IDENTIFICATION AND ISOLATION OF FAecal COLIFORM IN GROUND WATER NEAR GAJRAULA INDUSTRIAL AREA (U.P.) INDIA

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Abstract: Despite increasing mass awareness level, a very limited information is available on water borne diseases in India. This probably is due to absence of an infrastructure for detection and recording such infection and its source. However, the present study shows the faecal indicator bacteria, different waterborne bacterial pathogens in Gajraula industrial development areas has significantly reduced, due to fact that the emission of effluents are treated regularly for the last few years. This makes the groundwater quality in the catchments area of study is found to be severely polluted and moderately polluted in respect of faecal indicator bacteria. As per the current study, the ground water of the area is not suitable for direct human consumption.

Keywords: bacteria; faecal indicator; ground water; Water analysis.

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INTRODUCTION

Water covers approximately 70% of surface of earth and remaining volume is found in the environment, out of which only 2% of the world’s water is potable (Lim, 1998). Chemically water is a molecule containing importance of feature of life. As water is a universal solvent it dissolves salts, inorganic and organic compounds and gases that take part in metabolic reactions, maintain the macromolecular framework, stabilize plasma membrane, thermoregulation, transport nutrients, and maintain hemostasis and body volume/weight (Armstrong et al., 2007; Bourne and Seager, 2001; Buyckx, 2007; Charney, 2008; Kleiner, 1999; Sawka et al., 2005). Water is an important component of all cells and is prerequisite of life on earth. The water composition of a cell varies from 45% to 95%, according to Anthony and Jr. Elizabeth (1980), water comprises just about 80% of weight of a microorganism and above 70% of human body weight is water. Water helps regulate human body's temperature, works as a nature's air conditioner inside our body. An average body contains 42 liters of water. With a loss of 2.7 liters, one can suffer from dehydration, weakness, and headaches and consequently reach a state of pathology. It is one of most critical of all resources, equally for human and for the natural environment. The accessibility of potable water remains a key issue of development. Enough water is necessary for development. The demand and supply of water use-cycle puts pressure on human needs for fresh water. Reservoirs (dams), irrigation canals, wells and other withdrawal activities show that human have a manipulating and important impact on water cycle (Solley et al., 1998). The environmental effects of these activities are noticeable. For example, the dams can cause the loss of land, cultural and biological resources in that area. Displacements of people, loss of wild life and continuous alteration in river ecology and hydrology is another effect (Botkin and Keller, 2005). The faecal contamination of the fresh water sources also poses a major threat to the mankind.

The sewage pollution in tropical Asian regions is severe health risk to people that live near rivers and water ways. Direct discharge of domestic wastes leaching from poorly maintained septic tanks and improper management of farm wastes
are suspected as the major sources of waterborne diseases (Huttly, 1990). Many developing regions suffer from the lack of safe drinking water for their population. About 800 billion people in Asia and Africa are living without access to safe drinking water. Consequently, this has caused many people to suffer from various waterborne diseases (Tanwir et al., 2003). Few researchers are engaged in monitoring and assessment work on ground water profile and in water bodies and have done some work in this regards (Bharti, 2012a; Bharti and Singh, 2013; Bharti et al., 2014; Bharti and Niyogi, 2015a; Bharti and Niyogi, 2015b; Bharti and Niyogi, 2015c; Bharti and Gajananda, 2015; Bharti et al., 2016). The objective of the research work is to identify, evaluate and predict the impact of increasing contamination and microbial growth and to highlight its impacts on environmental components including human beings residing in the area. The generated data may reveal some interrelations of some anthropogenic activities in natural aquatic ecosystem. Selection of sampling stretch and its planned sampling and analysis work will disclose some relationship between some microorganisms and their availability, movement and distribution in the ground water table.

E X P E R I M E N T A L

S t u d y A r e a

Gajraula is a city and municipal board in Amroha district in the state of Uttar Pradesh, India (Figure 1). Gajraula is block headquarters of Gajraula block also. It is located on NH 24 a 4-lane highway connecting Lucknow and Delhi. As of 2001 India census, Gajraula had a population of 39,826. Males constitute 53% of the population and females 47%. Gajraula has an average literacy rate of 69%, higher than the national average of 59.5%: male literacy is 74%, and female literacy is 66%. In Gajraula, 14% of the population is under 6 years of age.

S a m p l e C o l l e c t i o n

Ground water samples were collected from different sources at varying interval (Figure 2) in thoroughly washed and sterilized bottle. Physico-chemical analysis and bacteriological was done within 48 hours and the sample were stored at room temperature. A kit containing sample collection bottles, standard chemical reagents, glassware’s, pH meter, thermometer and other accessories was used for sampling. Samples were collected fortnightly throughout the study period. Water was collected after discarding the stagnant water whereas it was

Figure 1. Location of Uttar Pradesh and Gajraula Alias Jyotiba Phule Nagar in India Map

after sufficient wastages from handpump. The water samples collected from different sources were analysed in the laboratory with the procedure as recommended by standard method of examination and wastewater (APHA, 2012).

M e m b r a n e F i l t r a t i o n T e c h n i q u e

Bacteriological analysis using the Membrane Filtration Technique was used by applying the standard method: Method for the Examination of waters and Associated Materials (ASM, 2002). In present study using this method the waterborne bacterial pathogens were isolated
and identified with different isolation rates. When necessary the water samples were diluted to 1:10, 1:100 and 1:1000 (Petitbon, 1998). The isolated colonies were independently identified using standard microbiological methods. A 100 mL aliquot of water samples were filtered through membrane filter of pore size 0.45 μm and the diameter 47 mm (Micropore). When samples from different sampling sites were analysed then to avoid the contamination filtration flask were sterilized after each sample filtered.

**Analytical Profile Index (API 20E)**

The basis of API 20E is classical microbiology, clinically proven and accepted. For the identification of members of Enterobacteriaceae the API 20E which can identify 20 different biochemical tests is a most suitable identification system (Koneman et al., 1997). In present study the final identification of all isolates was carried out by API 20E. (BioMerieux Vitek Inc. Hazelwood, MO 63042). The likelihood values were calculated on basis of cultural characteristics and morphology on selective media, Gram staining, motility and oxidase test. The isolates having 99% likelihood were subjected to API 20E. (Neubauer et al., 1998)

For every isolate API 20E strips in duplicate were inoculated and incubated according to manufacturer’s instructions. The identification of isolates was calculated Fusing the manufacturers coding system based on reactions to the reagents in the twenty compartments (Aldridge et al., 1978).

![Figure 2. Location map of Sampling Area](image)

**RESULTS AND DISCUSSION**

Very high numbers of fecal coliforms (E. coli) and total coliform was isolated, in drinking water samples (Table 1). The highest number of fecal coliform (E. coli) was observed during summer months compared to winter months. The distribution of fecal coliform (E. coli) was recorded in each month of study years. Because a large number of total and fecal coliform bacteria in water samples recorded, it was difficult to present these numbers in multi-digit form. Therefore, the data was transformed into Log. The Log is a scientific mathematical notation and an easy way to handle large data numbers. In 2005, in the month of January the number of fecal coliform (E.coli) was 2.9 log cfu (Colony-forming unit), in February 2.8 log cfu, in March 2.9 log cfu, in April 3.1 log cfu, in May, 3.3 log cfu, in June it was 3.3 log cfu, in July 3.4 log cfu, in August 3.3 log cfu, in September 3.2 log cfu.
cfu, in October 3.3 log cfu, in November 3.1 log cfu and in December 2.6 log cfu/100 mL was observed (CGWB, 2005).

The concentration of E. coli was significantly higher in summer months than in cold months (p< 0.01). In 2006, in the month of January the number of fecal coliform (E. coli) 100 mL of drinking water samples was, 2.6 log cfu, in February 3.0 log cfu, in March 2.9 log cfu, in April 3.1 log cfu, in May 3.1 log cfu, in June 3.3 log cfu, in August 3.4 log cfu, in September 3.3 log cfu, in October 3.3 log cfu in November 3.1 log cfu and in December the number of fecal coliform (E. coli) was 2.8 log cfu/100mL. The concentration of E. coli was significantly higher in summer months than in winter months (p< 0.01). In 2007 the number of fecal coliform in January was 3.0 log cfu, in February 3.1 log cfu, in March 3.1 log cfu, in April 3.2 log cfu, in May 3.3 log cfu, in June 3.4 log cfu, in July 3.4 log cfu, in August 3.4 log cfu, in September 3.3, log cfu in October 3.3 log cfu, in November 3.3 log cfu and in December the number of fecal coliform (E. coli) was 3.0 log cfu/100 mL drinking water counted. The number of fecal coliform bacteria per 100 mL in Gajraula municipal water throughout the study period was lowest in the month of December with the minimum 2.6 log cfu, maximum 3.0 log cfu and mean 2.8 log cfu and highest in the month of October minimum 3.3 log cfu, maximum 3.4 log cfu and the mean 3.3 log cfu /100 mL. of water were counted.

Table 1. Fecal Coliform Descriptive Statistics of Drinking Water Samples from Gajraula Industrial Area

<table>
<thead>
<tr>
<th>Month</th>
<th>Minimum CFU/100 mL</th>
<th>Maximum CFU/100 mL</th>
<th>Mean CFU/100 mL</th>
<th>± S.E CFU/100 mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2.6</td>
<td>3.0</td>
<td>2.9</td>
<td>2.3</td>
</tr>
<tr>
<td>February</td>
<td>2.8</td>
<td>3.1</td>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>March</td>
<td>2.9</td>
<td>3.1</td>
<td>3.0</td>
<td>2.2</td>
</tr>
<tr>
<td>April</td>
<td>3.0</td>
<td>3.2</td>
<td>3.1</td>
<td>2.2</td>
</tr>
<tr>
<td>May</td>
<td>2.9</td>
<td>3.3</td>
<td>3.1</td>
<td>2.5</td>
</tr>
<tr>
<td>June</td>
<td>3.0</td>
<td>3.4</td>
<td>3.2</td>
<td>2.7</td>
</tr>
<tr>
<td>July</td>
<td>3.0</td>
<td>3.4</td>
<td>3.2</td>
<td>2.6</td>
</tr>
<tr>
<td>August</td>
<td>3.2</td>
<td>3.4</td>
<td>3.3</td>
<td>2.6</td>
</tr>
<tr>
<td>September</td>
<td>3.2</td>
<td>3.4</td>
<td>3.3</td>
<td>2.6</td>
</tr>
<tr>
<td>October</td>
<td>3.3</td>
<td>3.3</td>
<td>3.3</td>
<td>1.5</td>
</tr>
<tr>
<td>November</td>
<td>3.0</td>
<td>3.3</td>
<td>3.1</td>
<td>2.3</td>
</tr>
<tr>
<td>December</td>
<td>2.6</td>
<td>3.0</td>
<td>2.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

CONCLUSION

Ground water and a few water bodies are chiefly used to draw raw water for drinking purpose in Gajraula area. Ground water was heavily contaminated with fecal and total coliform bacteria in Monsoon and Post Monsoon season. The number of total and fecal coliform in summer months increases as compared to winter months. Number of total and fecal coliform bacteria per 100 mL of water and water temperature were observed in positive correlation and directly proportional. Thermal activities can enhance he number and influx of microbial growth in drinking water. The coliform contaminated water is not suitable for drinking purposes. Appropriate treatment or alternative solutions must be adopted in the study area to avoid the drinking water pollution as well as abatement of water borne diseases.

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