Bacteriological studies on ground water quality in Kanpur city (U.P.)

■ **BRAJPAL SINGH, S.C. KHURANA, MANISH KUMAR, NEELAM YADAV, RENU YADAV** AND **RANJANA YADAV**

SUMMARY : The study was investigated on the groundwater quality in Kanpur metro with reference to microbiological assessment. Water samples from various residential areas (Higher Income Group, Minimum Income Group, Lower Income Group, Juggi Jhopari and Industrial area) of the Kanpur metro were subjected for the spectrophotometric method. The results have disclosed the elevated level of pollution present in ground water of residential area, Juggi Jhopari (JJ) and followed by Industrial Area (IA). These results can help the local authorities to take an action in term of remediation purposes.

HOW TO CITE THIS ARTICLE : Singh, Brajpal, Khurana, S.C., Kumar, Manish, Yadav, Neelam, Yadav, Renu and Yadav, Ranjana (2012). Bacteriological studies on ground water quality in Kanpur city (U.P.). *Asian J. Environ. Sci.,* **7** (2): 157-159.

Author for correspondence :

NEELAM YADAV
Department of Zoology, D.A.V. College, KANPUR (U.P.) INDIA
Email: neelu.amogh@gmail.com

See end of the article for **Coopted authors'**

Water pollution is alternation in physical, chemical and biological characteristic of water, which may harm humans and aquatic biota. Although it is more difficult to pollute ground water than surface water because the soil can either stop the pollutant reaching ground water or help to reduce its concentration. Many of our activities affect it adversely. Chauhan (1998) presented an extensive review of groundwater pollution in India from various factors. In and around urban areas, domestic and industrial effluents, septic tanks solid waste refuse dumps and their leachates are the potential sources of ground water pollution and also accidental spillages may lead to groundwater contamination. In rural areas, where extensive agriculture is done, many natural and man-made factors contribute to groundwater pollution. The extensive use of fertilizers, pesticides like insecticides, herbicides, rodenticides, miticides, processing wastes and animal wastes etc. contribute to groundwater pollution. Leachates from agricultural land containing nitrates, phosphates and potash move towards with percolating water and join the aquifers below posing danger to the groundwater. The quality of water available to man has received the earliest attention and over the years. Safe drinking water and sanitation facilities provided although not 100 per cent in the country is reported to have considerably brought down the incidence of diseases such as cholera, typhoid, dysentry and diarrhoea (Wishwakarma, 1993). Diarrhoea remains one of the commonest illness of children and also a leading cause of childhood mortality in developing countries. It is estimated that over 1,000 million episodes and 3 million deaths occur each year among children of less than five years of age in the developing countries (WHO, 1993). Comprehensive national and international studies have been carried out. The planned growth of urban centres in developed and less developed nations have resulted in the development of unplanned settlements without formal water supplies or sanitation. The urban centres with their factories and large population place an enormous strain on local rivers and aquifers. Khan *et al.* (1994) studied the different pollutants and degradation patterns of the leachate produced from the refuse of ITI Kharagpur Township and reported that different pollutants attained peak values at different times and manifested high rates of self-purification.

EXPERIMENTAL METHODOLOGY

Area under study:

The present study covers the entire urban area of Kanpur metro.

Selection of sampling points:

After a survey of the city, five types of locations were chosen for collecting groundwater samples. Each type of location has five sampling stations which included mostly the hand pumps, and some dug wells. The sampling points were classified occupation wise, using stratified random sampling techniques as HIG (I-IV), MIG (I-V), LIG (I-V), JJ (I-V) and IA (I-V).

Sample collection:

Samples from various groundwater sources were collected for the evaluation of bacteriological quality.

Water may contain bacteria which are very small organisms. These may be harmful or harmless. Multiple fermentation was the technjque used for MPN (maximum permissible number) count of coliforms. Coliform is a large group of disease causing bacteria that inhabit the intestine of man and animals. The technique involves inoculating the sample and/or its several dilutions in a suitable liquid medium. After the expiry of the incubation period, the tubes are examined for gas production by the coliforms. This is known as presumptive test. Since this reaction may also be produced by the organisms other than coliforms, it is subjected to confirmatory test. For a definite presence of coliform bacteria, the complete test was carried out. The bacterial density was calculated on the basis of positive and negative combination of tubes using MPN tables.

Presumptive test:

– In this test, there dilutions (0.10, 0.01 and 0.001) were selected and five tubes for samples.
– One Durham vial was placed in each test tube and Mc Conky broth was put into the test tube. The test tubes were sterilized. Broth was thin meat or fish soup.
– Samples were added to the test tubes.
– Within 30 min, all these tubes were placed in an incubator at 35-37^{0}C .
– After 48 hours these tubes were examined.

Those showing gas in the Durham vial recorded as positive. The tubes showing positive tests were subjected to confirmatory tests.

Confirmatory test:

For this Brilliant Green Lactose Bile (BGLB) broth was used.

– Fermentation tubes were prepared with 10ml BGLB medium and Durham vials.

– These tubes were incubated at 37^{0}C for 4 hours and the tubes which formed the gas were taken as positive.

Completed test:

This test was carried out for tubes showing positive confirmatory test.

– One or more eosin ethylene blue plates were streaked from each tube showing positive in confirmatory test in such a way that the colonies were seperated by at least 0.6 cm.
– These plates were incubated at 35^{0}C for 24 hours.
– Now, these plates were examined for bacterial growth and colony appearance. Well isolated colonies with a dark centre were typical coliform colonies. The colonies that were pink as typical colonies and may belong to the other coliform group.
– Now, a coliform colony was isolated from each plate into the tubes and gas production was reported within 48 hours at 35^{0}C.

MPN method for faecal coliform:

Coliforms in water may be derived from the sources other than the faecal matter. So, it was found desirable to carry out a separate faecal coliform test for the sample where a doubt from the pollution of human origin arises. Faecal coliforms are defined as gram-negative, non-spore forming rods that ferment lactose in 24 hours at 44.5^{0}C with the production of gas in multiple tube fermentation procedure. The major species in faecal coliform groups is *Escheria coli*. The presence of these indicates faecal pollution. For this test, the presumptive test was the same as for total coliform. In confirmatory test *E. coli* medium is used instead of BGLB. The tubes were incubated at 44.5^{0}C in a water bath within 30 minutes after inoculation 24 hours. The tubes were subjected to completed test if gas was produced.

Calculation of most probable numbers (MPN):

The MPN calculation was done by the Thomas formula:

$$MPN/100ml = \frac{\textbf{Number of positive tubes x 100}}{\sqrt{\textbf{(ml sample in negative tubes)} \, \textbf{x (ml sample in all tubes)}}}$$

EXPERIMENTAL FINDINGS AND DISCUSSION

The numbers of studies have been carried out to find the bacterial quality of ground water by determining the extent of presence of heterops, coliforms and *E.coli*. The presence of coliforms in groundwater in different residential areas of Kanpur metro was observed (Table 1, Fig. 1).

Not a single sample from LIG, JJ and IA confirmed to the prescribed limit. Only a few samples of HIG and MIG had met the standard. It is a serious matter and calls for emergency

Table 1: Annual mean of MPN in ground water samples of different five types of residential areas

Sr. No.	Residential areas	Concentration of MPN number 100/ml		Annual mean
		Minimum	Maximum	
1.	Higher income group (HIG)	101	261	158
2.	Medium income group (MIG)	128	740	411
3.	Lower income group (LIG)	203	692	432
4.	Juggi Jhopari (JJ)	210	652	486
5.	Industrial area (IA)	200	716	397

remedial measures for all types of residential localities specially LIG, JJ, and IA areas. The review on coliform contamination has been presented by George and Schroeder (1985), Singh and Kapoor (1989) and Rai and Sharma (1995).
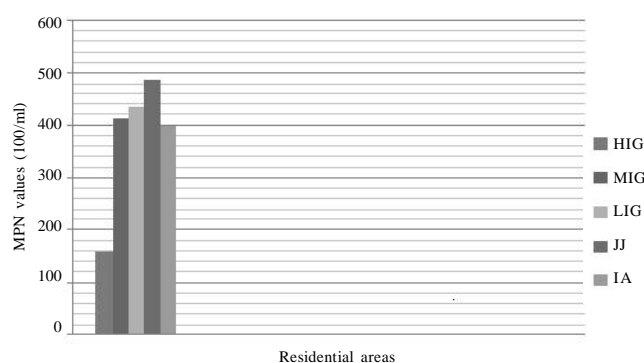

Fig. 1: MPN (100/ml) values of different groundwater samples of residential areas of Kanpur city

Coopted Authors' :

BRAJPAL SINGH, Department of Chemistry, R.S.G.U. College, Pukhrayan, KANPUR (U.P.) INDIA

S.C. KHURANA, Department of Chemistry, D.V. (P.G.) College, ORAI (U.P.) INDIA

MANISH KUMAR Department of Chemistry, C.C.S. P.G. College, Heonra, ETAWAH (U.P.) INDIA

RENU YADAV, Department of Zoology, C.C.S. P.G. College, Heonra, ETAWAH (U.P.) INDIA

RANJANA YADAV, Department of Zoology, Nehru Degree College, C.B.R., KANNAUJ (U.P.) INDIA

REFERENCES

Chauhan, B.S. (1998). Characteristics and ground water pollution potential of soils waste leachte. *Asian J. Chem.,* **10**(4): 135-138.

George, T. and Schroeder, E.D. (1985). *Water quality characterization- modeling modification.* Addison Wasley Pub. Company, USA.

Khan, S.K., Rao, C.U. and Bandhopadhya (1994). *Indian J. Environ. Health,* **36**(4): 248-250.

Rai, J.P.N. and Sharma, J.P. (1995). Bacterial contamination of groundwater in rural areas of N.W. Uttar Pradesh. *Indian J. Environ. Health,* **37**(1): 37-41.

Singh, R.P. and Kapoor, R.C. (1989). Groundwater quality of Kanpur city. *Proc. Nat. Acad. Sci., India,* **59** (B): II.

Wishwakarma, R.K. (1993). Health status of the underprivileged. Reliance Publishing House and Indian Institute of Public Administration. Centre for Urban Studies.

W.H.O. (1993). *Guidelines for drinking water quality.*

****
******