



# Impact Assessment of Municipal and Industrial Waste Discharges on Water Quality of River Ganga From Devoparyag to Haridwar .

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## Abstract.

The present investigation was conducted to study the water quality of river Ganga, from Devoparyag, Rishikesh and Haridwar. During the period June and November 2020. The water quality of the Ganga river has been increased during this period. The physico-chemical characteristics at the Deoparyag, Rishikesh and Haridwar city. The 22 sampling sites upper and down stream of the drain discharge into Ganga river including STP drain to indicate the water quality of the water. According to the report of CPCB 2019 show the 86 live monitoring stations installed in as many locations, only seven areas have been found to be fit for drinking after disinfection process while 78 have been found unfit. The CPCB says the river water is so polluted that it is unfit for bathing, let alone drinking. The sewage is a big issue. Work is going on and it will take a little while. Every day we monitor the water quality.

**Keywords.** Deoparyag, Rishikesh and Haridwar. Ganga River water quality. Alkalinity, Hardness, Ca, Mg, pH, Electrical Conductivity, TDS (total dissolved solid), Sodium (Na), Potassium (K), Chloride Cl<sub>2</sub> and Turbidity, etc.

## Introduction.

The River Ganga is the most important river system in India. Due to the copious availability of water throughout the year, it has played a major role in the growth of India civilization and economy. It accounts for 25% of India water resource (B.D. Tirpathi) The Ganga is the thirtieth longest river in the world, covering a basin area. The Ganga basin is among the most heavily populated areas in the world. The Ganga is one of

the mainly essential of all natural resource on earth. It is important to all living organism, most ecological system, human health food production and economic development (Central Water Commission 2017 -2018 report). Ganga has great ritual importance among pilgrims and touristtin India. The Ganges is invoked whenever water is used in Hindu than a dip in the actual river which is thought to remit sins especially at one of the famous tirthas, such as Gangotari, Haridwar . Paryag, or Varansi. The symbolic and religious importance of the Ganges is one of the few things that Hindus, even their skeptic, have agreed upon “ Jawaharlal Nehru”, a religious iconoclast him self, asked for a handful of his ashes to be thrown in to the Ganges ( a report of Jal Shakti Mission Nov 2018). The River Ganga occupies a unique position in our country. It has served as the cradle of Indian civilization and is interwoven with India's history, culture, religion and philosophy. A large number of tributaries of varying dimensions merge their identity with this mighty river, which is respectfully worshipped by millions of Indians. Ganga and its tributaries constitute one of the largest riverrine systems in the world. Besides being a source of supply of drinking water to the people inhabiting the cities, towns and villages situated on its banks, it is also being used for navigation, irrigation, bathing, washing, fishing and for industrial purposes.

The Ganga river basin is the largest inland river basin of India draining a catchment of about 8,61,404 km<sup>2</sup> and an average density 520 persons/Km<sup>2</sup>. The basin substance more than 300 million people in India, Nepal, and Bangladesh the basin of river Ganga and cover a long distance about 2,525 km from Gangotari to Bay of Bengal. And it is face a grave threat due to the numerous cremation ritual on its banks over the year, unplanned urban and industrial growth, and sewage and chemical effluents. (A of CWPCB Report since 2017) state that about 4.8 billion litres of sewage from 118 town and cites flow into the Ganga daily, in addition to garbage and organic waste. But the functioning capacity of sewage treatment plants is only a billion litres. (According to India's Central Pollution Control Board, pollution level at 80 monitored site on the Ganga have since 2013). The biochemical oxygen demand was more than 3milligrammes per litres at 36 site not even fit for bathing and 2 to 3 mg per litres at another 30site in 2017. Than in 2018, the Uttar Peadesh government shut down around 260 tanneries to keep the river clean. Many of them have since been allowed to reopen if they operate at 50 percent of installed capacity and meet environment norms. The quality of water is a vital concern for mankind since it is directly linked with human welfare. The major pollutant found in water included volatile, biodegradable and recalcitrant organic compound, toxic metal, plant nutrient, sudpended solid, microbial pathogen and parasite. Among the pollutant, toxic metal are of serious concern because they accumulate through the food chain and create environmental problem. The higher harmful complex compound, which critically effect different biological function. The presence of heavy metal in the waste water of industry is a potential risk to aquatic ecosystem, animal, and human.

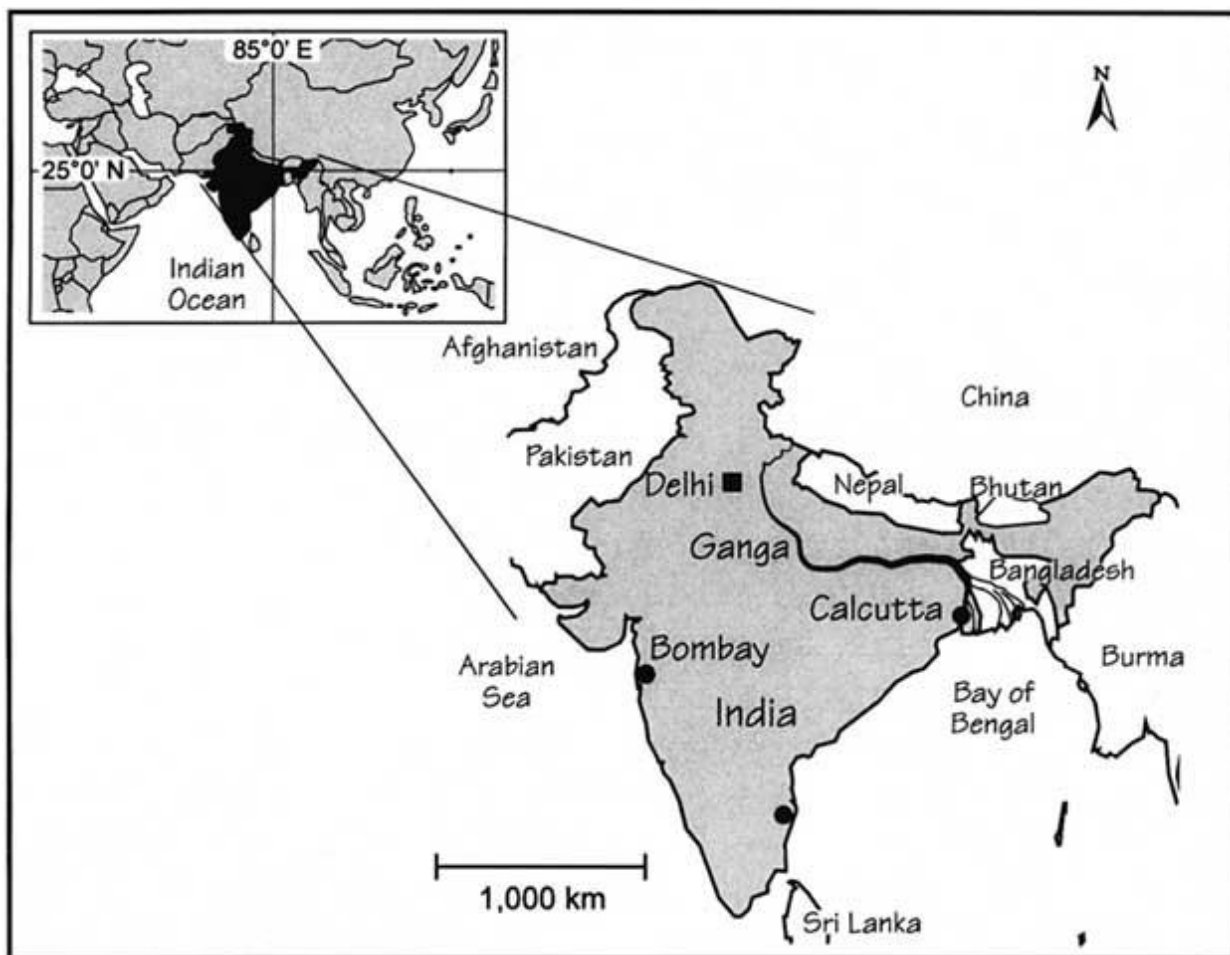


Fig.1 ( g.map) showing India. Ganga River

The growing pollution of the river Ganga in recent year make a noticeable change in its physico-chemical and water quality to an extent that the aquatic animal community is affected and the biodiversity has decreased (Singh and Lakra et al. 2010). The decline in ecological condition and water quality is a typical indication for river and other water bodies globally as human demand for water resources increase (Sarita. Tirpathi, et al. 2017). The human activity have powerfully changed productivity and species richness of the fresh water ecosystem, over the world. The water most important natural resources in the world has the unique property of dissolving and carrying in suspension a huge variety of chemical and hence water can easily become contamination about 2,506km long stream of the river Ganga sustain town, and thousands of village which are contaminating. The river by over 1.3 billion litres waste per day. The water quality, rendering serious environment problem posing threat on human being (Md.Aktar, Paramasiva.M et, al. 2008). The industrial effluents of different origins containing toxic metal pesticides. The industrial pollution degrade ecosystem many folds and damage aquatic ecosystem soil fertility and sub- soil ecosystem.



Fig.2 (g.map) (Ganga pollution wikipedia)

The tannery industry, discharge, different type of waste in the environment primarily in the form of liquid effluents containing organic matter chromium sulphide, ammonium and other salts, (Arya, Gupta, et al 2013). A variety of activities related to development industrialization and religio- touristic industrialization quality contribute towards increasing quality deterioration within Haridwar city. The city municipal, established in 1968, so for the sewage treatment within Haridawr city and large part of this sewage is routinely disposed directly into the canal of the Ganga river, (B.D. Joshi, 2012). The Ganga draining has caused massive side effect ranging from dislocation of human communities, through loss of resources such as fishery stock and increased hazard from flooding to saltwater incursions and erosion of the Ganga delta excessive ground water pumping for irrigation agriculture has caused surface subsidence and water quality that incorporate not only organic contaminants but also synthetic chemical is critical even the sacred Ganga can not with stand the onslaught of contemporary resources use and remain eternally pure. The recognition that people can must make difference in the quality of the region where they live has the potential not only to save the river of the Ganga draining but to empower the people living along the bank of these river and relying on river water for life. It self as well as human and animal waste more dangerous and persistent chemical contaminate released by the hundred of factories along the Ganga and its tributaries include mercury highly toxic heavy metal such as lead and copper, and various synthetic chemical, crop land leak pesticide and excess fertilizer into the river ( prof. Ellen woh , Colorado state university U.S.A 2012).

### Study Area.

The Ganga river is a holy river in India. It has position among the world top 20 river by the volume of water discharge. It cover 7 state of India. That is Uttrakhand, Uttar pardesh, Madhya- Pardesh, Jharkhand, Bihar, Chattisgarh, West – Bengal etc. the Ganga basin lie in the middle of E longitude  $73^{\circ} 2'$  to  $89^{\circ} 5'$  and latitude  $21^{\circ} 6'$  to  $31^{\circ} 21'$ . The maximum width and length of about 1024km and 1543km (by Athority of Ganga River Basin ). the entire extent of river Ganga up to its outfall into the bay of Bangal is 2525km. The Ganga basin in India covered with agricultural land accounting to 65.65% of the total area and 3.47% of the basin is covered by water bodies.



Fig.3( Devoparyag wikipedia)



Fig.4( Haridwar wikipedia)

The study area to be conduct the water quality of the river Ganga to the three station of monitoring and 22 point of the sampling the total 96km area of the Ganga river is monitoring that is Devoparyag, Rishikesh and Haridwar. The monitoring the municipal, industrial and major STP derectaly discharge into the Ganga River. The Devoparyag is the scared event of merging two visible heavenly river, Alaknanda and Bhagirathi to from the holy Ganga ( by Nagar Nigam of Devparyag). It believed that a third river, the mathical Saraswati river is underground and meet these two river at the confluence. Rishikesh is a city governed (by Rishikesh Municipal Coporation ( since October 2017). The river Ganga leave the Sivalik hill in the Himalaya and flow into the plain of northern India. Several temple, ancient and new, are along the bank of river Ganga in Rishikesh. The Ganga emerges from the mountain to touch the plain in Haridwar. The water in the river Ganga is mostly clear and generally cold, except in the rainy season, during which soil from the upper regions flow down into it.

### Experimental Method.

In order to study impact of waste discharges on water quality of River Ganga, water samples will be collected from different location from Deoprayag to Haridwar on alternate month for a period of two years by dip or grabsampling method. All the samples was collected from 15 cm depth using standard water sampler in clean narrow-mouth polyethylene bottles fitted with screw caps.

In the field, temperature, pH and conductance was measured by means of portable meters. For other parameters, samples was preserved by adding an appropriate reagent and water samples will be brought to the laboratory in sampling kits maintained at 4°C for detailed analysis. Physico-chemical analysis was conducted following Standard Methods for the Examination of Water and Waste Water (APHA, 2005). All

chemicals and reagents to be used in the analysis will be of analytical grade. Double-distilled water was used throughout the study. All glassware and other sample containers will be thoroughly cleaned and finally rinsed with double-distilled water several times prior to use. The River water sample were collected from twenty location on a alternative of monthly basis using a Hydro-Biostanderd water sample for a period of (Jun 2020 to July 2021). At each station two sample were collected from 1/3 1/2 width of river and upper drain point and lower of the drain point . All sample collected from the upper 15 cm of the water surface and stored in polyethylene HDPE bottles fitted with screw cap. Determination of pH, conductance and temperature was performed on site using portable meter (WTW, Germany). For other parameters, sample were preserved by adding an appropriate reagent and brought to the laboratory in sampling kits maintained 4C for detailed chemical analysis. The physic-chemical analysis was performed following standard method (APHA, 2005). The accuracy of the method.

Many organic compound are only slightly water soluble they tend to be adsorbed by particulate matter in the water. This requires a sampling method that does not allow transfer of water from the sampling container without transfer of water from the sampling container material. The depth integration is used to collect a water sediment sample that weighted according to velocity at each increment of depth. If the depth integrating sample is lowered from the surface to the bed and back at the same rate, each increment of flow in that vertical is sampled proportionality to the velocity. The analyzed water various quality parameter during alternative monthly periods effect of industrial waste, municipal sewage, and agricultural runoff on river water quality. The determination of physical, biological and chemical parameter of surface water at different point.

The open mouth weighted bottle sampler dose not collected by depth integrating method using either a hand held or a cable and reel suspended sampler whenever it is analysis. In such cases, dip sample collected at one or more vertical across the stream are appropriate, however, the sample container should be carefully held just beneath of water surface in order to avoid disturbing the stream bed. The choice of parameter to be tested is closely linked to the objective of the water quality survey programme and to the available manpower and financial resources.( C.K Jain et al 2002) The table lists the major ions and physical parameter which will provide considerable information on the quality of water being evaluated. Test results on these parameter may be used for interpretive studies with respect to the Chemical quality of water for domestic and industrial water supplies and other uses.

Analytical results in mg/L are converted to epm by dividing the actual concentration of the ion in mg/L by the equivalent weight of the ion. Theoretically the sum of the cations in epm should be equal to sum of the anion in epm but these may differ by certain percentage points depending upon the accuracy of the analytical method used and the quality of the water being tested. Percent error of up to 1% are usually considered excellent while the higher percent error should alert the analyst to check his analysis or to determinethe cause for such error.

In ionic balance determination, calcium, magnesium, sodium and potassium ions from the cationic group while bicarbonate, sulphate and chloride ion from the anionic group.

## Result and Discussion.

From the observation that uncontrolled population increase the pollution in the River Ganga and change the water quality of the river Ganga. The river basin demonstrate that the water quality of Deovprayag, Rishikesh and Haridwar remain in the three month for Jun, 2020 . The river at this location has high stream flow and the waste generate in this area and STP is the failure and overflow in the devoprayag. So that the waste directly discharge into the river Ganga. The second and third location the generate waste in this area is treated before discharge it to the river. Therefore in the upper reach segment of the river change in the water quality

### Colure.

Colure is determined by comparison of the sample with know concentration of colour solution. The platinum- cobalt platinum/L in the from of chloroplatinum ion, Interference. Even a slight turbidity causes the apparent colour to be noticeable higher than the true colour, therefore remove turbidity before approximately true colour by differential reading with different colour filters. The colure was indicate is Greenish White .

### Conductivity :

Conductivity is a measurement of water's capacity for conveying electrical current and is directly related to the concentration of ionized substance in the water. The conductivity is Solid refer to matter suspended or dissolved in water or waste water. Solid may affected water or effluent quality adversely in a number of ways. Water with high dissolved solid generally are of inferior palatability and may induce an unfavourable physiological reaction in the transient consumer. The amount of Total Dissolve Solid was conduct is 90 to 100mg/L of all point that observed.

### Temperature.

The temperature is the most important parameter it is increase the solubility of many mineral, salt and gases it was observed to the 20 to 25 °C in all point.

### pH :

The pH value is a measure of hydrogen ion concentration and is the negative exponent of the logarithm of the hydrogen ion concentration. A low pH solution has a high hydrogen ion concentration and is therefore, acidic while high pH solution are low in hydrogen ion concentration and are alkaline ( pH 7 being neutral ). The pH was observed at all three station is 7.63 to 8.22 according to ISI and WHO standard.

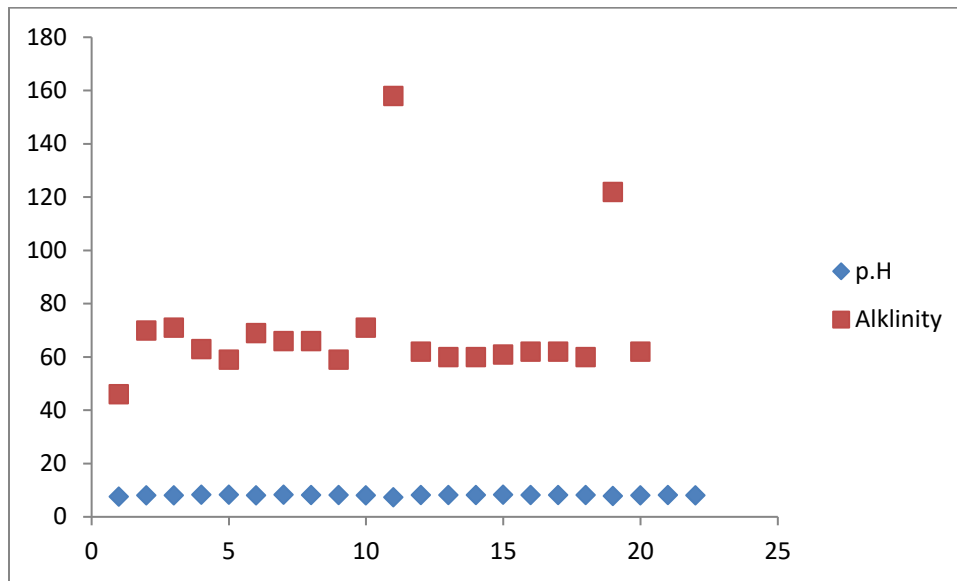


Chart 1 showing value of p.H and Alkalinity

### Alkalinity:

Alkalinity refers to the capability of water to neutralize acids. The presence of carbonate, bicarbonate and hydroxide is the most common cause of alkalinity in natural water. Alkalinity values provide guidance in applying proper dose of chemical in water and waste water treatment processes, particularly in coagulation, softening and operational control of anaerobic digestion. The alkalinity was indicate the all point that

### Potassium :

Potassium rank seventh among the element in order of abundance, yet its concentration in most drinking water seldom reaches 20mg/L. However, occasional brines contain more than 100mg/L potassium. Is that observed 1.5 to 2.0mg/ml. is 50 to 100 mg/L.



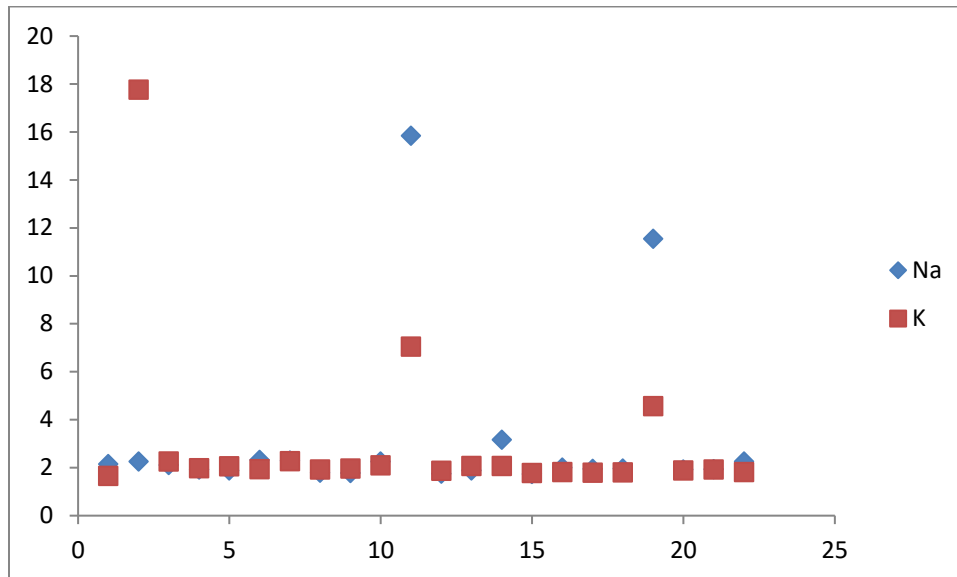


Chart 2 showing value of Na and K

**Sodium :**

Sodium, the sixth most common element, is present in nearly all natural water. The level may vary from less than 1mg/L to softened by the sodium exchange process. Ratio of sodium to total cation is important in agriculture and human pathology. The sodium was indicate the all station is that 2.0 to 3.0mg/ml.

**Hardness :**

The Hardness of water was originally defined in term of ability to precipitation soap. Calcium and magnesium ions are the principle cause although iron, aluminium, manganese, strontium, zinc and hydrogen ions are capable of producing the same effect. High concentration of the latter ions are note commonly found in natural water. The total hardness is observed that is 60 to 90mg/ml. and calcium hardness is indicate the 20.0 to 40.0mg/ml. magnesium hardness is observed that is 5.0 to 7.0 mg/ml in all sample.

**Hardness Mg:**

Magnesium is the rank of eight among element in order of series and is a common constitute of natural water. It contribute to the hardness properties of water and break down when heated forming scale in boilers. Concentration greater than 125mg/L also can have a cathartic and diuretion effect.

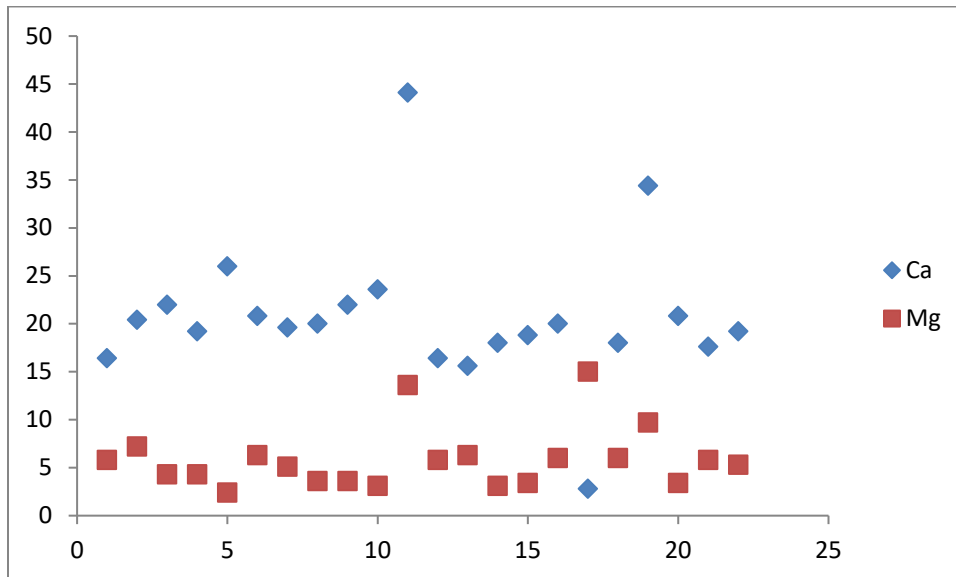


Chart 3 showing value of Ca and Mg

### Hardness Ca:

Calcium is the most common element, is found in the natural running water from zero to several hundred milligrams per liter, depending on the source and treatment of the water

### Sulphate:

Majority of the sulphate mainly in soluble in water ( exceptions, sulphate of lead, barium and strontium ). Sulphate is poorly absorbed from the human intestine. Sulphate dose of 1.0-2.0g have a cathartic effect on human, resulting in the purgation of the alimentary canal.

### Chloride:

Chloride in the form of chloride ion, is one of the major inorganic anions in water and waste water. Chloride are present in all potable water supplies and in sewage usually as a metallic salts. When sodium is present in drinking water, chloride concentration in excess of 250mg/L give a salty taste.

### Turbidity :

The turbidity is the cloudiness of water it is a measure of the ability of light to pass through water. It is caused by suspended material, such as clay, silt, organic material, plankton, and other particular material in water. It can increase the cost of water treatment for various use. Turbidity the amount of available food is reduced because higher raise water temperature in light of the fact that suspended particle absorb more sun heat.

### Conclusion .

This study dedicate to the Ganga river. The study observed that the quality of river Ganga is very poor at the Rishikesh and Haridwar considered least polluted. Therefore the water founded cannot be recommended for drinking and other domestic purpose without purification. The study suggest that the water this situation at almost source is not fit for human consumption and as it flow other major cities is

the highly polluted rising toxic level. Water quality of the discharge municipal and industrial effluent location can be subject of further investigation.

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