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Sewage contamination and diminished water quality of Naubatpur, Patna: A microbiological approach

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Abstract : Water is considered as the elixir of life. Apart from its central role in governing biological activities, it has also contributed a lot in the evolution of the human civilization. Water bodies like springs, rivers, lakes etc. have provided suitable sites for human settlements between states & countries and with advent of time, these sites later developed as political centers. Microbial analysis is one of the basic tools to evaluate the pollution status of the water bodies. The presence of coliform bacteria is considered as the bio-indicator of fecal contamination of water. The findings of the present study give an insight to the diminished water quality of the Naubatpur Block of Patna, Bihar due to sewage contamination. The increased incidence of water borne diseases in the local inhabitants should be thoroughly managed. A judicious intervention of the local authorities and the stakeholders are the need of hours to restrict unscientific and untreated sewage disposal in the water bodies of the said.

INTRODUCTION

Water and aqueous medium are essential and unique among the chemical substance in the evolution and support of biomass More than 80% of our body and more the 60% of our eye is water. In past the biologists had looked upon water merely as a liquid filled up the "holes" in living cells and Tissues.[2,3] But later on they realised that this most peculiar solvent plays a major possible even the predominant role in the determination of biomacro molecular conformation and changes of conformation, and that is also control in a wide spectrum of biological processes, in particular those involving chemical mass transport through the biomembranes. Water is very important for the activities of the human civilization and it is apparent from the fact that apart from the direct human consumption and other domestic usage, water finds its applicability in a majority of industrial, agricultural and medical activities as well as in the production of various types of energy for the civilized world. Failing home septic systems can allow coliforms in the effluent to flow into the water table, aquifers, drainage ditches and nearby surface waters.[4-6] Sewage connections that are connected to storm drain pipes can also allow human sewage into surface waters. Pets, especially dogs, can contribute to fecal contamination of surface waters. Runoff from roads, parking lots, and yards can carry animal wastes to streams through storm sewers. Birds can be a significant source of fecal coliform bacteria.[7-9] Swans, geese, sea gulls, and other waterfowl can all elevate bacterial counts, especially in wetlands, lakes, ponds, and rivers. Besides, agricultural practices such as allowing livestock to graze near water

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bodies, spreading manure as fertilizer on fields during wet periods, using sewage sludge biosolids and allowing livestock watering in streams can all contribute to fecal coliform contamination. The pathogenic bacteria, associated with the sewage mixed water, are generally inherent in the coliacrogenous or coliform group of bacteria of which *B. coli* or *E.coli* is important. A faecal Coliform is a facultatively anaerobic, rod- shaped, gram- negative, non- sporulating bacterium. They generally originate in the intestines of warm- blooded animals. They are capable of growth in the presence of bile salts or similar surface agents, are oxidase negative, and produce acid and gas from lactose within 48 hours at $44 \pm 0.5°C$.[1] The term "thermotolerant coliform" is more correct and is gaining acceptance over "fecal coliform".[2] Coliform bacteria basically includes the genera originated in faeces e.g. *Escherichia* as well as genera not of fecal origin e.g. *Enterobacter*, *Klebsiel la*, *Citrobacter*. The assay is intended to be an indicator of fecal contamination; more specifically of *E.coli* which is an indicator microorganism for other pathogens that may be present in feces.

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The *E. coli* bacteria inhibit the intestinal tracts of warm blooded animals and human beings. They appear in very large number in their daily faecal discharges and also in crude sewage. They are not harmful but their presence indicate the presence of other bacteria like typhoid bacillus tec. Large quantities of fecal coliform bacteria in water indicate a higher risk of pathogens being present in the water.[3] Some waterborne pathogenic diseases that may coincide with fecal coliform contamination and originate from the intestinal disorder of sick persons. Such diseases include cholera, typhoid, paratyphoid, dysentery, viral and bacterial gastroenteritis, and hepatitis and ear infections. The part played by water in the spreading of these diseases is like a mechanical agent. Thus the faces and the urine of a sick person, is not properly disposed, are conveyed by storm water or other agencies to a stream, well or other sources of water. They are then conveyed to persons who use the contaminated water. Untreated organic matter that contains fecal coliform can be harmful to the environment. Aerobic decomposition of this material can reduce dissolved oxygen levels, if discharged into rivers or waterways. This may reduce the oxygen level enough to kill fish and other aquatic life. The coliform bacteria should not exceed more than coliform colony per 100 ml. of water sample i.e. M.P.N. of *B.coli* should not exceed 1 per 100 ml. The bacterial quality should not be relaxed as to avoid the set of any serious water disease.

The objective of the present study is to determine the bacterial load of coliform in the local domestic water of Naubatpur block, Patna and suggest ways of its removal.

MATERIALS & METHODS

Microbiological examination is regarded as the main component of analysis of water which produces unique information on water quality. The main function of this examination is to detect the potentially dangers faecal pollution and the presences of organisms that causes diseases. The coli form bacteria is the most important bacteria causing the faecal pollution in drinlang and domestic water. Its determination is made as below:

Sampling of water for microbiological analysis:

The sterilized glass bottles of 300 ml capacity were used for sampling of water especially for coli form bacterial analysis. The bottle was kept stoppered until the moments it is required for filling. After collection of the sample, the bottle was immerately stoppered. It was kept in ice container and transported to the laboratory.

MPN Method for coli form bacterial analysis:

The coli form bacterial analysis in different water sample was carried QUL MPN method i.e., Most Probable Number method which is popularly known as Multiple Tube method or Sometimes it is also termed as Dilution Method.

In the MPN method, the measured volumes of samples (50 ml, 10 ml, 1 ml) are transferred to tubes containing a liquid differential medium. On incaution at specified temperature for specified period, the microorganism will either produce acid or gas or both which is considered as positive. The positive tubes are counted and the probable number of coliform organisms present in the sample.

Procedure: The sample containing bottles were shaken well and the required volume of the sample into different tubes containing the modified format Glutamate Lactose medium of double strength. 10 ml of ample was added to five tubes containing the media, 1 ml of sample to mother five tubes containing the same media and 0.1 ml of sample was transferred to five tubes containing the

same media or modified Formate Gulamate Lactose medium of Single strength. Now these tubes having their moll the carved with cotton are incubated at 37°C for 48 hours. The tube in which gas is entrapped in the inner Durham tube is considered positive. The positive tubes was then subjected confirmatory test which was performed as below.

With the help of 3 mm loop, the culture of the positive tubes was transferred to formate ricinoleat unoleats broth in tubes. They were further scubated at 37°C for 48 hours. Any amount of gas produced and entrapped A the Durhan tube contibuted a positive confirmed test.

The number of positive tubes was countered and from it the MPN Most Probable number of coliform was derived from the table 3.1 given

RESULTS AND DISCUSSION

The study of the presence of micro organism in water is highly mordant as it predicts the potentially dangerous faecal pollution and also shows the presence of micro-organisms that cause diseases. So drinking, domestic water samples need this test or analysis to ascertain its quality. Industrial water is also required to be subjected to micro biological examination to detect organisms that may contaminate or interfere in process or spoil the food products or develop unwanted growth in the water carrying structures like pipes and conduits.

The number of bacteria present in water is taken into account while assessing the quality of water for drinking domestic and industrial uses the microbiological analysis is also useful in assessing the efficacy of certain Water treatment processes like coagulation, filtration and disinfection. It also gives an early indication of pollution.

Most industries require water that contains a few numbers of microorganisms. Food processing industries need water showing a standard plate count below, fermentation industries require water with a total bacterial count below 100. The number of microorganisms should not exceed 100 per ml for water used in the manufacture of rayon.

There are several types of microorganisms which affect the quality of water in one way or other. The most important organisms are listed below:

1. Coliform bacteria
2. Proteolytic bacteria
3. Lipolytic bacteria
4. Thermophilic bacteria
5. Gelatinliquefying bacteria
6. Iron bacteria
7. Sulphete reducing bacteria
8. Sulphur reducing bacteria
9. Yeast and mould
10. Slime forming organisms.

The coliform bacteria is most important which is mainly concerned with the faecal pollution in water bodies, the presence of coliform organisms indicates faecal contamination in water. It is highly important and necessary to carry the ast for coliform bacteria in different, resources of water in Naubatpur block. Besides indicating the faecal contamination; coliform organisms are also ported to retard fermentation. Coliform organisms are the best lactose trapper and the lactic acid produced by lactose fermentation would diminish the yeast activity.

100 ml of each water samples are used for coliform analysis in MPN/100 ml of samples unit by multiple fermentation tube method (Mac Donald and David kay). As per a report in HMSO, the standards of bacteria quality of drinking water have been given in table-1.

Table - 1

Coliform, M.PN/ 100 ml	Class	Quality of Drinking Water
0	I	Excellent
1-3	II	Satisfactory
4-10	III	Suspicious
> 10	IV	Unsatisfactory

The coliform bacterial values for well water samples coincide at1.00 250 MPN/100 ml of samples while for hand pipe water samples the value is approximately 010 1.5 MPN /100 ml. The values fall between 3.50 to 3.75 MPN /100ml for pond water samples while for river water the values are approximately 3.350 MPN/100 ml.

In the present investigation, the values are maximum for pond water which may be attributed to the fact that villagers used the open defecation around the pond which contributed heavily to the faecal contamination of pond water. The situation is more or less similar for river water except for the fact that due to extreme water current in river faecal contamination is a bit less severe.

The quality of tube well water is excellent so far the faecal pollution is concerned, while water of well and hand pipe bear satisfactory quality.[10-18]

The compo native quality of water of different water resources is given in table 2.

Table-2. Comparative Values of coliform bacteria in different water sources in MPN / 100 ml of samples

Well Water Sample	Hand Pipe Water Sample	Tube Well Water Sample	Pond Water Samples	River Water Samples
1.95	0.925	0.00	3.75	3.125
AV-0.00024	0.0018		10.00052	0.000012
Quality: Satisfactory	Satisfactory	Excellent	Suspicious	Suspicious

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