RESEARCH PAPER:

Potability of drinking water at various sites of Sagar city, Madhya Pradesh

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SUMMARY

Bacteriological quality of drinking water of all the sampling station near the Sagar city was taken for study. To verify the report, drinking water available at various station of Sagar city were examined for its potability. Analysis of heterophic bacteria in aquatic system is of primary importance for evaluating its tropic status, as well as for assessing input of microorganisms from extra aquatic environments. Coliform have been recognized as suitable microbiological indicator of water quality because, it is considered as traditional bacteriological tool for measuring the effectiveness of water treatment against fecal contamination.

Key words : Heterotrophic bacteria, Coliform bacteria, Water quality

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Provision of safe drinking water is a adequate basic necessity for the well-being and socio-economic development of the community. Throughout the developing world, supply of potable water to urban and rural population has been challenging task. Both nationally and internationally a reliable and safe water supply is essential basic reqyurenebt for development and stability. The World Health Organization estimates that burning dung (waste of animal) and drinking contaminated water together cause 8 million deaths per year.

Natural water always contains dissolved and suspended substances of organic and mineral. These enter the water with atmospheric precipitation and from soils where water comes into contact with underground streams or in surface water bodies. Water pollutant can be defined as a "Physical, chemical or biological factor causing aesthetic detrimental effects on aquatic life and on those who consume water. Majority of water pollutants however, is in the form of chemicals which remain dissolved or suspended in water and give an environmental response which is usually not acceptable.

The public health acceptability of water is evaluated by the presence of indicator bacteria. These microorganisms are widely employed to determine the potability of drinking water through the use of standardized test procedure. Bacteriological analysis of drinking water is primarily carried out to asses water potability and to determine a course of action for the protection of population against water borne disease. Bacteria of the coliform group are considered as the primary indicators of fecal contamination and are some of the most frequently applied indicators of water quality.

Study area:

The study area comprised of four sampling sites surrounding the Sagar city. Rajghat dam (S_1) is 22 km situated at south east of Sagar city. The dam is made on Bewas river. Second study site of water works (S_2) is constructed on the Patharia hilltop of the University of Sagar. Third study site Funnusa well (S_3) is located at Katra bazaar of Sagar city. It stores water from Bewas river and other sources. As the well is not covered and located in high air pollution zone, the stored water gets contaminated due to human activities. Forth study site Rambag well (S_4) is situated at Bada bazaar area and which supplies water to different area of Rambag and near by locality (Table 1). The water is used for the domestic purpose and is also located in air pollution zone, thus gets contaminated due to human activity.

MATERIALS AND METHODS

The surface and ground water samples were collected in presterilized glass bottles from four different sampling stations at during Jan. - Dec. 2004. The bottles were brought to the laboratory in an ice box and immediately processed for bacteriological tests. Heterotrophic plate count and total coliform were analyzed by pour plate dilution and multiple tube fermentation techniques. The methods used APHA (1992), Aneja (2002) and

Table 1: Details of dam and well water around Sagar city

Sampling station no.	Sampling area	Use	Distance from Sagar city (in center) KM
1.	Rajghat dam (S_1)	Domestic and irrigation	22
2.	Water works (S_2)	Domestic	3
3.	Funnusa well (S_3)	Domestic	0
4.	Rambag well (S_4)	Domestic	2

Kumar and Ravindranath (1998).

RESULTS AND DISCUSSION

Analysis of heterotrophic bacteria in an aquatic system is of primary importance for evaluating its tropic status as well as for assessing input of microorganisms from extra aquatic environments. The density of heterotrophic bacterial plate counts varied from 5±2 to 58 ± 2 CFU/ml x 10^{-4} at site S_1, 58±2 to 47 ± 2 CFU/ mlx10^{-4} at Site S_2, 7±2 to 34±2 CFU/mlx10^{-4} at Site S_3 and 5±2 to 34±2 CFU/ml x 10^{-4} at site S_4 (Table 2 and 3). The higher heterotrophic bacterial density was recorded at Site S_1 and S_2 when compared to site S_3 and S_4. This may be attributed to extensive run-off from the catchments area, which increased the degree of organic pollution thereby increasing the bacterial density.

Stine *et al.* (2005) observed the relative contribution of heterotrophic bacteria from various sources in the normal diet of an average person in the United States, due to concerns regarding the potential health implications of such bacteria in household tap water. Sumitha *et al*. (2003) enumerated heterotrophic bacteria, total coliforms and two indactors of fecal contamination (fecal coliforms and fecal Enterococci) as well as two types of bacteria (*Staphylococcus aureus* and *Pseudomonas aeruginosa*) from 32 drinking water samples from residences and workplaces of Bangalore.

The total coliform occurrence reported at site S_1 (in June) at site S_2 (in June and September) and the highest number of total coliform in the month of September (500 MPN/100 ml) followed by site S_3 (490 MPN/100 ml) Table 4 and 5.

The result obtained in the present study indicated that the MPN value for total coliforms at site S_3 and site S_4 were higher and exceeded the permissible limit, as

Table 2: Heterotrophic bacterial late count (*CFUx10^{-4} dilution) in site S_1 and S_2

Study site	Month											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
S_1	5±2	9±2	20±2	28±2	25±2	34±2	52±2	58±2	49±2	41±2	25±2	9±2
S_2	8±2	9±2	20±2	28±2	29±2	32±2	43±2	47±2	30±2	21±2	17±2	6±2

*CFU: Colony Farming Unit: Temperature 37±1^{0}C; Incubation: 24 h.

Table 3 : Heterotrophic Bacterial plate count (*CFUx10^{-4} dilution) in site S_3 and S_4

Study site	Month											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
S_1	7±2	11±2	14±2	12±2	14±2	26±2	31±2	34±2	20±2	19±2	16±2	7±2
S_2	6±2	11±2	14±2	10±2	13±2	21±2	29±2	34±2	18±2	21±2	15±2	5±2

*CFU: Colony Farming Unit: Temperature 37±1^{0}C; Incubation: 24 h

Table 4 : Most Probable number (MPN) of Total coliform Bacteria in site S_1 and S_2

Study site	Month											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
S_1	Nil	Nil	Nil	Nil	Nil	6	Nil	Nil	Nil	Nil	Nil	Nil
S_2	Nil	Nil	Nil	Nil	Nil	4	Nil	Nil	2	Nil	Nil	Nil

*CFU: Colony Farming Unit: Temperature 37±1^{0}C; Incubation: 24 h

Table 4 : Most Probable number (MPN) of Total coliform Bacteria in site S_3 and S_4

Study site	Month											
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
S_1	75	80	135	220	300	300	350	480	490	280	220	110
S_2	80	80	126	200	190	302	350	470	500	220	200	210

*CFU: Colony Farming Unit: Temperature 37±1^{0}C; Incubation: 24 h

shown by WHO,BIS and Ministry of Housing and Works, where the MPN value for coliform should be zero (0 MPN/100 ml). Therefore, these sampling stations could be designated as polluted sites, while the MPN value for site S_1 and S_2 were found under standard limit (WHO, 1974 and BIS) thus, good for drinking purpose. Begum *et al*. (2004) collected a total of 180 water samples from the river Brahmaputra, well supply water and tubewells of Guwahati villages of Kamalpur and Bezera development block, Assam during 2001-02, out of 180, different water samples examined 93 (51.57%) were positive for coliform bacteria. In the present study a total of 112 coliform bacteria were obtained from 93 positive water samples out of which 56(50%) were *E. coli* 46 (41.07%), *Klebsiella*, 6 (5.36%) *Enetrobacter* and 4 (3.57%) *Citrobacter*. Mahanta (1984) showed that the presence of coliform organisms in water is an indicative of the water being contaminated with fecal matter. Coliform count performed by the probable number (MPN) method in commonly used indicator of portability of water (Ramteka *et al.*, 1992, Agnihotri, 2006).

The physico-chemical properties of water changed due to the addition of organic and inorganic compounds as well as by the presence of microorganisms in water. Heterotrophic plate count indicated the distinctive level of bio-pollution status at site S_3 and S_4. The seasonal fluctuation in MPN of total coliform was observed. The values variables were relatively higher during rainy season in comparison of other seasons.

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