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Assessment of Physico-Chemical and Microbial Characteristics of River Ganga Haridwar, Uttarakhand

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Abstract – Pure water and clean air is the fundamental right of the every citizen of India given by the constitution, but the current scenario is that the contamination of surface water, ground water is going to new heights. So, our study focuses the present contamination scenario of river Ganga water. Our government specially concern agencies can take the serious steps to control the water pollution. In this study, we cover the physic-chemical and microbial parameters to analyze the water quality.

Water pollution is a major global problem. It requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that water pollution is the leading worldwide cause of death and diseases, and that it accounts for the deaths of more than 14,000 people daily.

Key Words: Contamination, Microbial Characteristics, Pathogens, Disease

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INTRODUCTION

Clean water sources are vital for drinking and recreational purposes, but many can get contaminated by fecal material. Direct contact with and ingestion of waters contaminated by fecal material can affect millions of people every year as a result of the gastrointestinal and respiratory illnesses and eye and skin infections caused by enteric pathogens. Among the possible types of fecal contamination, that from a human source may represent a major concern to our health given that human enteric pathogenic bacteria, protozoans and enteric viruses are among those that can cause most of the mentioned diseases. Thus, the identification of the fecal contamination in waters is necessary to eliminate the source and to minimize the potential risk that enteric pathogens represent to public health. In order to infer fecal contamination and the possible presence of enteric pathogens in water sources, other enteric microorganisms (e.g. enterococci, thermotolerant and coliforms are used, and these are known as microbial indicators of fecal pollution (Berg, 1978).Traditionally, indicator micro-organisms have been used to suggest the presence of pathogens Today, however, we understand a myriad of possible reasons for indicator presence and pathogen absence, or vice versa. In short, there is no direct correlation between numbers of any indicator and enteric pathogens (Grabow 1996).

Water covers approximately 70% of Earth's surface, and is an essential resource for all life. Water pollution caused by human activities contaminates surface and ground water, and poses a considerable threat to human health and well-being as well as the preservation of the environment. The specific contaminants include a wide spectrum of pathogens and chemicals, from various sources such as sewage, fertilizer and agriculture runoff, and industrial discharges. Understanding and monitoring these contaminants is of great significance to inform the public, protects the water environment, and ensures access to safe water. This task, however, could be especially challenging when the detection matrix is complicated and more than one contaminant is of concern.

Different methods have been devised for detecting the source of contamination and used for a variety of purposes: to improve water quality by identifying problematic sources and determining the effect of implemented remedial solutions (Scott et al., 2002; Simpson et al., 2002), for more cost-effective and efficient management and remediation (Savichtcheva and Okabe, 2006; Simpson et al., 2002), to measure the proportional contribution of each source of faecal contamination (Field and Samadpour, 2007), and to assess health risks associated with the origin of faecal contamination

(Scott et al., 2002). A number of methods can be used to help identify sources of faecal contamination in water. The general concept is referred to microbial source tracking (MST) (Scott et al., 2002) and is a field of intensive research worldwide (Meays et al., 2004; Savichtcheva and Okabe, 2006; Scott et al., 2002; Simpson et al., 2002; Sinton et al., 1998; Stoeckel and Harwood, 2007).

MATERIAL & METHODS

Samples were collected from a variety of surface waters, both sewage and fresh, across all over the Haridwar city. Sampling took place weekly, over a period of 2 consecutive months and 15 days, beginning from January 2019 and ending in March 2020. Freshwater samples were obtained from several regions of Haridwar including Harkipauri, Premnagarasharm, Fountain region of BHEL Ranipur Haridwar, and ponds and lakes of rural Haridwar.

RESULTS AND DISCUSSIONS

Site 1 LOCATION (CHOUDHARY CHARAN SINGH GHAT)

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Clear
3.	Odour	-	Odourless
4.	pH	-	7.5
5.	Temperature	ºC	25
6.	Turbidity	NTU	142
7.	Total dissolved solid (TDS)	mg / L	495
8.	Dissolved oxygen (DO)	mg / L	6.9
9.	Bio-chemical oxygen demand (BOD)	mg / L	14
10.	Chemical oxygen demand (COD)	Mg / L	1.5
11.	Total coliform (TC)	Per 100ml	680
12.	Fecal coliform (FC)	Per 100ml	390

2. LOCATION (DHAMKHOTHI)

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Clear
3.	Odour	-	Odourless
4.	pH	-	7.9
5.	Temperature	ºC	25
6.	Turbidity	NTU	162
7.	Total dissolved solid (TDS)	mg / L	513
8.	Dissolved oxygen (DO)	mg / L	7.0
9.	Bio-chemical oxygen demand (BOD)	Mg / L	14.5
10.	Chemical oxygen demand (COD)	mg / L	1.9
11.	Total coliform (TC)	Per 100ml	710
12.	Fecal coliform (FC)	Per 100ml	405

3. LOCATION {VIP GHAT}:

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Clear
3.	Odour	-	Odourless
4.	pH	-	7.10
5.	Temperature	ºC	26
6.	Turbidity	NTU	248
7.	Total dissolved solid (TDS)	mg / L	505
8.	Dissolved oxygen (DO)	mg / L	7.4
9.	Bio-chemical oxygen demand (BOD)	mg / L	14
10.	Chemical oxygen demand (COD)	Mg / L	2.4
11.	Total coliform (TC)	Per 100ml	963
12.	Fecal coliform (FC)	Per 100ml	460

4. LOCATION {LALTARA BRIDGE}:

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Clear
3.	Odour	-	Odourless
4.	pH	-	7.7
5.	Temperature	ºC	26
6.	Turbidity	NTU	208
7.	Total dissolved solid (TDS)	mg / L	525
8.	Dissolved oxygen (DO)	mg / L	7.2
9.	Bio-chemical oxygen demand (BOD)	mg / L	15
10.	Chemical oxygen demand (COD)	Mg / L	2.3
11.	Total coliform (TC)	Per 100ml	950
12.	Fecal coliform (FC)	Per 100ml	514

5. LOCATION {HAR KI PAURI}

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Clear
3.	Odour	-	Odourless
4.	pH	-	7.59
5.	Temperature	ºC	27
6.	Turbidity	NTU	219
7.	Total dissolved solid (TDS)	mg / L	588
8.	Dissolved oxygen (DO)	mg / L	8.2
9.	Bio-chemical oxygen demand (BOD)	mg / L	20
10.	Chemical oxygen demand (COD)	Mg / L	2.8
11.	Total coliform (TC)	Per 100ml	950
12.	Fecal coliform (FC)	Per 100ml	575

6. LOCATION {BRAHMA KUND}:

S. No.	PARAMETER / SAMPLE	UNITS	RESULT
1.	Weather	-	Clear
2.	Colour	-	Turbid
3.	Odour	-	Odourless
4.	pH	-	7.37
5.	Temperature	ºC	28
6.	Turbidity	NTU	320
7.	Total dissolved solid (TDS)	mg / L	595
8.	Dissolved oxygen (DO)	mg / L	6.3
9.	Bio-chemical oxygen demand (BOD)	mg / L	4.5
10.	Chemical oxygen demand (COD)	Mg / L	34.2
11.	Total coliform (TC)	Per 100ml	894
12.	Fecal coliform (FC)	Per 100ml	566

Haridwar is a place of cultural heritage city of pilgrims. Haridwar is the city of ganga ,but know a day's people ignoring the natural heritage and avoid it people create pollution in rever ganga which indicates the presence of *fecal coliform ,E.coli,* other harmful bacteria likesalmonella, vibrio.spp, which contaminated the river and show adverse effect on the livinghood.it can leads to water pollution The role of indicator microorganism to indicates the pollution present in the water by means of fecal indicator microorganism present in various region of Haridwar. I conduct a series of experiment including various known places of Haridwar, and showing the results that how much it is use full for us and how much it is harmful of us .The measurement of temperature is the physical assessment of water quality. The impact of temperature is observed on the water's chemical and biological characteristics. The normal pH range is found on all the rivers being studied. The pH means the measure of the intensity of acidity or alkalinity and the concentration of hydrogen ion in water is observed on health; still the higher values of pH hasten the scale formation in water heating apparatus and also reduce germicidal potential of chloride. High pH induces the formation of trihalomethanes which are toxic. pH affects the dissolved oxygen level in the water, photosynthesis of aquatic plants, metabolic rates of aquatic organisms and the sensitivity of these organisms to pollution, parasites and disease.

The pH level of most of the rivers fall between 6.5-8.5, which indicates the level of neutral to slightly basic. If the pH of stream water is less than 5.5, it indicates threat for fish as it is too acidic, whereas if the pH of stream water is more than 8.6, it indicates the level of too basic. The pH also impacts the life related activities inside aquatic world as it impacts the chemical level of water. The low level of pH allows the heavy metal to get easy absorbable.

The water turbidity is the measure of water that includes factors such as soil erosion, elevated nutrient inputs that stimulate algal blooms, waste discharge, and an abundance of bottom feeders that stir up sediments. Water turbidity talks about that degree to which the light enters a column of water and scattered by the presence of suspended solids like mud, algae, fecal material, etc.

As water becomes more turbid, less sunlight is able to penetrate its surface, therefore the amount of photosynthesis that can decrease. This results in a decrease in the amount of oxygen produced by aquatic plants. In addition, suspended materials absorb heat from sunlight and raise the water temperature. This also limits the amount of dissolved oxygen water can hold.

BOD or biochemical oxygen demand represents the amount of oxygen that microbes need to stabilize biologically oxidizable matter. The chemical oxygen demand (COD) is commonly used to indirectly measure the amount of organic compounds in water. Most applications of COD determine the amount of organic pollutants found in surface water, making COD a useful of water quality. It is quantitatively measured in milligrams per liter (mg/l). This measurement is the mass of oxygen consumed per liter of solution.

The consumption of contaminated water in form of bath, eatable, drink, wash results in waterborne diseases. It is due to pathogenic micro-organisms that are transmitted and make water polluted. It affects the people of all age groups but more negative impact is seen on children and less developed and developing countries.

As per the reports of World Health Organization (WHO), waterborne diseases are responsible for approx loss of 1.5 million lives. Of the total DALY (disability- adjusted life year), 3.6% are due to waterborne diseases. The shortage of safe drinking water, and water for hygiene purpose results on 842,000 deaths yearly.

The intake of contaminated water is results in disease termed as "waterborne disease". The infections due to waterborne disease may transmit through parasites that entered in the water. The disease like malaria can't be referred as "waterborne" disease just because mosquitoes have aquatic phases in their life cycles.

Microorganisms causing diseases that characteristically are waterborne prominently include protozoa and bacteria, many of which are intestinalparasites, or invade the tissues or circulatory system through walls of the digestive tract. Various other waterborne diseases are caused by viruses. The metazoan parasites are also found as an important cause that attributes waterborne diseases. The example includes Nematoda. The disease is Dracunculiasis which is occurred by consumption of water that has specific capepoda. The capepoda works as vectors. The one will be diagnosed with Nematode larvae in the genus Drancunculus, if they consumed copepod.

The ancient culture has also warned about the use of polluted water. It favored the consumption of processed beverages. The germ theory of disease talks about the contaminated water that becomes the source of transmission of diseases.

SOCIOECONOMIC IMPACT

The socioeconomic impact of waterborne disease is evidently visible on local, national and international levels. The waterborne disease not only brings financial issues to people but also with other issues such as specific diet for patients, transportation charges, medicines, medical facilities, loss of lives and more care for patients. The families of patients are not limited with these problems but have also to arrange the huge amount to get proper treatment and care. These are more in less developed countries that have less facilities and services to deal with. Approximately, 10% of the monthly household's income is spent by family on per person infected for treatment.

The pathogenic microorganisms are responsible for diseases that are caused due to water such as cholera, typhoid, trachoma, dysentery, etc. The water borne disease happens with the intake of polluted and contaminated water by various sources like drinking such water, preparing meals with contaminated water.

Waterborne disease can be caused by protozoa, viruses, or bacteria, many of which are intestinal parasites.

CONCLUSION

The present investigations conclude that the quality of water samples subjected to study was acceptable from physico-chemical parameters, while ***E. coli**,* an indicator of fecal pollution was found in all samples. The river Ganga at Brahma Kund in Haridwar was most polluted despite being a quite popular tourist place in Haridwar which indicates that the water is polluted for the human use so people are aware about it that how much harmful for the by means of this types of study government conduct regular test and cleaning procedure.

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