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MICROBIAL ANALYSIS OF WATER IN SELECTED INDUSTRIAL AREAS OF GWALIOR DISTRICT, MADHYA PRADESH

1. **Anamika Pathak, Research Scholar, Department of Chemistry ,Singhania University, Pacheri Bari , Jhunjhunu,Rajasthan**
2. **Dr.Yogesh Kumar ,Assistant Professor ,Department of Chemistry ,Singhania University, Pacheri Bari , Jhunjhunu,Rajasthan**

Abstract

Coliform is group of aerobic and facultative anaerobic gram negative, non spore forming rod shaped pathogenic organisms. Total coliform counts provides general indicator of the hygienic condition of the food as well as water supply. In present study Microbiological assessment for total coliform was carried out by the multiple tube fermentation methods using MacConky's broth (Hi Media) and the values were measured by most probable number (MPN) index. Similarly Fecal Coliform was also determined by the multiple tube fermentation methods using EC media (Hi Media).The groundwater samples of industrial areas were found moderately contaminated.

Keywords : Total Coliform , Faecal Coliform, Most Probable number,

Introduction

Water plays very important role in human life. Water can be available from different sources such as streams, lakes, rivers, ponds, rain, spring and wells. Fresh water is essential to support the living creature as it helps in the growth of the entire living Organism.The rising population, industrialization and urbanization change the quality of fresh water. Generally these resources are degrading gradually due to anthropogenic impacts, lack of awareness among people and lack of legal and institutional framework (Pavan and Benarjee, 2015;Gulia, Ganie & Yadav,2017).

In India, approximately 70% of water becomes contaminated due to the release of domestic sewage and industrial effluents into freshwater bodies. According to WHO, 0.4 million people has lost their life in India due to the lack of unpolluted and clean water **(** Sheetal and Sudan,2017**)**. It is very much important to know the quality of water before its consumption since consumption of water containing impurities will cause various water

borne diseases. All the parameters should be compared with the standard prescribed by Bureau of Indian Standards and World Health Organization before consuming it as a drinking, domestic, industrial, recreation and irrigation purposes etc (Nighojkar A and Chaurasia S, 2017).

Drinking water regulations in developed countries necessitate the monitoring of numerous chemical and microbiological parameters. It is well established that the health risks associated with microbiologically contaminated drinking water are extremely serious (OECD, 2003). Pathogens have been shown to correlate well with the presence of faecal contamination (Leclerc et al., 2001, Pam Tallon et al.,2005), so modern drinking water testing relies on faecal bacteria as indicators of both faecal contamination and the possible presence of disease-causing organisms .

Methodology

Sampling Locations

To assess the quality of water of the study areas, groundwater water samples were collected in and around the Old Industrial Area Birla nagar (OIABN), Industrial Area Gospura (AIG), Industrial Area Maharajpura (IAM) and Industrial Baraghata (IAB). The groundwater samples were also collected from the selected industrial units having maximum water pollution load.

Coliform Analysis

Total Coliform is group of aerobic and facultative anaerobic gram negative, non spore forming rod shaped pathogenic organisms. These are present in food, vegetation, water, soil, aquatic environment, digestive tracks of animals and waste materials. Total coliform counts provides general indicator of the hygienic condition of the food as well as water supply. Faecal Coliform is the assembly of total coliforms which are specifically present in the gut and faces of warm blooded animals. The Faecal Coliform count gives more accurate indication regarding sanitary condition of food as well as water supply than Total coliform. Microbiological assessment for total coliform was carried out by the multiple tube fermentation methods using MacConky's broth (Hi Media) and the values were measured by most probable number (MPN) index. Similarly Fecal Coliform was also determined by the multiple tube fermentation methods using EC media(Hi Media).

MPN Estimation

MPN /100 ML = **No. of positive tubes X 100**

√ ML Sample in negative tubes x ML Sample in all tubes

Results and Discussion

Total Coliform Count

Total Coliform (TC) bacteria are a group of reasonably harmless microbes present in the gut of both cold and warm blooded organisms. It is considered as "indicator organisms" as their existence alert the people about the potentiality of ailment causing organism so that preventative measures may be taken. The detection of total and fecal coliform is a vital module of any kind of water quality study (Vahith R.A. & Sirajudeen 2016). The Total Coliform count in groundwater and in and around the Old Industrial Area Birla nagar (OIABN), Industrial Area Gospura (IAG), Industrial Area Maharajpura (IAM) and Industrial Area Baraghata (IAB) are summarized in Table **1** Total Coliform count in groundwater was observed <1.8 to 8.2 MPN before monsoon and <1.8 to 8.4 MPN after monsoon period. Most of the groundwater samples were contaminated with Total Coliform which might be due to indiscriminate discharge of domestic as well as industrial wastes.

Table 1 : Total Coliform (MPN/100 ml/l) in groundwater samples in and around the Old Industrial Area Birla nagar (OIABN), Industrial Area Gospura (IAG), Industrial Area Maharajpura (IAM) and Industrial Area Baraghata (IAB).

Sampling Stations	**2018**		**2019**		**2020**	
	Pre Monsoon	**Post Monsoon**	**Pre Monsoon**	**Post Monsoon**	**Pre Monsoon**	**Post Monsoon**
Groundwater						
GW 1-OIABN	3.6	4.0	6	7.2	5.4	6.0
GW 2-OIABN	<1.8	<1.8	5.4	6	4	5.6
GW 3-OIABN	6.0	8.2	7.2	6.0	8.2	8.4
GW 4-IAG	<1.8	3.6	3.6	5.4	4.0	5.6
GW 5-IAG	5.4	6.0	6.0	7.2	7.1	6.1
GW 6-	<1.8	<1.8	3.6	5.4	4.0	6.0

IAG						
GW 7-IAM	6.0	7.2	5.4	6.0	6.0	8.2
GW 8-IAM	<1.8	<1.8	5.4	6.1	4.0	5.6
GW 9-IAM	5.4	6.0	3.6	5.6	4.0	5.4
GW 10-IAB	<1.8	<1.8	<1.8	3.6	3.6	4.0
GW 11-IAB	5.4	6.0	4.0	6.0	5.4	6.0
GW 12-IAB	<1.8	3.6	3.6	5.6	4.0	3.6
Mean	**3.7**	**4.6**	**4.6**	**5.8**	**5.0**	**5.7**
Minimum	**1.8**	**1.8**	**1.8**	**3.6**	**3.6**	**3.6**
Maximum	**6.0**	**8.2**	**7.2**	**7.2**	**8.2**	**8.4**

Faecal Coliform Count

Faecal coliform bacteria is a sub group of the Total Coliform as they can cultivate at elevated temperature and are present in the gut and feces of warm blooded animals and humans. It is also known as thermo tolerant coliforms (Somaratne N. and Hallas G,2015). The Faecal Coliform count in groundwater samples in and around the Old Industrial Area Birla nagar (OIABN), Industrial Area Gospura (IAG), Industrial Area Maharajpura (IAM) and Industrial Area Baraghata (IAB) are summarized in Table 2. Faecal Coliform count in groundwater was observed <1.8 to 5.6 MPN and <1.8 to 7.1 MPN during pre monsoon and post monsoon seasons Correspondingly. Faecal Coliform count in surface water was observed 220 to 430 MPN and 240 to 350 MPN during pre monsoon and post monsoon seasons correspondingly.

Table 2 : Faecal Coliform (MPN/100 ml/) in groundwater samples in and around the Old Industrial Area Birla nagar (OIABN), Industrial Area Gospura (IAG), Industrial Area Maharajpura (IAM) and Industrial Area Baraghata (IAB)

Sampling	**2018**	**2019**	**2020**

Stations	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon
Groundwater						
GW 1-OIABN	<1.8	<1.8	5.4	7.1	5.6	5.4
GW 2-OIABN	<1.8	<1.8	4.0	6.1	5.4	5.4
GW 3-OIABN	4.0	3.6	5.6	6.0	5.4	7.1
GW 4-IAG	<1.8	<1.8	<1.8	4.0	3.6	5.4
GW 5-IAG	3.6	<1.8	4.0	5.4	4.0	5.6
GW 6-IAG	<1.8	<1.8	<1.8	3.6	3.6	5.6
GW 7-IAM	4.0	3.6	4.0	5.6	4.0	6.0
GW 8-IAM	<1.8	<1.8	3.6	4.0	3.6	4.0
GW 9-IAM	4.0	3.6	<1.8	3.6	4.0	4.0
GW 10-IAB	<1.8	<1.8	<1.8	3.6	3.6	3.6
GW 11-IAB	4.0	3.6	3.6	4.0	3.6	4.0
GW 12-IAB	<1.8	<1.8	3.6	4.0	3.6	3.6
Mean	2.75	2.49	3.46	4.80	4.15	4.87
Minimum	1.8	1.8	1.8	3.6	3.6	3.6
Maximum	4.0	3.6	5.6	7.1	5.6	7.1
Standard deviation	1.08	0.91	1.31	1.18	0.77	1.13

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