Plant Sci. Arc.
Plant Science Archives
An International Journal of Plant Biology

Research Article
ISSN 2518-6965
www.plantarc.com

Microbiological Assessment of Sai River, Raibareily, Uttar Pradesh, India Using Indicator Organisms

Vinay Singh Baghel*, and Vishvas Hare

Department of Environmental Microbiology, Babasaheb Bhimrao Ambedkar University, Lucknow 226025, India

Citation: Vinay Singh Baghel*, and Vishvas Hare (2019). Microbiological Assessment of Sai River, Raibareily, Uttar Pradesh, India Using Indicator Organisms. Plant Science Archives. **DOI: https://doi.org/10.51470/PSA.2019.4.2.01**

Corresponding Author: **Vinay Singh Baghel** | E-Mail: **(baghelbbau@gmail.com)**

Received 30 March 2019 | Revised 29 April 2019 | Accepted 25 May 2019 | Available Online May 26 2019

ABSTRACT

The study's objective is to determine the Sai River's water quality, which is a sacred river in Uttar Pradesh, India. The river Sai, a significant river in Uttar Pradesh, rises from a pond in the hamlet of Bijgwan, close to Pihani in the district of Hardoi. It flows for around 600 kilometers, forming the district border between Lucknow and Unnao. It ultimately meets the Gomati River near Rajepur in Jaunpur district, having previously passed through Raebareli, Hardoi, and Jaunpur district. In the Indian state of Uttar Pradesh, the Sai River is a tributary of the Gomti River. In UP, the Sai is revered as a sacred river. Three water samples in total from the Raebareli area Bhanvareshvar Mandir Raebareli, Raj Ghat Raebareli, and Shaheed Smarak Raebareli were gathered, and their microbiological analyses were utilized to determine the samples' overall water quality index. The observational and significant technique used here is MPN (Most Probable Number). Here the study will focus on the amount of Total Coliform (TC) Fecel Coliform (FC) and Fecel Streptococci, present in the Holy water Sai and significantly discuss the Water Quality and health implications. Since water is the basic requirement for not only humans but also for every living organism, Quality and purity given human health especially in view its microbial contamination.

Keywords: *Microbiological analysis, Organisms, quality, coliform.*

INTRODUCTION

The majority of prehistoric societies developed alongside riverbanks. Millions of people rely on rivers for their life and still live along their banks now all over the world. The Sai River, a significant water body in Uttar Pradesh, rises from a pond in the hamlet of Bijgwan, close to Pihani in the district of Hardoi. It flows for around 600 kilometers, forming the district border between Lucknow and Unnao. It ultimately joins the Gomati River near Rajepur in Jaunpur district after passing through the districts of Hardoi, Raebareli, and Jaunpur. Locals in Hardoi refer to the area where the Bhainsta river takes shape as "Jhabar." Before the river is known by its more common name, Sai, it flows for a good ten kilometers. The Raebareli River spans around 100 kilometers during its whole course. The Gomti River is 940 kilometers long and drains 30,437 square kilometers in total. The Ganga watershed borders the Sai catchment on the south, and the Ghaghara catchment on the north. Sai River flows over alluvial terrain during its route, carrying silt from the Himalayan region. The rivers Bhainsta, Loni, Sakarni, and Bakulahi provide water to the river over its extensive course [1-3].

There are two ways to look at the use of bacteria as water quality indicators: first, their presence can be interpreted as a sign that feces are contaminating the water, which can be used as a signal to find out why the contamination is there, how serious it is, and what can be done to remove it; second, their presence can be interpreted as a sign of the possible health risks that feces pose. The likelihood of contracting a water-borne illness increases with the amount of indicator bacteria present and the degree of fecal pollution [4]. A water quality monitoring program is required for the preservation of fresh water resources as drinking water quality has become a serious problem in many nations, particularly because of worries that fresh water may become limited in the future [5].

For many human activities, including transportation, manufacturing, and agriculture, water is a vital natural resource. It comprises 50–97% of the weight of plants, animals, and around 70% of the human body. It is necessary for all life forms. According to WHO estimates, over 20% of the world's population lacks access to clean drinking water, and over 40% of people do not have proper sanitation. Unhealthy water is a major issue in many regions of the world. In more severe situations, it may even endanger humans and other living forms. It frequently restricts the utilization of essential resources. According to [6] solid particles and insoluble liquid droplets that become suspended in water can also contaminate it, as can compounds that dissolve in it. On the other hand, little is known about the quantity of enterococci in the Gomti River, as well as the distribution of related antibiotic resistance and virulence indicators. Board for the Control of Pollution (CPCB); 2002]. Enterococci have been identified as potential pathogens by a number of virulence traits, including gelatinase (gelE), endocarditis-associated antigen (efaA), collagen binding protein (ace), and enterococcal surface protein (ESP) [7-12]. The global burden of water-borne illness has been estimated by several academics. In 1990, Huntley et al. reported that there were 1.4 billion bouts of diarrhea each year in children under five, and that this resulted in an estimated 4.9 million deaths (albeit these instances were not limited to diarrhea caused by water).According to [13] water, sanitation, and hygiene account for 5.7% of the global illness burden and 4.0% of all fatalities (including diarrheal diseases, *schistosomiasis, trachoma, ascariasis, trichuris*, and hookworm disease). A significant portion of these illnesses would be water-borne in nations where a sizable portion of the populace lacks access to clean drinking water. [14] calculated that water-borne diseases might be responsible for one-third of intestinal infections globally. The current increase in human population is endangering aquatic habitats, as is the expansion of industrial and agricultural operations. Therefore, to maintain water qualities per quality goals, appropriate management of watersheds requires the detection of sources of geotaxis and microbiological contamination [15]. Coliform bacteria, which can be the whole coliform that was reduced to faecal coliforms and faecal streptococci, are the most commonly used indicators [16]. According to [18], changing lifestyles, a faster rate of infrastructure development, urbanization, industrialization, and development have all contributed to significant environmental pollution and degradation, which eventually upsets the balance between nature and humanity and, consequently, sustainability. Environmental Impact Assessments (EIAs) were first implemented in India in 1994 as a result of growing awareness of the environmental risks posed by industrialization. According to [18] a river's quality at any one time is influenced by several significant factors, such as the basin's lithology, atmospheric inputs, climatic factors, and human activity. Anthropogenic emissions are a continuous source of pollution, while surface runoff is a seasonal event that is heavily influenced by the climate in the region that [19] examined. According to [20], there is a serious health risk associated with the Gomti's pollution, especially for people who bathe in the river and consume its water. The river's water quality and amount fluctuate. According to the findings of [20-21], pollution is causing the physicochemical and bacteriological characteristics of several river systems to deteriorate daily. Furthermore, a number of researchers [22] have examined many facets of bacterial contamination and pollution in the Gomti River at different sites. Furthermore, even though the importance of microbes is well understood, little is known about their variety and many of the crucial functions they play in maintaining life support systems. Broadly speaking, drinking water tainted with human or animal waste poses the most microbiological dangers. Freshwater and coastal seawater wastewater discharges are the primary source of fecal bacteria, including diseases. Many water-borne illnesses, including diarrhea, gastroenteritis, cholera, dysentery, typhoid, and others, are brought on by pathogenic bacteria found in drinking water in tropical and subtropical regions, especially during the warmer months. These hazardous substances can contaminate surface and groundwater sources because of their environmental durability. Pollutants with high water solubility have been observed to be transported across comparatively large distances [23]. Although the spread of waterborne cholera and typhoid has been successfully stopped by the use of (thermotolerant) Coliforms and *Enterococci* as indicators of fecal contamination, a new threat to public health was discovered in the 1960s. The possibility that drinking water may potentially spread enteric viruses, including hepatitis A and other enteroviruses, was becoming more widely acknowledged [24]. Human excrement pollution is another source of viral infection in water. One particular marker of faecal contamination in tropical and temperate climates is E. *Coli*. Analyzing the bacterial density in water may offer a method for evaluating the accuracy of monitoring data. In many nations, *enterohaemorrhagic E. coli* has become a major gastrointestinal infection. While eating infected meat is the primary means of transmission [25] outbreaks linked to water-borne entero haemorrhagic E. Coli have also been reported. Total coliform, faecal coliform, and E. coli show continuous contamination in the Danube River basin; July and August have the lowest and highest levels of total coliform, respectively. Changes in these indicators may be momentarily correlated with the quantity of people visiting this environment [26]. A native of brackish and estuary habitats, Vibrio cholerae is a Gram-negative bacterium linked to zooplankton, primarily copepods [27] and aquatic birds [29]. It is a significant endemic disease that mostly affects communities in the third world and is known to produce high rates of morbidity and death in cholera cases [30]. In endemic places, there is a correlation between the prevalence of cholera and sea surface height and temperature, according to ecological studies of cholera and V. cholera [31]. Plankton blooms, salinity, water temperature, and turbidity have all been connected to the frequency and intensity of outbreaks [32]. In recent times, an additional obstacle has been recognized in the form of intestinal disease epidemics caused by Giardia sp. and Cryptosporidium sp. Similar to viruses, outbreaks have happened even when coliform tests revealed no signs of a weakened water quality [33]. The reason for the coliform bacteria standard's failure was identified as the protozoa's resistance to disinfection, which led to the inactivation of the indicator bacteria but not of the viral and protozoan pathogens. As substitute microbiological criteria for such protozoa, the spores of the Clostridium perfringens bacterium and the sulphatic reducing Clostridia have been suggested. These bacteria are also known to be strong and resistant to disinfection. Aerobic spores are another set of indicator measures that have been proposed to evaluate the effectiveness of treatment for pathogen eradication [34-35] created a most probable number (MPN) approach that made it possible to estimate populations of bacteria that are capable of heterotrophic nitrification for the first time.

MATERIALS AND METHODS

In sterilized glass bottles, water samples were collected from three different sites along the Sai River in Raebareli, India. After that, they were transported on ice to the lab, where they were processed in 6-7 hours. The three samples in the collection were collected from three different places. The study area was divided into three divisions. The traditional most probable number (MPN) method was employed to assess the water's quality. The detection of total coliforms, Fecel streptococci, and Fecel coliforms involved the inoculation of samples into MacConkey broth tubes and a 48-hour incubation period at 37 ±1ºC. The positive tubes were subcultured in Brilliant gGeen Bile Broth (BGBB) and incubated at 44.5±1ºC. Faecal coliform was detected by gas production in BGBB at 44.5±1ºC after a 48-hour incubation period. To detect fecal streptococci, water samples were inoculated into Azide Dextrose broth and incubated at 37.5±1ºC for 24 to 48 hours [36].

RESULT AND DISCUSSION

Total coliform,faecal Coliform and Faecal Streptococci count study has been conducted for assessment of River three sampling sites (SS) from Raebareli district which are Bhanvareshar Mandir (BM), Raj Ghat (RG), and Shaheed smarak (SM). During our first sampling sites Total Coliform Count (TC) was 110, Fecel Coliform (FC) was 30 and Fecel Streptococci (FS) was 22. While during second Sampling Study Raj Ghat (RJ) study of TC, FC and FS was 140, 30 and 26 respectively. Last sampling site was Shaheed Smarak (SS) and results of TC, FC and FS was 350, 50 and 33 respectively, and results suggested that BM sampling site was less microbial burden comparatively RG and SM. Humans can become infected with a broad variety of dangerous bacteria by water polluted with excrement. These include opportunistic pathogens including Pseudomonas aeruginosa, Klebsiella, Vibrio parahaemolyticus, and Aeromonas hydrophilia in addition to enteropathogenic agents like Shigella, Salmonella, enteroviruses, and multicellular parasites [37]. Testing the water for each of these creatures is not practical. This is due to the fact that many of these are very difficult to isolate and identify, and they are seldom quantifiable [38]. It has recently been discovered that certain areas of the River Gomti contain E. coli resistant to different antimicrobials as well as particular virulence genes for STEC [39-40].

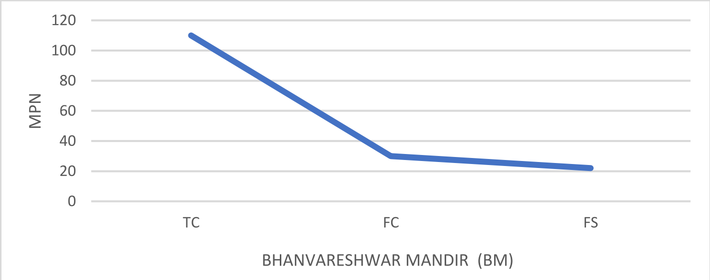

Fig 1. TC, FC and FS (MPN) Count of Bhanvareshwar Mandir

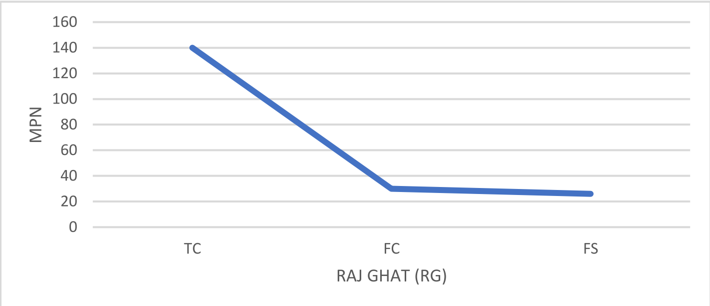

Fig 2. TC, FC and FS (MPN) Count of Raj Ghat (RG)

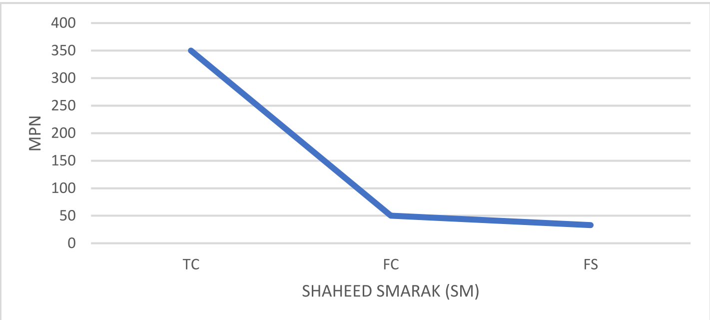

Fig 3. TC, FC and FS (MPN) Count of Shaheed Smarak

Since many infections are frequently linked to feces, the pollution of water resources by faecal contaminants poses serious threats to the health of humans and animals [41]. A comprehensive analysis of pollution dynamics and catchment hydrology is necessary for an effective quantitative microbiological assessment. An essential need is the long-term monitoring of water quality and seasonal variations in the dynamics of microbial sources [42].To safeguard the environment and stop consumers from being exposed to diseases, standard tests based on microbial indicator concentrations are utilized [43-44]. Continuous microbiological monitoring of any river system is necessary and this report will navigate planning members and environmental scientist for better management and sustained utilization of river water for mankind.

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