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Study on Quantity Analysis of Chloride Presence in Ganga Basin

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Abstract: Water pollution and its consequences for humans and agriculture compelled us to examine a variety of water quality indicators. We used a variety of water quality testing methods, including the Wrinkler's method, the EDTA procedure, a pH meter, and others. Ganges water samples are analyzed for their physicochemical properties. Throughout the months of April and May of 2010, water samples were taken from several locations in and around Kanpur. To determine the importance of water quality indicators, a correlation analysis was done between a wide range of properties, including pH, temperature, turbidity, total hardness (TH), metal, total alkalinity (TA), dissolved oxygen (DO), and suspended solids (SS) and Chloride(Cl). It was found that, with the exception of turbidity, all of the properties are well within the WHO-recommended ranges. Several negatively charged species, as NO3 - and Cland Fare, were also discovered to be beyond of acceptable ranges.

Keywords: Physicochemical attributes, Ganges, WHO, River, Water, SS, TH, DO,Cl

Introduction

Chloride ions are very dispersed, and changes in their concentration in water do not result from chemical reactions. Chloride does not easily biodegrade, precipitate, volatilize, or bio accumulate because of this. Chloride ions cannot easily adsorb onto mineral surfaces, which is why they are found in very high quantities in surface water and sediment pore water while being relatively absent in sediment Excessive chloride concentrations in water are not known to be dangerous to humans, but they may corrode metal pipelines and kill plants in big enough quantities[1-3]. Both fresh and salt water include chlorides, which are crucial to life. Sodium chloride and other common salts are made up of bound ions. Dissolving table salt in water causes the sodium and chloride ions to split apart. Several studies have shown that fish are more resistant to chloride than tiny, free-swimming planktonic crustaceans . These planktonic organisms not only provide food for fish and amphibians, but they also assist keep the algae populations in lakes under control, preventing the depletion of oxygen caused by eutrophication. High levels of chloride have been shown to be detrimental to many aquatic organisms, according to recent studies[4].

Sediments absorb the vast majority of pollutants that are released into aquatic systems. Since they are the primary location for biogeochemical cycling and the basis of the food web, sediments are the most crucial part of aquatic ecosystems[5]. The Communities of microorganisms, meiofauna, and macrofauna found in sediments are known to break down organic materials and provide sustenance for higher organisms, such as humans.

Depositional sediments in urban and agricultural regions are often polluted with chemicals that are both inorganic and organic, as is now well documented. Toxins from urban, agricultural, and industrial sources that find their way into bodies of water may either float about in the water, be ingested by aquatic biota, or sink to the bottom and form part of the sediments. More than 300 million people call the Ganga basin home; 20 million of these individuals reside in highly crowded urban areas along the river's banks. Most cities do not have enough sewage treatment facilities[6] There are 27 cities along the banks that are responsible for 88% of the pollution. Domestic and industrial wastes are the main contributors to pollution in the Ganga. According to conservative estimates, over 1.4 billion liters per day of untreated effluents flow into Ganga. Industries including as food production, textiles, leatherworking, papermaking, toolmaking, and chemical processing are particularly prominent in the Ganges Delta.

Metals and other minerals are mined at the river's mouth. Although while industrial pollution only makes up approximately a quarter of the total issue, it is by no means negligible since it is localized and the effluents are more dangerous. Many studies have zeroed in on trace metals and other organic pollutants, but the majority of the evidence for pollution has been presented in terms of physical and chemical characteristics. As more and more factories spring up along the banks of the country's major waterways, more and more contaminants are being washed downstream in wastewater discharges. There has not been a lot of research done on the toxicological and eco-toxicological consequences of complex pollutant combinations in aquatic systems[5,7] Costly chemical identification of these molecules (pollutants) offers little information on toxicity since toxicological data does not available for most of the hundreds of chemicals that may be present at any location. Even if individual toxicological data were available, synergistic and antagonistic interactions would make the total toxicity uncertain[8].

Consequently, it is preferable to use more recent methods for assessing water contamination. Rather than focusing just on chemical and physical testing, this research also takes into account a biological test system that can accurately distinguish between polluted and unpolluted regions. This method will aid policymakers in rapidly pinpointing contaminated areas and formulating solutions. The possible consequences on aquatic biota and river ecosystem health cannot be evaluated with only pollution monitoring. For instance, chemical tests cannot be relied upon to assess the effects of chemical interactions or the impact of complex matrices on toxicity. Toxic compounds have varying effects on aquatic creatures at different stages of their life cycles and on different species. Prior exposure to toxins might also have an effect[9-11]. Moreover, even when all other factors are constant, the response of organisms of the same species to the same quantity of a toxicant might vary over time. Subsequent to entering a river, pollutants are either carried away from the source or get trapped at the river's bottom as a result of settling with suspended particles. Hence, sediment serves as both a source and a sink for pollutants. One of the biggest problems with the water supply is harmful sediments. Sediments are thought to be polluted in many locations. Because of its usefulness in distinguishing contaminated from unpolluted areas, sediment was selected for this study's investigation of the link between chemical contaminants and gross toxic consequences.

After traveling for about 250 kilometers, the Ganga emerges from a gap in the Himalayan mountains at Rishikesh and flows southwestward for another 30 kilometers before emptying into the Gangetic plain at Haridwar. Rishikesh, Haridwar, Garmukteshwar, Kannauj, Allahabad, Mirzapur, and Varanasi see thousands of pliligrims visiting their holy waters every day[12-13]. Taking a plunge in the Ganges is a typical activity for Indians at religious sites all along the river's length, from its beginning at Gaumukh to its end at a bigger island. As water quality is crucial, it is necessary to keep a close eye on it at all times, from source to tap. This is especially important in the Ganga's most heavily trafficked stretches, such as its sacred bathing Ghats, pilgrimage sites, and points of abstraction. Water from the Ganga is utilized for both residential and industrial purposes in the cities and villages situated along its path, therefore monitoring the river's pollution levels throughout the year is essential.

For effective steps to be made to maintain safe levels of pollution concentrations in water. Irrigation is another important use for Ganga water. The upper Gangatic canal network, with its head works at Haridwar, diverts a massive volume of water for irrigation of the Ganga-Yamuna doab in Uttar Pradesh, reducing the river's annual flow to only 15 billion cubic meters at Balwala. Many smaller tributeries join the Ganga farther downstream, increasing its volume and contributing silt that gives the river its characteristic golden ochre color[14].

Table 1.1: Location of different major cities from origin of Ganga river.

S. No.	Stations	Distance from source (km)	Elevation from mean face level(m)
1	Rishikesh	250	350
2	Garhmukteshwar	440	200
3	Fatehgarh	670	145
4	Kanpur	800	138
5	Allahabad	1050	95
6	Mirzapur	1170	90
7	Varansi	1295	80
8	Buxar	1430	60
9	Patna	1600	50

Literature Review

Vigya Kesari *et al.*, (2021) Although physicochemical characterisation is the mainstay of water quality evaluation, eutrophication and climate change are promoting the prevalence of hazardous microcystins (MCs) generating cyanobacteria as a promising new bio-indicator. Water quality in the Ganga River was analyzed using physico-chemical parameters in a spatial-temporal analysis conducted at 10 sample locations in Prayagraj and Varanasi between June 2017 and March 2018.MC-LR parity, cyanobacterial variety, and the identification of MCs-producing strains. Putative MCs-producing cyanobacteria thrive in

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environments polluted with coliform bacteria, cyanobacterial oxidative demand (COD), nitrate (NO3 -N), and phosphate. The National Sanitation Foundation Water Quality Index (NSFWQI) rates the quality of water at specific sample locations as poor or moderate. Morphological examination verifies the presence of several cyanobacterial taxa, including Microcystis, Anabaena, Oscillatoria, Phormidium, and others. In all of the locations sampled, PCR amplification confirmed the presence of hazardous microcystin (mcy) genes in uncultured cyanobacteria. Both the protein phosphatase 1 inhibition test (PPIA) and high-performance liquid chromatography (HPLC) techniques found MC-LR equivalency concentrations in water samples below the World Health Organization's (WHO) safe drinking water standard of 70 ng/L. (WHO). The toxicity of isolate 1 from Ganga was verified by the presence of mcy genes and the ability to produce MCs, confirming its identification as Microcystis based on partial 16S rDNA sequencing. Our results indicate that identifying MCs producers to the species level and monitoring the water quality index would be useful for river Ganga restoration efforts.

Aurora Ghirardelli *et al.*, (2021) The Ganga basin is home to some of the world's most populous cities, and the region as a whole is seeing rapid economic and population expansion. The pollution state of the Ganga is still little investigated and understood, despite the fact that human activity is expanding in the region. This motivated us to conduct the first comprehensive literature evaluation of organic pollutants in Ganga basin surface water and sediment, including a number of first time emerging contaminants, with a focus on their origins, concentrations, and spatial and temporal distributions (ECs). Pesticides, industrial chemicals and by-products, artificial sweeteners, medications, and personal care items are only some of the 271 organic compounds studied in 61 papers spanning the previous 30 years (PPCPs).Pesticides are the most well investigated class of organic pollutants, but our understanding of other classes—including some of the most significant ECs—remains rudimentary. Nevertheless, most of the Ganga's major tributaries and the whole southern half of the basin have not been explored, whereas research have focused on the river's main course, the Yamuna, the Gomti, and the deltaic area. Delhi, Kolkata, Kanpur, Banaras, and Patna are all important metropolitan agglomerations that also happen to be hotspots of pollution. Although pesticide levels have gone down at most locations over the last several decades, polychlorinated biphenyls (PCBs), organotin compounds (OTCs), and other persistent, bioaccumulative, and toxic substances (PPCPs) have been found at dangerously high levels in the last decade. This study emphasizes the need of PPCPs and catchment-scale, source-to-sink investigations in light of the insufficient geographical coverage of sampling and the small number of chemicals that have been studied.

Mohammad Zakwan *et al.*, (2021) The social and spiritual significance of India's greatest river basin, the Ganga, cannot be overstated. While the Ganga basin has been the subject of much research, the observed trend in the flow and sediment output of the Ganga River has received far less attention. When river flow and sediment transport are changed, it has a profound effect on river geomorphology and the surrounding ecology. This study looks for patterns in the monsoon season water and sediment production, as well as the highest and lowest yearly flows of the Ganga River. Throughout the monsoon months, we analyzed

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trends at many gauging stations along the river using the Mann-Kendall (M-K) test, Sen's slope, and our own unique method. The threshold of significance used for testing trends was 5%. New methods of analyzing trends (ITA) uncovered non-monotonicity in the time series and elucidated the nuances of hydrological shifts. Although virtually all gauging stations exhibited a downward trend in annual maximum discharge, those located upstream of the Yamuna confluence showed an upward trend in annual minimum discharge. Most of the gauging sites likewise showed decreasing patterns in flow and sediment load throughout the monsoon months. The yields of water and sediment at all locations except Gandhighat moved downward. The Western Ganga Plain (WGP) has seen a steeper decline in sediment and water output than the Eastern Ganga Plain (EGP) (EGP). Future water management initiatives may benefit from incorporating these tendencies. The changing flow pattern of the Ganga River seems to be the result of both natural and anthropogenic causes**.**

Nitin Kaushal *et.al.* (2019) Many Indians all throughout the globe have worshiped the Ganges from the beginning of time. The Ganga River is not only important to the people who live in its basin because of its cultural significance, but also because of the economic and social benefits it provides. With so many people putting a strain on its water supply, this river basin is among the world's most complicated. As a result, the river has a number of problems to deal with. In India, there is a rising discussion over how to better maintain the Ganga River by increasing both its water quality and its flow. WWF-India and its collaborators have been fighting to protect the Ganga for the last decade. While the study has been multifaceted, including topics such as river flows, water pollution, climate change adaptation, and the protection of habitat and biodiversity, this research focuses on the problem of appropriate flows in the river Ganga. In order to better understand the challenges associated with implementing Environmental Flows (E-Flows) in the crucial stretch of the River Ganga, WWF-India and its partners conducted an action research study in 2015–16 across more than 2 million cultivable command area of two irrigation systems originating from the Ganges (between Haridwar and Triveni Sangam Allahabad). The goal of this project was to fill in the gaps in understanding around the costs and benefits of implementing E-Flows along a strategic section of the Ganges. This group investigated the distribution and use of surface water in western and central Uttar Pradesh, where the Ganga is put to use in extensive irrigation systems for farming. Two barrages, or the headworks of two important irrigation projects, were studied in order to provide E-Flows recommendations for key downstream areas. Many management alternatives, such as I encouraging efficient use of irrigation water, and (ii) institutional considerations, are discussed in this work as potential means of restoring E-Flows along this section of the Ganges. Although there is considerable concern that reducing the allocation limit for irrigation will have a negative effect on farmers, this research indicates that this worry is unfounded. The introduction of E-Flows along this section of the Ganga would necessitate an increase in river water quality, although it seems from weighing the costs and benefits that this increase may be quite small. The report concludes by discussing the potential and threats associated with implementing E-Flows in the Upper Ganga.

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Material and Methods

The River Ganga in Kanpur was sampled at three separate locations before, during, and after the monsoon. Before collecting the water, the bottles were sterilized with a $KMnO_4$ rinse. The glassware was cleaned in three steps: first, with concentrated nitric acid (conc. HNO_3); next, with ethanol; and last, with water.Last but not least, we used double-distilled, deionized water to thoroughly rinse off our glassware. The necessary chemicals were acquired from regional vendors, and were of suitable quality for use as laboratory reagents.The 400 million people who make their homes in close proximity to the Ganges contribute significantly to the river's tremendous pollution. Industrial trash and sewage from several cities along the river's path.Furthermore, since the river passes through highly populated regions, it picks up a great deal of pollution from a variety of sources, including religious gifts wrapped in nonbiodegradable plastics. Many low-income individuals depend on the river for their everyday needs, including drinking, bathing, and cooking. The World Bank estimates that the cost to India's health due to water pollution is 3% of the country's GDP. One-third of all fatalities in India and 80% of all illnesses are suspected to be due to contaminated water.Increased population density, human activities like bathing, washing clothing, and bathing animals, and the dumping of different toxic industrial waste into the river are the primary causes of water pollution in the Ganga.

Procedure

Remove any sediment or other particles floating in the water sample provided by filtering it. Take a 50 ml sample of the filtered liquid and place it on a big porcelain disc, then add 3–4 drops of phenolphthalein indicator. After adding methyl orange indicator to a red solution, dilute it with a sodium carbonate solution (N/50) until the color changes to orange. ii. Put the resulting solution and 1 ml of potassium chromate indicator in a 250 ml conical flask. Pour in the N/50 silver nitrate solution gently while shaking the burette. A white silver chloride precipitate will form. iv. A red color will emerge in the flask as you continue the adding procedure; this will fade after you shake the flask. Now, gradually add silver nitrate solution until a dark reddish brown color is achieved.

The Ganges, often known as the Ganges River, has a profound effect on daily life across India. Culture, religion, and commerce in India have all been influenced by the Ganga. The river is used to both beneficial and harmful purposes, such as providing drinking water and powering factories. Severe river water contamination is caused by the improper disposal of sewage and industrial pollutants. Unsurprisingly, the Ganga River's alarmingly high levels of pollution have garnered a lot of attention and worried many.

The River's pollution concerns have prompted a number of remedial initiatives, all of which aim to improve the river's water quality.

The system needs a critical evaluation to see if the current measures are effective and whether there are better, more cost-effective ways to apply them. In 1979, the Central Pollution Control Board of India began a regular program to check the quality of the water in the Ganga basin due to these concerns. Consistent water quality monitoring will assist evaluate

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the river's pollution load and the efficacy of various pollution prevention strategies. The information will be used to protect the long-held faith in the Ganga River's sanctity and the cleanliness of its water.

The south-west monsoon (June–September) is responsible for over 70% of the water flow, whereas the summer (March–May) sees a dramatic drop in water levels. The Bhagirathi is tidal from Swarupganj all the way to the mouth, and there is significant siltation near the mouth. Pollutants, whether they are in suspension or dissolved in water, travel with the diurnal rhythm of the flow and ebb tides, and the speed and direction of the water flow in estuary streams and creeks are constantly changing. Tides have significant implications for the control of water pollution.

When it comes to the tannery industry, Kanpur is unrivaled on a worldwide scale. The city of Kanpur is notorious for its high levels of air pollution. The tanneries in Kanpur are a major contributor to the city's air pollution problems. Leather only absorbs around 20% of the chemicals used in the tanning process; the rest are discharged as wastes and taken up by the bioaccumulation process in farmed plants. Tannin and unattended solids, as well as waste effluents and waste gases, make up the tannery's wastes. There are several leather factories in the Jajmau neighborhood of Kanpur, Uttar Pradesh (India), which is situated on the banks of the Ganges River.

Chloride (mg/l): The chloride ion is a common constituent of water, often bound to another cation like calcium, magnesium, or sodium. The weathering of rocks, soil, and groundwater may result in the leaching of chlorides. Chloride ions are very movable, therefore they are carried to the enclosed basin. Chloride results show monthly fluctuations starting at a high of 200.5 mg/l. Fish and plants may both suffer from an excess of chlorine in the water. Anthropogenic or human-caused causes including road salts, sewage pollution, and water softeners have contributed to a countrywide rise in chloride content.

These factories employ so many hazardous chemicals that they are primarily responsible for polluting the Jajmau neighborhood's surface and ground water.

Urbanization and industrialisation contribute significantly to one of the world's most pressing problems: environmental degradation. Large-scale chemical use has increased rapidly over the last several decades, especially in countries like India. It's no secret that agriculture, industry, and municipal water supply all rely on ground water. Urbanization, industrial expansion, and agricultural practices all pose a growing danger to ground water supplies. Water contamination on a worldwide scale is a major issue in the contemporary world because of the proliferation of factories. Water contamination is caused mostly by the release of effluents into the receiving water. Pollutants like these may endanger human and environmental health when they make their way into water sources like rivers, lakes, and ponds. Practically every industrial process involves the release of water-based wastes from the industry. The garbage produced by industries varies greatly.

Hence, the presence of contaminants in water causes shifts in a variety of physicochemical parameters from their ideal ranges. Increases in turbidity, color, and nutrient load, as well as

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the introduction of hazardous and persistent chemicals, all have a detrimental effect on water quality. Because of the wide range of physical, chemical, and biological properties that may be found in tannery effluent, studying each effluent habitat separately is necessary.

Leather tanneries released a notably greater concentration of metals, particularly chromium, in their industrial effluents. The buildup of chromium is a result of these effluents being discharged into ground water or released into rivers and canals.

Table 1: Chloride ion concentration of river Ganga from Kanpur district

S.N.	Season	Sampling station						unit
		2018-2019			2019-2020			
		B G	S G	D G	B G	S G	D G	
1.	Pre monsoon	47.96	109.36	78.46	51.86	111.36	77.46	Mg/l
2.	monsoon	30.46	42.49	34.21	31.22	46.78	46.46	Mg/l
3.	Post monsoon	58.63	90.12	67.46	49.86	48.47	63.13	Mg/l

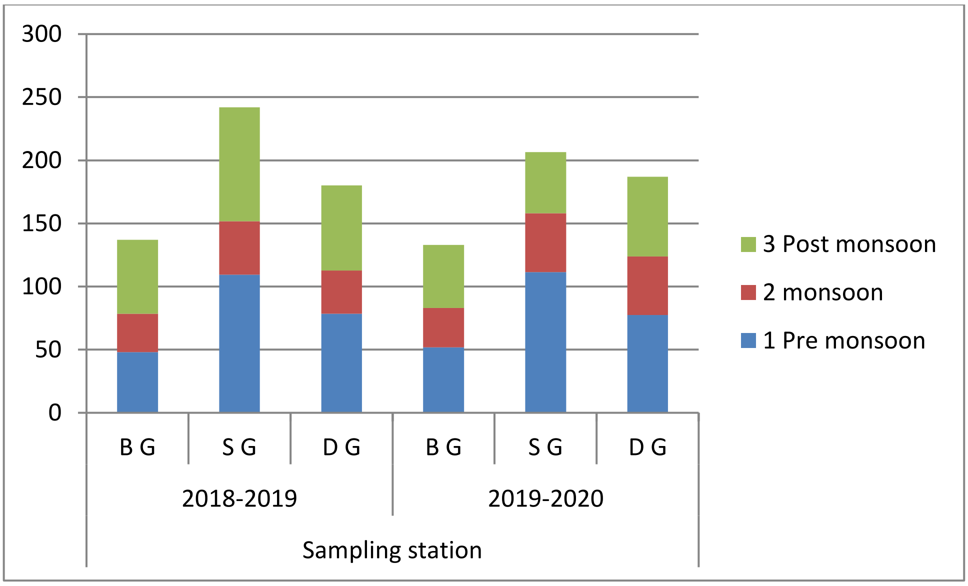

Figure 1: Chloride ion concentration in season

Conclusion

The analysis of river water samples in the Kanpur area showed that the concentration of chloride ions was well within safe levels. A high chloride concentration in a body of freshwater or an aquifer may be an indicator of contamination by sewage or industrial wastes, or the entry of saltwater or salty water. The length of the Ganga from its source is determined to be mostly within the required limits with regard to chloride based on a long-term evaluation of the mean value of water quality data.

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