

A Review on Microbial Characteristic in Ganges Water

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ABSTRACT: This study is primarily done to identify the various growths of dangerous bacteria in river Ganga and their impact on human and other animals. The primary requirements of the project are to examine the microbial development in water and their colony features by conducting the biochemical tests of the microorganisms. The evaluation of the quality of water was done by conducting various plots followed by MPN technique and the different parameters acquired from them include pH, conductivity of water, DO and biochemical oxygen demand ranges of water, faecal coliform value, and total coliform value. The microorganisms that are generally causes of the pollution of river Ganga are *Escherichia coli*, *Clostridium perfringens*, *Actinomyces sp.*, *Aerobacter aerogenes*, *Arcobacter cloacae*, *Micrococcus sp.*, *Salmonella sp.*, *Staphylococcus aureus*, *Bacillus sp.*, *Shigella sp.*, *Streptococcus faecalis*, *diplococcus sp.*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Klebsiella sp.*, *Clostridium welchii*, and *Bacillus anthracis*. Another sources of pollution of Ganga River include human wastes and industrial risks. The primary criteria of the evaluation are to raise a concern among the people of India to halt the excessive abuse of River Ganga.

KEYWORDS: Basin, Gangetic Plain, India, Pollution, River Ganga.

INTRODUCTION

The Ganga basin accounts for a little more than one-fourth (26.3 percent) of the country's total geographical area and is the biggest river basin in India, covering the entire states of Uttarakhand, Uttar Pradesh (UP), Bihar, Delhi, and parts of Punjab, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, and West Bengal. The Ganga basin is bordered in the north by the Himalayas and in the south by the Vindhyas. The major river stream originates in the Garhwal Himalaya under the name of the Bhagirathi [1].

The ice-cave of Gaumukh near the snout of the Gangotri glacier, 4100 m above sea level, is regarded as the historic source of River Ganga. The river cuts its way through the Himalayas and travels a distance of approximately 205 km from Gaumukh and transverses through two districts of Uttarakhand state, i.e., Uttarkashi and Tehri to reach Devprayg where another headstream, the Alaknanda, joins it to create Holy Ganga. The River Alaknanda is a significant tributary of the River Ganga in Uttarakhand that starts at the junction of the Satopanth and Bhagirath Kharak glaciers in Uttarakhand, and it flows about 190 kilometers before meeting Bhagirathi [2].

After flowing through the northern-most portion of Uttarakhand, the river travels through Uttar Pradesh, Bihar, Jharkhand, and West Bengal, and eventually empties into the Bay of Bengal. The river covers a length of 1450 km through Uttarakhand and Uttar Pradesh while touching the border between UP and Bihar for a stretch of 110 km. It then runs into Bihar, more or less spanning a distance of 405 kilometers. The length of the river measured along the Bhagirathi and Hooghly rivers throughout its journey in West Bengal is approximately 520 kilometers. The River Ganga has a vast number of tributaries, including Kali, Ramganga, Yamuna, Gomti, Ghaghara, Gandak, and Kosi. The River Yamuna, while a tributary of Ganga, is a river basin in itself. Its main tributaries are Chambal, Sind, Betwa, and Ken [3].

Millions of people rely on the Ganges River. The Ganges River basin, with a land area of more than 1 million hectares (Mha), crosses through four South Asian nations, with India, Nepal, Bangladesh, and China accounting up 79, 14, 4, and 3 percent of the area of the basin. In the plains, it travels approximately 2000 km before its confluence with the Brahmaputra and Meghna Rivers in Bangladesh. Benefits of water pervade the environment of the Ganges. In its meandering path over 2500 km from Gangotri Glacier to the Bay of Bengal, rich terrain and plentiful water resources sustain both livelihoods and food security of more than 600 million people, of whom the majority live in rural regions. River water is a significant supply for fisheries and other riverine ecosystems, and also for transportation spanning a length of 1500 km. Hydropower production with an installed capacity of approximately 2000 megawatts is a significant financial advantage of the river. The Ganges River is also regarded holy and cherished by its riparian population, and its water is utilized for various religious and cultural events, with more than 290 locations set up for visitors to access water along the main rivers and tributaries. Many environmentally sensitive areas, like lakes and wetlands, offer many ecosystem

services, including maintenance of aquatic creatures for food and medicine, and space for flood management and nutrient recycling, and preserving water quality [4].

Yet, the heavy rainfall during the monsoon season and accompanying floods, coupled with very low rainfall during the non-monsoon season and associated droughts, inflict significant effects on the vast riparian population. Floods impact millions of people, and damage is inflicted of hundreds of millions of dollars' worth of property and productivity yearly. Water shortage, both physical and economic in the non-monsoon season owing to inadequate water supply or insufficient development, respectively, barely enables cropping to only approximately 1.3 times the net planted area [5].

ROLE OF RIVER GANGA

Economy:

The Ganges Basin with its rich soil is important to the agricultural economy of India and Bangladesh. The Ganges and its tributaries offer a perennial supply of irrigation to a vast region. Chief crop grown in the region are sugarcane, lentils, oil seeds, potatoes, and wheat. Along the banks of the river, the existence of marshes and lakes offer a fertile growing environment for crops such as legumes, chiles, mustard, sesame, sugarcane, and jute. There are also numerous fishing possibilities along the river, but it remains extremely polluted. Furthermore, the important industrial cities of Unnao, Kanpur, located on the banks of the river with the preponderance of tanning industry contribute to the pollution [6].

Tourism:

Tourism is another connected activity. Three cities sacred to Hinduism - Haridwar, Prayag (Allahabad), and Varanasi - draw millions of pilgrims to its waters to take a plunge in the Ganges, which is thought to wash oneself of sins and aid achieve salvation. The rapids of the Ganges also are popular for river rafting, drawing adventure seekers in the summer months. Furthermore, many towns like as Kanpur, Kolkata, and Patna have built riverside walks along the banks to attract visitors [7].

Some Specific Uses Are Listed Below:

- Ganga River has remained significant over the centuries.
- The regions along the banks of rivers have seen tremendous cultural and economic development since ancient times.
- Rivers are essential elements of our culture and folk-songs.
- River water is a fundamental natural resource.
- It is important for human, agricultural, and industrial activity.
- Ganga River deposits alluvial soils.
- They offer the most fertile agricultural areas to the nation.
- The Ganga delta has historically been the rice producing region.
- An agriculture-dependent on the vagaries of the monsoon; obtain irrigation water from river.
- Ganga River valley contains dense and concentrated communities.
- Most of the major cities are situated on the banks of rivers.
- Rivers supply us with vital water sources.
- They also absorb, dilute and convey trash from communities. Hence, they show to be the greatest cleansers to towns and cities.
- Industrial growth has thrived along the river since many industrial operations rely on water.
 - Water is utilized as raw material.
 - It is utilized to cool down the heated items.
 - It is utilized in the production of energy.
- Ganga River offers main routes of inland waterways in the form of navigable rivers.
- They also indirectly via their flatlands, where highways, railroads lines, and other routes are constructed.
- Rivers are also being utilized for leisure; tourism marketing and fishing activities in a significant manner.

Ecology and Environment:

Human activity, mainly agriculture, has destroyed almost all of the original natural vegetation of the Ganges basin. More than 95 percent of the upper Gangetic Plain has been degraded or converted to agricultural or urban areas, extending along the Himalayan foothills. Only one big block of reasonably intact habitat remains

Rajaji National Park, Jim Corbett National Park, and Dudhwa National Park. As recently as the 16th and 17th centuries the upper Gangetic Plain harbored impressive populations of wild Asian elephants (*Elephas maximus*), Bengal tigers (*Panthera t. Tigris*), Indian Rhinoceros (*Rhinoceros unicornis*), gaurs (*Bos gaurus*), barasinghas (*Rucervusduvaucelii*), sloth bears (*Melursus ursinus*), and Indian lions (*Panthera leo persica*) (*Panthera leo persica*). In the 21st century, there are few big wild creatures, mainly deer, wild boars, wildcats, and tiny populations of Indian wolves, golden jackals, and red and Bengal foxes. Bengal tigers exist exclusively in the Sundarbans region of the Ganges Delta. The Sundarbans freshwater marsh ecoregion, however, is almost gone. Threatened animals on the upper Gangetic Plain include the tiger, elephant, sloth bear, and four horned antelope (*Tetracerus quadricornis*) [8].

Many kinds of birds are present across the basin, such as myna, *Psittacula* parakeets, crows, kites, partridges, and fowls. Ducks and snipes travel over the Himalayas during the winter drawn in huge numbers to wetland regions. There are no endemic birds in the upper Gangetic Plain. The great Indian bustard (*Ardeotis nigriceps*) and smaller florican (*Sypheotides indicus*) are considered internationally endangered. The natural forest of the upper Gangetic Plain has been so completely removed that it is impossible to identify a native plant type with confidence. There are a few tiny patches of forest remaining, and they indicate that most of the upper plains may have supported a tropical wet deciduous forest with sal (*Shorea robusta*) as a climax species [9].

A comparable scenario is seen in the lower Gangetic Plain, which contains the lower Brahmaputra River. The lower plains have more open woods, which tend to be dominated by *Bombax ceiba* in conjunction with *Albizia procera*, *Duabanga grandiflora*, and *Sterculiavilosa*. There are early seral forest communities that would ultimately become dominated by the climax species sal (*Shorea robusta*) if forest succession was allowed to continue. In most locations, woods fail to achieve climax conditions owing to human activities. The woods of the lower Gangetic Plain, despite 1000 of years of human habitation, remained substantially untouched until the early 20th century. Today just about 3 percent of the Eco area is under natural forest and only one big block, south of Varanasi, survives. There are approximately 40 protected areas in the Eco zone, although almost half of them are <1002 km (39 sq mi). The fauna of the lower Gangetic Plain is similar to the upper plains, with the addition of a number of additional species such as the smooth-coated otter (*Lutrogale perspicillata*) and the big Indian civet (*Viverrazibetha*) [10].

It has been estimated that approximately 350 fish species exist in the whole Ganges watershed, including many endemics. In a large 2007–2009 survey of fish in the Ganges basin (covering the river itself and its tributaries, but omitting the Brahmaputra and Meghna basins), a total of 143 fish species were documented, including 10 nonnative imported species. The most diverse orders are Cypriniformes (barbs and allies), Siluriformes (catfish), and Perciformes (perciform fish), each representing approximately 50 percent, 23 percent, and 14 percent of the total fish species in the drainage.

The major parts of the Ganges River are home to the gharial (*Gavialis gangeticus*) and mugger crocodile (*Crocodylus palustris*), while the delta is home to the saltwater crocodile (*C. porosus*).

RIVER GANGA AND POLLUTION

Passing across five states, the Ganga spans 26 percent of the country's landmass. Despite the huge sums of money spent on cleaning it, the river continues to flow filthy. Worse, the pollution is rising even in areas that were previously deemed clean. The Ganges suffers from severe pollution levels, caused by the 400 million people that live near to the river. Sewage from numerous towns along the river's path, industrial trash and religious gifts wrapped in non-degradable plastics contribute significant quantities of contaminants to the river as it passes through highly populated regions. The issue is compounded by the fact that many impoverished people depend on the river on a regular basis for bathing, washing, and cooking. The World Bank estimates that the health costs of water pollution in India equal 3 percent of India's gross domestic product. It has also been claimed that 80 percent of all illnesses in India and one-third of fatalities may be linked to waterborne infections.

Varanasi, a city of 1 million people that many pilgrims visit to take a "holy dip" in the Ganges, discharges approximately 200 million L of untreated human sewage into the river each day, resulting to high concentrations of fecal coliform (FC) bacteria. According to government regulations, water suitable for bathing should not include more than 500 FC per 100 ml, but upstream of Varanasi's ghats the river water already contains 120 times as much, 60,000 FC bacteria per 100 ml.

After the cremation of the dead at Varanasi's ghats, the bones and ashes are thrown into the Ganges. However, in the past thousands of uncremated corpses were dumped into the Ganges during cholera outbreaks, spreading

the illness. Even today, holy men, pregnant women, persons with leprosy/chicken pox, individuals who had been bitten by snakes, people who had committed suicide, the impoverished, and children under 5 are not burned at the ghats but instead floated free to disintegrate in the waterways. In addition, individuals who cannot afford the huge quantity of wood required to incinerate the whole corpse, leave behind a number of half-burned body parts.

After flowing through Varanasi and collecting 32 streams of raw sewage from the city, the concentration of FC in the river's waters increases from 60,000 to 1.5 million, with recorded peak values of 100 million per 100 ml. Drinking and swimming in its waters, therefore, entail a significant risk of illness. The monitoring findings collected during 2011 under National Water Quality Monitoring Program indicate that organic matter and bacterial population of fecal origin continue to dominate the pollution issue in River Ganga. The main water quality issues as indicated by the monitoring findings include pathogenic contamination as represented through indicators, i.e. Total coliforms and FC, organic matter as reflected through biochemical oxygen demand (BOD) and salt as reflected through conductivity. The observed range of water quality parameters of River Ganga for the year 2011 along with a summary for the year 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, and 2010 is provided in Table 1 for comparative evaluation of water quality changes throughout the years.

MICROORGANISM FOUND IN GANGA

Some of the important bacteria which were encountered in the Ganga waters include:

- *Escherichia coli*.
- *Clostridium perfringens*.
- *Actinomyces* sp.
- *Enterobacter aerogenes*.
- *Arcobacter cloacae*.
- *Micrococcus* sp.
- *Salmonella* sp.
- *Staphylococcus aureus*.
- *Bacillus* sp.
- *Shigella* sp.
- *Streptococcus faecalis*.
- *Diplococcus* sp.
- *Proteus vulgaris*.
- *Pseudomonas aeruginosa*.
- *Klebsiella* sp.
- *Clostridium welchii*.
- *Bacillus anthracis*.

Total bacterial density and qualitative changes are greatest in the wet seasons and lowest during the winters. The primary cause of bacterial contamination at most of the locations is sewage discharge. Air marginal soil decaying plant, debris and livestock washing were the other main sources of bacterial contamination.

DISCUSSION

Pollution of the Ganges (or Ganga), the biggest river in India, presents major risks to human health and the wider ecosystem. This pollution, in turn, promotes the development of a broad range of dangerous bacteria which cause different infectious illnesses in people as well as animals. Severely contaminated with human waste and industrial pollutants, the river supplies water to approximately 40 percent of India's population over 11 states, servicing an estimated population of 500 million people or more, more than any other river in the world. Today, Ganges is regarded to be the sixth most polluted river in the world. However, pollution has been an ancient and ongoing process in the river as by the time people were finally speaking of the Ganges as polluted, sections of over 600 km were basically biologically dead zones.

CONCLUSION

A lot of efforts have been made to clean the river but failed to achieve the intended outcomes. After being elected, India's Prime Minister Narendra Modi confirmed to engage in cleaning the river and reducing pollution. Subsequently, the Namami Ganga Project was announced by the government in the July 2014 budget. An estimated Rs. 2,958 Cores had been spent until July 2016 in different initiatives in cleaning up of the river. According to Scientific Studies Ganga would vanish until 2035 and the entire North India (UP, Bihar,

Uttarakhand, West Bengal, and Jharkhand) will become a desert. Saving Ganga means saving your own life. Hence, everyone should take an oath to preserve the Ganga.

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