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BACTERIOLOGICAL ANALYSIS OF RIVER GANGA NEAR BARAUNI(BIHAR).

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Abstract

In the present investigation, the water of river Ganga near Barauni (Bihar) was studied at two different sites for two consecutive years with reference to standard plate count (S.P.C) and most probable number (M.P.N) of coliform bacteria. The average value of standard plate count(S.P.C) of bacteria were found varying from 0.19 – 4.82 x 10^6/lit. at site-I and from 0.24 - 4.95 x 10^6/lit. at site-II. Similarlly, the M.P.N of coliform bacteria were found varying from 0.92 – 7.5 x 10^3/lit. at site-I and from 1.2 – 8.4 x 10^3/lit. at site-II. According to W.H.O the potable water should not contain any coliform organisms in 100ml. But in practice this standard is not attained hence the maximum permissible limit is 10 coliform. From the above finding the present investigation indicates that the higher concentration of bacteria and M.P.N of coliform at both sites exhibiting bacteriological degradation of river water.

(Key Word: River Ganga, Bacteria, Coliform, S.P.C, M.P.N)

Introduction

In aquatic environment, different pollutants like industrial effluents, domestic sewage, remains of dead bodies, excreta from human beings and animals etc. causes significant increase in bacterial population. Bacteria are a great health risk. Many of these bacteria spread various diseases like typhoid, paratyphoid, gastrointestinal disease when water is consumed by human being. In addition, they are also good indicator of organic pollution. Indicator coliform organisms have been used by many investigators to gauge the quality of aquatic environment (Hynes 1971, Bonde 1977, Ramteke et al. 1994, Brenna et al. 1993 and Grant 1997). Total coliform and faecal coliform counts are the most widely used bacteriological procedures for assessment of the quality of drinking and surface water (Mc.Daniels et al.1985). The total count bacteria test is a primary indicator of potability and sustability for consumption of drinking water. In the present work total bacteria counts as well as M.P.N. of coliform becteria have been ascertained to evaluate the quality of water.

Experimental

Materials and Methods.

The bacteriological analysis was made with reference to standard plate count and most probale number of coliform bacteria only. The mean of two data obtained were statistically analyzed for authentic interpretation. The statistical principles (Garret and Wood worth 1969) adopted for analysis.

STANDARD PLATE COUNT:

Preparation of dilution water-

Stock phosphate buffer was prepared by dissolving 34.0 gms potassium dihydrogen phosphate (KH_2Po_4) in 500 ml distilled water. pH was adjusted with 1N NaOH and diluted to 1 litre. Now 1.25 ml. of this stock buffer solution and 5.0 ml. magnesium chloride solutions (38 gm $MgCl_2$/l distilled water) was added to1 litre distilled water. It was sterilized for 15 minutes.

Preparation of Nutrient Agar Medium..

Reagents used:

(a) Trypton - 5 gms.
(b) Yeast extract - 2.5 gms.
(c) Glucose - 1.0 gm.
(d) Agar - 15.00 gm.

The above chemicals were dissolved in 1 litre distilled water and the medium was sterilized, pH was adjusted to 7.0 ± 0.01 after sterilization.

Procedure-

The water sample was shaken vigourously for ten seconds and an initial dilution 1:100 was prepared by pipetting 1 ml. of original sample into 99 ml. dilution water. Additional dilution 1:10 and 1:0 were also prepared in sterile dilution bottle. The nutrient agar medium was melted on a water bath (44^0C -46^0C). 1ml and 0.1ml from the undiluted and diluted samples were transferred to sterilized petriplates in asceptic condition. 12-15 ml of liquefied medium was poured to these plates slightly. The medium was mixed thoroughly with the sample in petriplates. When the medium become solidified, the plates were inverted and kept for incubation at 37^0C ± 0.5^0C for 48 hours. After incubation the colonies were counted in a colony counter and S.P.C was calculated as follows. SPC / ml = colonies counted/ dilution factor.

M.P.N of coliform bacteria.

Apparatus used.

(a) Fermentation tubes.
(b) Inoculation loops
(c) Durham vials.
(d) Water bath.

Preparation of McConky broth medium

Bile salts (sodium tauro cholate) - 5 gms
Pepton - 20 gms
Lactose (bromocresole purple) - 10 gms
1% neutral methyl red - 1lit
pH - 7.4-7.5

Procedure-

Different dilutions of the water sample were prepared. Now for each sample fermentation tube were taken. Durham's vials were put on inverted in each tube and Mc conkey broth medium was kept into the tubes. Tubes were sterilized at 121^0C for 15 minutes. Samples were added with sterilized pipettes to each test tube and mixed
thoroughly. All the tubes are now placed into an incubator at 35 -37^0C for 48 hours. After 48 hours all the tubes were examined and those showing gas in Durham's vial were recorded as positive and without gas were designated as negative. With the help of positive and negative tubes, the M.P.N value can be calculated as follows- MPN/100ml = M.P.N. table value x 10 / starting dilution.

Results and Discussion

Bacteria exist in a very diverse habitat in aquatic environment associated with all types of available surfaces. They are good indicator of organic pollution and at the same time they are a great health hazard. The major causes of their growth in aquatic ecosystem are sewage disposal, human faeces and urine etc directly in to the river water. Due to the high level of coliform bacteria and the other bacteria,

the river water become organically polluted and cause serious health problems. The main activity of bacteria is with the transformation of organically bound carbon, nitrogen, phosphorus, magnesium, sulphur and other complex materials into unbound oxidized state i.e their role in mineralization.

The river Ganga is getting ecologically degraded from Patna to Farakka (Bilgrami and Dutta Munshi, 1985) in Bihar. Pahwa and Mehrotra (1966), Roy and David (1966), Bilgrami et al. (1985) have recorded deterioration in the water quality at several points along the course of river Ganga. Incidence of water borne diseases among the people who consume river water in this region is quite high. In the present investigation, the S.P.C and M.P.N of coliform bacteria were studied for two consecutive years at both the sites and average of two years have been presented in the table-1.

As evident from the table-1, the S.P.C of bacteria was found varying from 0.19-4.82 × 10^6 /lit at site I and from 0.24-4.95 ×10^6 /lit at site II. Simlarly, the M.P.N of coliform bacteria was found varying from 0.92-7.5×10^3 /lit at site I and from 1.2-8.4×10^3 /lit at site II. According to W.H.O, the potable water should not contain any coliform organism in 100 ml. In practice this standard is not attained hence the maximum permissible limit is 10 coliform. The present investigation indicates the higher concentration of bacteria and M.P.N of coliform at both sites exhibiting bacteriological degradation of river water.

As regards the annual trend of variations, it exhibited lower concentration of bacteria during winter and higher during late summer and rainy season. Maximum bacterial population was present in rainy season due to organic matter which enhance bacterial growth and multiplication. Rajiv et al. (2012) studied the microbial population of different rivers in Western Tamilnadu and found the number of bacterial colonies from 100 - 200 CFU/ml. Highest microbial count were observed in Shanmuga river and lowest in Shiruvani river. Nitish Priyadarshi (2010) reported that about 89 million litre of sewage is disposed into the river Ganga, consequently about 5000 coliform bacteria developed in river water. In Varanasi, the coliform bacteria in river Ganga was found 3000 times higher than the standard established as safe by W.H.O. Mishra et al. (2009) while studying the river Ganga at Varanasi found higher concentration of bacterial population during July which is due to higher temperature, high turbidity and addition of more sewage and faecal matters. Minimum bacterial population was observed during January which is due to low temperature and low input of organic matters.

The present value indicates the higher concentration of bacterial and M.P.N. of coliform at both sites exhibiting bacteriological degradation of river water. The concentration of bacteria was found lower during winter and higher during late summer and rainy season due to more organic matter enhancing bacterial growth and population.

TABLE-1 : Monthwise Variations in **bacterial population density**

	(**Site- I**)			(**Site- II**)	
	SPC	**MPN**		**SPC**	**MPN**
Jan	0.19	0.92	Jan	0.24	1.2
Feb	0.37	1.4	Feb	0.44	1.7
Mar	0.62	1.9	Mar	0.79	2.5
Apr	0.89	2.6	Apr	1.27	3.7
May	1.75	3.8	May	2.25	4.6
Jun	2.45	4.5	Jun	2.89	5.8
Jul	3.25	5.6	Jul	4.16	7.2
Aug	4.82	7.5	Aug	4.95	8.4
Sep	4.62	7	Sep	4.8	7.6
Oct	2.15	3.2	Oct	2	2.8
Nov	0.24	1.8	Nov	0.47	2.5
Dec	0.2	1.2	Dec	0.28	2.5
M.V	1.794	3.451	M.V	2.045	4.208
S.E.	0.488	0.653	S.E.	0.513	0.756

SPC=x10 ^{6} /Lit.

MPN=x10 ^{3} /Lit.

Conclusion

The present value indicates the higher concentration of bacterial and M.P.N. of coliform at both sites exhibiting bacteriological degradation of river water. This water is not suitable for drinking purpose or domestic use. But since it is used heavily by the people so there is need to increasing awareness among the people to maintain the quality and purity level of Ganga water is necessary.

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