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PHYSICO-CHEMICAL ASSESSMENT OF GANGA CANAL (GHAZIABAD)

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ABSTRACT

The piece of investigation was carried out to study the canal water as quality, nutrient status and Physico-chemical characteristic of Ghaziabad district of Uttar Pradesh, India. River water samples collected from residential area in 3 different locations were analyzed according to standard methods. The physical-chemical parameters such as pH, TSS, TDS, ALKALINITY, CHLORIDE, TOTAL HARDNESS, PHOSPHATE, SULPHATE, NITRATE, BOD, COD, DO, TURBIDITY, COLOUR, MAGNISIUM HARDNESS and CALCIUM HARDNESS have been analyzed. The results revealed that among the residential locations, many of the estimated physical-chemical parameters of residential areas are more or less with the permissible limits of WHO.

Keywords: Quality, Parameter, Samples, Permissible limit.

I. INTRODUCTION

Water is an essential part of human being for living. A man can live without food for several days but he cannot live not more than four days without water. If there is any impurity in water then it may be hazardous for human being as well as agriculture so that the very important part of human being should be free from any impurity. The rapid rate of industrialization and urbanization in India has changed the face of urban landscape and brought in its wake problems of surface water contamination imperiling human beings. Effluents released from various industries are dumped into open pits or unlined channels without any treatment which contaminate canal water sources. In urban societies like our India with developing economics, the optimum development, efficient utilization and effective management of their water resources should be the dominant strategy for economic growth, However in recent year's unscientific management and use of this resources for various purpose almost invariably has created undesirable problems in its wake, water logging and salinity in the case of agriculture use and environment pollution of various limits as a result of mining, industries and municipal use. The canal water, the main source of irrigation purpose has become a cocktail of chemicals and human wastes in most of the Indian cities .It has been observed that among the population belongs to urban societies, about 10% of people are not able to have safe irrigation water apart from that 30% of urban and 90% of rural households depend on unsafe water sources to meet their daily needs. Contaminated water containing virus causes various diseases. In India about 21% of communicable diseases are water born diseases.

Water is one of the most indispensable resources and is the elixir of life. Water constitutes about 70% of the body weight of almost all living organism. Life is not possible on this planet without water. It exists in three states namely solid, liquid and gas. It acts as a media for both chemical and biochemical reactions and also as internal and external medium for several organisms. About 97.2% of water on earth is salty and only 2.8% is present as fresh water from which about 20% constitutes ground water. Canal water is highly valued because of certain properties not possessed by surface water.

II. GEOGRAPHICAL LOCATION OF EXPERIMENTAL SITE

Ghaziabad city (28°66` North latitude and 77°45` East longitude) was chosen as the study area because it is the second largest urban center in National Capital Region experiencing rapid urbanization and is the second most important small scale industrial center in the state of Uttar Pradesh. Density of population is very high in the core areas of the city. The density of population is 3,971 persons/ km^2. It has experienced a continuous increase in the population of the city from 0.29 million in 1961 to 1.4 million in 2011. The population growth registered an increase of 15.92% during the decade 2001-11, which could be attributed to high industrial growth during the same decade. The topography of the city is featureless plain with many small and big drainage canals. Maximum and minimum temperatures remain 44^0C during summer and 2^0C during winter. The average rainfall of the city is 714 mm. Ghaziabad district is amongst top 100 districts in India having more than 4500 small scale industrial units. In fact Ghaziabad considered as first District in Uttar Pradesh and 39 in all India with about 8,244 small scale units .These industries are operating in old part of the city while large industries have grown in newly developed areas. However, due to absence of any zoning regulation by authorities or a proper plan for urban environment, most of the industries in the city located haphazardly and were responsible for unhealthy living conditions. As a result of industrialization, large cluster of migrants entered into the city for their employment purpose and thereby demand for residential areas created. These migrants occupied vacant government lands and developed squatter settlements. Among the total population of the city, about 30% persons live in slums having unhealthy and poor conditions. There are more than 102 notified slums in Ghaziabad city. Among these, 51% have access to municipal water supply and only 7.0% have partial water supply. There are only 30% area of the city is covered through sewerage system while in remaining parts of the city, people are using septic tanks and soak pits. The major source of irrigation water within the Ghaziabad is Ganga canal and Hindan River. It is estimated that about 46,000 tube wells are privately owned and 500 are installed by the government. Ghaziabad city placed on the banks of river Ganga, once boasted of a large number of irrigation canal however due to increase in uncontrolled population and industrialization the city is witnessing water crisis now a days.

III. MATERIALS AND METHODS

Nine water samples from the canal in three sites during March 2016 were collected. Sampling locations were selected on the basis of the presence of residential areas and colonies. Three places (Muradnagar, Niwari, Dasna) of Ghaziabad having concentration of large and small scale residential were selected. From each selected ward 3 water samples from Ganga canal in 2016 were selected from each selected location. Samples

were collected in sterilized plastic/polyethylene bottles. Before sampling, all the sampling bottles were washed and rinsed thoroughly with the canal water to be taken for analysis. The samples were tested for sixteen physical and chemical parameters using standard methods.

Water Analysis:

In present study, Ganga canal water sample were collected and analyzed for various physico-chemical parameters to find out the characteristics of the canal water of Ghaziabad City, India. All the samples were analyzed to determine PH, TSS, DO, COD, BOD, TDS, Alkalinity, Phosphate, Sulphate, Colour, Turbidity, Calcium Hardness, Magnesium Hardness, Total Hardness, Nitrate, and Chloride using standard methods.

Table 1- Average of Levels of different parameters from site-1(Muradnagar), Site-2(Newari) and Site-3(Dasna) of district Ghaziabad.

Parameter	SITE 1	SITE 2	SITE 3	Max. limit as per Irrigation purpose
pH Value	7.55	6.28	6.28	6.5-8.5
TSS(mg/l)	23.09	24	24.03	100
TDS(mg/l)	85	87.96	88.50	2000
Alkalinity(mg/l)	55.19	57.16	57.17	500
Chloride(mg/l)	51	52.59	52.70	500
Total Hardness(mg/l)	24.03	25.15	25.12	500
Phosphate(mg/l)	0.42	0.44	0.43	50
Sulphate(mg/l)	10.38	11.06	11	400
Nitrate(mg/l)	2.09	2.18	2.19	45
BOD(mg/l)	10.50	12..16	10.03	30
COD(mg/l)	15.20	17.94	16.01	100
DO(mg/l)	4.17	4.19	4.23	4
Turbidity(NTU)	17.03	22	22.39	15
Colour (pcu)	3.06	5.01	5.03	25
Mg Hardness(mg/l)	9.67	10.05	10.05	100
Ca Hardness(mg/l)	14.55	15.07	15.06	100

IV. DISCUSSION

4.1. pH VALUE

pH would prove to be ecological factor of major importance in controlling the activities and distribution of aquatic flora and fauna and it is clear that at all seven stations, pH values are well within the range 0 to 14 given in the WHO recommendations and permissible limit of pH in drinking water is within 6.5 to 8.5 .

Most of the fresh water reservoirs are alkaline due to inter dependency of factor as carbon dioxide, carbonate and bicarbonate. Generally pH of water is influence by geology of catchments area and buffering capacity of the water. The pH value was found in the range of 7.55 in s Site1 indicating slight alkalinity dominance. High pH indicates the free availability of heavy metals as a result of their precipitation in hydroxide form. Alkaline range of pH may be due to occurrences of limestone in the surrounding region of sampling stations. Acid- base equilibrium is also a controlling parameter for change in pH of the sample. In this study it is also observed that station Site1, Site2 & Site3 are differing in pH value because the primary source of water bodies is not same.

So it is seen that in results that all values are within the permissible limit so the water is safe for agriculture purpose.

4.2. Alkalinity

Alkalinity is the ability of water to neutralize the hydrogen ion concentration so that it should be within the permissible limit**.** Compared to WHO permissible limit as all these sources are available after treatment of water. An anionic radical such as carbonates, bicarbonates, hydroxide and phosphate contributes to increase in alkalinity. This phenomenon has also been recorded by Site1 and Site3. Variation of alkalinity (mg/l) of Canal at different sites in Ghaziabad district is varied from 50 to 60 mg/l (ppm). As per the parameter mentioned under analysis of Agriculture water given by standard BIS IS 13428: 2005 the water with alkalinity below 500 is in a permissible limit and beyond 500 is considered to be a water which is not fit for agriculture purpose.

Thus alkalinity is within the permissible limit.

4.3. Total Hardness

Hardness water is not fit for agriculture purpose because it increases the soil moisture tension of the crop.

All the water samples from three sites showed hardness below 500 ppm, so this Concludes that water contains permissible amount of hardness. Thus water is fit for agriculture purpose.

4.4. COD

The highest value of COD in river and lake water is due to the increase in concentration of oxygen demanding pollutants and also because of high sun radiation and lowering water level. In summer, at high temperature the living planktons require more oxygen to oxidize organic matter. Variation of COD (mg/l) of Ganga canal at different sites in Ghaziabad district is varied from 15 to 18 mg/l (ppm). The maximum value of COD in the present study was found to be highest in river water and lake water but the tube well and tap water contain very less.

Thus COD is in permissible limit.

4.5. DO

Dissolved oxygen is an important water quality parameter in assessing water pollution. Oxygen is fixed in water either due to the direct dissolution from the atmosphere or a result of primary production. Variation of dissolved oxygen (mg/l) of Ganga Canal at different sites in Ghaziabad district is found to be from 4 to 5 mg/l (ppm). The change in oxygen content leads to undesirable obnoxious odour, under anaerobic conditions. Some

samples shows less amount of DO than BIS values. Thus minimum dissolved oxygen of Ganga canal water is 4.2ppm which is favorable to the most aquatic life**.**

4.6. Chloride

In potable water the salty taste produced by chloride concentration and it is variable and dependent on the chemical composition on water. Some water containing concentration 25 mg/l chloride may have a detectable salty taste if the cation is sodium. Chloride is one of the major inorganic anion of water. High concentration of chloride indicates pollution due to organic waste. In this study, the chloride was found in the range of 50 to 55 mg/l. i.e., very less than the tolerance limits (500mg/l). Site second has a high concentration of chloride which maybe an indicator of high organic pollution as well as Eutrophication of water. Thus chloride within the permissible limit.

4.7. TDS

TDS refer to suspended matter for dissolved in water or waste water. Solids may affect water or effluent quality adversely in a number of ways. Water with high dissolved solids generally is inferior quality.TDS in Ganga Canal at different locations in Ghaziabad district is varied from 85 to 89 mg/l. Water sample of sites 1, 2 and 3 observed with the thin film layer of suspended solid. Thus is safe for agriculture purpose.

4.8. Turbidity

Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, planktons and other microscopic constituents. Turbid water interferes in self purification of water by reducing photosynthesis activity of aquatic plants. Turbidity of Ganga Canal water samples in Ghaziabad district is varied from 17 to 23 NTU and permissible limit is 10 NTU.

4.9. Colour

Natural colour reflects the presence of complex organic molecules derived from vegetable (humic) matter such as peat, leaves, branches and soon. Its effect can be enhanced by the presence of suspended matter but this is normally eliminated in the analysis by filtration. The value of colour of Ganga canal water from different sites is varied from 3 PCU to 6 PCU which is within the permissible limit 25PCU. So the colour is fair in appearance.

4.10. Calcium Hardness

This element is the most important and abundant in the human body and an adequate intake is essential for normal growth and health. The maximum daily requirement is of the order of 1 - 2 grams and comes especially from dairy products. The calcium hardness of Ganga canal water from different sites in Ghaziabad is varied from 14 to 16ppm which is within permissible limit 100ppm. Thus Calcium hardness is fit for agriculture purpose.

4.11. Magnisium Hardness

Like calcium (q.v.), magnesium is abundant and a major dietary requirement for humans (0.3-0.5 g/day). It is the second major constituent of hardness (see above) and it generally comprises 15-20 per cent of the total hardness expressed as $CaCO_3$. The magnesium hardness in Ganga Canal water from different sites in Ghaziabad

are varied from 9 to 11ppm which is within permissible limit 100ppm.Thus Magnesium hardness is safe for irrigation purpose.

4.12. BOD

Biological oxygen demand is the consumption of oxygen for the decomposition of organic matter by the bacteria. The measurement of BOD is done by using the dissolve oxygen value. High concentration of BOD value indicates that there is significant difference between initial and final dissolve oxygen value. Variation of BOD (mg/l) in Ganga canal water at different sites in Ghaziabad district is varied from 10 to 13 mg/l (ppm). Thus BOD is in permissible limit.

4.13. Nitrate

Relatively little of the nitrate found in natural waters is of mineral origin, most coming from organic and inorganic sources, the former including waste discharges and the latter comprising chiefly artificial fertilizers. However, bacterial oxidation and fixing of nitrogen by plants can both produce nitrates. Variation of nitrate (mg/l) in Ganga canal water at different sites in Ghaziabad district is varied from 2to 3 mg/l which is within the permissible limit 45mg/l. Thus nitrate is in permissible limit.

4.14. Sulphate

Sulphate exists in nearly all natural waters, the concentrations varying according to the nature of the terrain through which they flow. They are often derived from the Sulphides of heavy metals (iron, nickel, copper and lead). Variation of Sulphate (mg/l) in Ganga canal water at different sites in Ghaziabad district is varied from 10 to 12 mg/l which is within the permissible limit 400mg/l. Thus Sulphate is in permissible limit.

4.15 Phosphates

There is considerable debate as to the availability of the various forms of phosphorus (orthophosphate, polyphosphate, organic phosphate and so on) for the growth of algae although it is considered that orthophosphate is the most readily used form. Phosphorus may be in true solution, in colloidal suspension or adsorbed onto particulate matter, and it is very difficult to differentiate between the various fractions by separation (e.g. filtration) or analysis. Variation of Phosphate (mg/l) in Ganga canal at different sites in Ghaziabad district is varied from 0.4 to 0.5 mg/l which is within the permissible limit 50mg/l. Thus Phosphate is in permissible limit.

4.16 TSS

Matter which is suspended in quiescent water consists of finely divided light solids which may never settle or do so only very slowly. Indeed, the net effect may be one of apparent turbidity without any discernible solids. In flowing water, on the other hand, the solids which are kept in suspension by the turbulence may be settleable if the water is let stand. While the latter would be determinable as "Solids, Settleable," and the former could possibly be assessed as "Turbidity," there will be those solids of intermediate grading which also require estimation. To determine as much as possible of the solids present (not in solution), the determination of "suspended" solids is carried out. Variation of TSS (mg/l) at different sites of Ganga canal in Ghaziabad district is varied from 23 to 25 mg/l which is within the permissible limit 50mg/l. Thus TSS is in permissible limit.

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