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WATER QUALITY ASSESSMENT OF RIVER ALAKNANDA

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ABSTRACT

In the present study, water sample was collected from river Alaknanda near Srinagar town located in District Pauri of Uttarakhand state. The water samples were tested for the presence of different pathogenic bacteria and other chemical parameters by standards methods. The results indicated the presence of a high degree of chemical and biological impurities in the river.

KEY WORDS: Alaknanda, water quality, Uttarakhand.

INTRODUCTION

Water exists in nature in many forms - clouds, rain, snow, ice, fog etc. As it flows over or through the surface layers of the earth, it dissolves and carries with it some of almost every organic and inorganic material it touches, including that which is dumped into it by man. These added substances may be arbitrarily classified as biological, chemical (both inorganic and organic), physical, and radiological impurities. They include industrial and commercial solvents, metals and acid salts, sediments, pesticides, herbicides, plant nutrients, radioactive materials, road salts, decaying animal and vegetable matter and various types of living microorganisms. These impurities may give water a bad taste, color, odor, or cloudy appearance (turbidity), and cause hardness, corrosiveness, staining, or frothing. They may damage growing plants and transmit disease. Water has been implicated as a medium for the transmission of diseases for many years (Taweel and Shaban, 2001). Many of these impurities are removed or rendered harmless, however, in municipal drinking water treatment plants. Water quality is the physical, chemical and biological characteristics of water. It is most frequently used by reference to a set of standards against which compliance can be assessed. The water quality is assessed in order to determine its potability, safety of human contact and for the health of ecosystems. A number of studies have been made worldwide to assess quality of different river water (Menon, 1985; Shaban and Taweel, 1999; Singh et al., 2004; Ramchandra et al., 2006; Sood et al., 2006). However, it is mandatory that all water reservoirs in the world must be periodically checked for the presence of various contaminants in order to assess its suitability for a variety of human uses

Garhwal Himalaya is positioned almost centrally in the long Himalaya sweep. Garhwal Himalaya abounds in numerous small and large flowing water systems such as rivers, streams and springs. Srinagar is an important township situated enroute the shrine resorts of Badrinath and Kedarnath in the district Pouri, Uttarakhand, India. The residents of this town and surrounding areas largely depend on river Alaknanda for drinking and irrigation purposes. However, people use water from some other local sources such as hand pump etc. Since periodic assessment of water quality of such resources is of great significance, the present work was undertaken with the objectives of detecting the pathogenic bacterial load of water sample collected from different natural and manmade sources.

MATERIALS AND METHODS

The ready- to- use kit used in this study was HIMEDIA K015-1KT HiWater™ Test Kit. All other chemicals used in the present study were of analytical/ laboratory grade procured from Himedia Pvt ltd., India, SRL Pvt ltd., India, Loba chemicals, India and CDH ltd., India

1) **Collection of Water samples-** The water samples were collected from Alaknanda river near Chauras Bridge, Srinagar (Garhwal). The water samples were collected in sterile capped bottles in the month of June. They were brought to the laboratory under aseptic conditions.
2) **Detection of pathogenic microorganisms:** The Hiwater™ test kit used in the present study does not give an estimation of colony forming units (CFUs). Instead it relies on the specific biochemical activities of pathogenic bacteria to change the colour of media into a particular type. This gives a

preliminary insight of the presence of potential pathogens in the water samples. The user manual supplied with the kit was followed in order to detect the pathogenic bacteria present in Alaknanda water.

3) **Coliform estimation-** Maximum Probable number (MPN) estimation as described by Chakraborty and Pal, (2008) was used for the detection of coliform bacteria in the water sample. This number, based on certain probability formulae, is an estimate of the mean density of coliforms in the sample.

4) **The confirmatory test for coliforms-** In this test 100ìl of culture broth from each tube detected positive for gas production was plated on EMB Agar media.

5) **Examination of Physical and chemical parameters-** Standard methods were used to determine temperature, pH, alkalinity, acidity, DO, BOD, Nitrate, H_2S, Chloride and hardness of the water sample.

RESULTS AND DISCUSSION

Detection of Pathogenic organisms in water samples – On detection with the kit used in the present study the river water was found to be contaminated by *S. serotype, Typhimurium, C. freundii, S. serotype, Enteritidis* and *Vibrio cholera.* Off course it is a preliminary investigation and a further detailed analysis involving biochemical and molecular tools needs to be done to confirm its findings but it is sufficiently giving insights about the alarming situation that has reached now.

Coliform estimation- The MPN method after a confirmatory test resulted in the estimation of 330 coliform bacteria/100 ml of water sample. A different value have been reported by previous workers (Semwal and Akolkar, 2006; Sood et al., 2008) and it may be due to their collecting the sample at different period and different sites as the anthropological load (pilgrims etc.) is not similar throughout the year and also varies from place to place. The results of the current study indicate the increased anthropogenic activities near the river and suggest precautionary measures to prevent contamination its water.

Estimation of physical and chemical parameters- Results of this investigation are summarized in Table 1. The temperature of river water was found to be around 25^0C. To the best of our knowledge no standard temperature ranges have been recommended by any of the agency working in the area of water quality monitoring and its standardization. The pH value is well within the standard limit of 6.5-8.5. Beyond this limit the water will affect the mucous membrane and water supply system. The temporary hardness is due to the biocarbonates of Calcium and Magnesium and the permanent hardness is due to the Sulphate, Chlorides and Nitrate salt of the same. As per the present investigation the Alaknanda water was found to be moderately hard (a range between 50-150mg/l). The alkalinity refers to the capacity of water to neutralize acid. In the present study, the alkalinity for the river water was found to be almost equal to its hardness and it indicates the presence of Ca and Mg salt in it. Chloride ions to a certain limit are not harmful to human being. Generally, in the absence of any Industrial effluent the river water chloride values are well within the admissible range. In the present case it was found to lie much below the threshold value. Nitrate compounds are increased in water due to agricultural fertilizers, manure, animal dung, nitrogenous material ,sewage pollution. Excess of it may lead to excessive growth of algae. Methemoglobinemia or blue baby disease in infants is also known to be caused by excess nitrogenous compounds in the drinking water. In the present case, however, the values are quite below the upper limit. In addition to that the other parameters such as BOD, COD were found to be slightly above the standard limits and a detailed investigation is further required to establish the exact cause behind this. The inorganic phosphate concentration was found to lie near the upper limit.

CONCLUSION

The present study indicates that barring a few parameters the quality of water of river Alaknanda near Srinagar seems to be well within the standard limits and therefore, can be declared fit for its use for various human purposes. However, a variety of other potential chemical contamination indicators such as Arsenic, fluoride, sulphate, Iron, Magnese, Copper, Lead, Mercury, Zinc, and Pesticides etc. needs to be tested in its water before reaching any final conclusion. In any case precautionary measures to stop increasing pollution whether of human origin or of industry/agriculture origin must be taken by the government and local agencies/NGOs working in this area.

Table 1. Estimation of various physical and chemical parameters of water from river Alaknanda

Parameters	Estimated value (Average of 3 independent estimated values)	Permissible limit (PL)*
Temperature (Centigrade)	24.50	N.R.
pH	7.4	6.5-7.5
Alkalinity (mg/l.)	60	200-600*
D.O. (mg/l.)	11.6	6.0-4.0*
B.O.D (mg/l.)	3.4	2.0-3.0*
Nitrate (mg/l.)	1.1	45-100*
H_2S (mg/l.)	6.9	N.R.
Chlorides (mg/l.)	7.68	250-1000*
CO_2 (mg/l.)	9.2	N.R.
Hardness (mg/l.)	55	300-600*
Inorganic Phosphate (mg/l.)	0.07	0.046-0.068*

*Permissive values as prescribed by Bureau of Indian Standards (http://www.indiawaterportal.org.

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