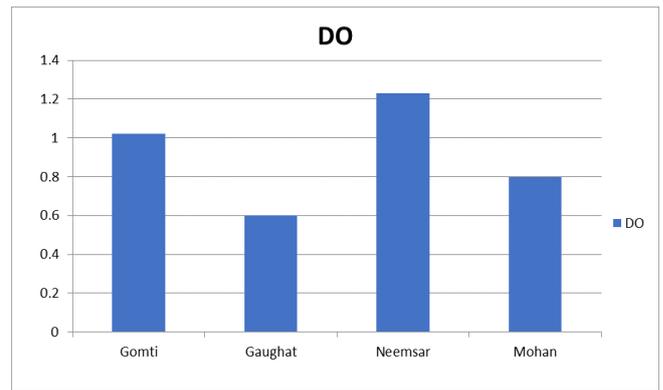


Fig. 4.7: Average DO of the samples from different areas.

H. Alkalinity

In the present study Phenolphthalein Alkalinity was absent in all samples and Methyl Orange Alkalinity was ranged from 98 mg/l to 106.3 mg/l, this indicates the absence of Hydroxyl and Carbonate and presence of Bicarbonate. However the prescribed limit for Total Alkalinity is 120 mg/l.

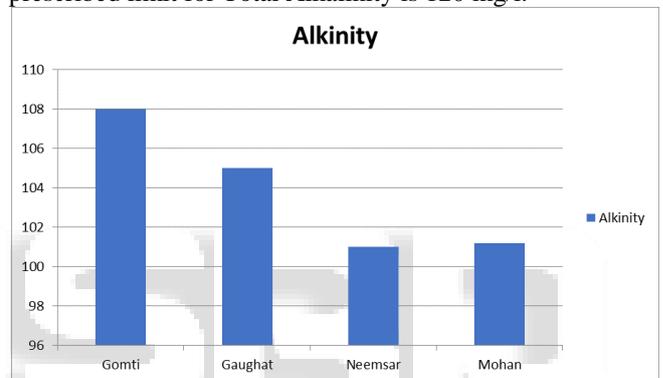


Fig. 4.8: Average Alkalinity of the water samples from different areas.

I. Chloride

In the study area there is no significant change in chloride concentration and it ranged from 21.0 to 21.4 mg/l. Chloride which have been associated with pollution as an index are found below the permissible value set at 250 mg/l in most of the study area. Chloride in excess (> 250 mg/l) imparts a salty taste to water and people who are not accustomed to high Chlorides can be subjected to laxative effects.

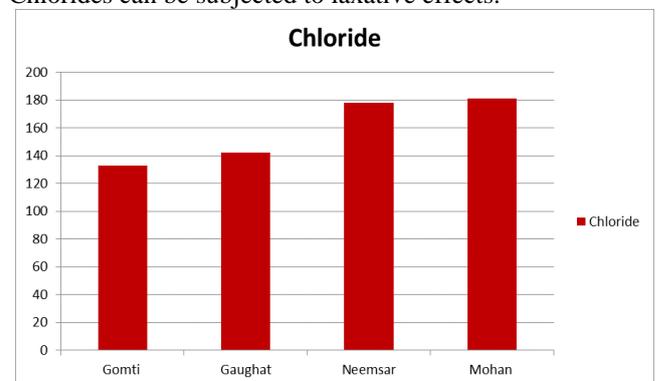


Fig. 4.9: Average chloride present in the samples from different areas.

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