Contamination of Ground Water Layers in Bhanpur Bhopal (MP) due to Improper Solid Waste Disposal

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Abstract - This paper presents results of physico chemical and bacteriological examination of ground water layers in Bhanpur Bhopal due to improper solid waste disposal. Bhopal city is situated close to the geographical center of the country. It is the capital city of Madhya Pradesh. The waste generated in the city is deposited at this landfill site at Bhanpur .In most of the places near Bhanpur ground water is the only source of drinking water. Improper management of municipal solid waste causes hazards to inhabitants as it creates the contamination of ground water resources and soil. A thorough study was conducted during the year 2013, 2014 and it has clearly indicated that the concentration of most of the parameters is below the maximum permissible limits for TDS, alkalinity, Magnesium, chloride, sulphate, and fluoride. The bacteriological contamination of ground water layers at places near Bhanpur was reported and at some places it even exceeded the permissible limits and not suitable for drinking purpose. The sample collection, preservation and pretreatment were according to standard method of collecting samples at international level i.e. BIS procedure. Prior to this a thorough survey conducted to know about probable pollution source and other relevant features.

KeyWords- Inhabitants, Permissible, contamination, Bacteriological, concentration.

I. INTRODUCTION

The importance of ground water for the existence of human society cannot be overemphasized. Water is essential for life on earth. Water is a unique liquid, without it life is impossible. Ground water is the major source of drinking water in both urban and rural areas. Besides, it is an important source for the agricultural and the industrial sector.
Water extraction without proper recharge and leaching of pollutants has polluted ground water supplies. In addition, leachates from agriculture, industrial waste and mainly the municipal solid waste have been polluted surface and ground water. As far as the quality of ground water is concerned, many places including Bhopal have been identified as endemic to contamination due to disposal of untreated solid waste at the disposal site of Bhanpur Bhopal.
Water pollution refers to any type of aquatic contamination rendering the water body poisoned by toxic chemicals and pathogenic microorganisms which affect living organisms and all forms of life.
To study the extent of pollution in ground water, we have selected ground water bodies at Bhanpur Bhopal which is the disposal site of municipal solid waste.

II. MATERIAL AND METHOD

Bhopal city is situated close to the geographical center of the country between 23º 35'N latitude and 77 º 23' E longitudes. The area of the city is 285 sq.km with maximum altitude of 625m above sea level.
The ground water bodies of Bhanpur Bhopal have been surveyed during the year 2013 and 2014. Few sampling sites were selected where municipal solid waste is disposed of without any scientific treatment.
It has been observed that in the areas near Bhanpur, hand pump is the only source of drinking water; few places like Mohali, Patel nagar, Bhanpur under bridge area, Damkheda were selected for sampling of potable water. The samples were collected from the study area and were analyzed for turbidity, ph., conductivity; chlorides, nitrates, total hardness, TDS, iron, fluoride and bacteriological analysis include detection of fecal coli form by following standard techniques as per BIS-10500 for drinking water requirement.

Table1: Showing physico chemical and bacteriological contamination in the month of September 2015

location	Source	turbidity	ph	conductivity	chloride	nitrates	Total hardness	TDS	Fe	F	Fecal coliform
Mohali1	TW	1.3	7.8	1020	21	19	572	725	0.20	0.35	-
Mohali2	TW	3.2	7.9	1123	12.5	12.5	-	665	0.71	0.31	-
Mohali3	HP	1.9	7.4	1192	16.5	13.2	612	812	0.23	0.30	-
Damkheda	TW	78	7.6	1312	27	25	325	830	0.52	0.25	520
Bhanpur1	TW	2.4	7.5	1010	5.9	7.2	-	650	0.25	0.38	1000
Bhanpur2	HP	2.1	7.8	985	18.2	18.3	-	690	0.19	0.29	1150
Bhanpur3	TW	2.5	7.6	1132	1.5	2.1	-	695	0.26	0.39	-
Bhanpur4	TW	1.3	7.4	960	1.2	1.2	562	725	0.20	0.28	-
Bhanpur5	Tap water	2.9	7.9	820	3.3	3.9	281	475	0.21	0.26	-
Bhanpur6	TW	2.5	7.6	1135	25.9	25.3	501	-	0.20	0.20	45

TW= Tube well

HP= Hand pump

Table2: Showing physico chemical and bacteriological contamination in the month of March 2015

location	Source	turbidity	ph	conductivity	chloride	nitrates	Total hardness	TDS	Fe	F	fecal coliform
Mohali1	TW	3.1	7.1	2058	558	115	852	719	1.5	0.25	-
Mohali2	TW	2.5	7.3	2165	525	28.4	992	599	-	-	-
Mohali3	HP	2.8	7.4	2167	495	120	735	695	0,30	0.23	-
Damkheda	TW	4.9	7.4	1425	335	80.2	452	856	1.15	0.15	75
Bhanpur1	TW	2.1	7.6	1030	290	40.5	410	702	0.18	0.24	520
Bhanpur2	HP	2.6	7.2	1125	225	37.9	325	610	0.22	0.25	1010
Bhanpur3	TW	1.9	7.7	862	340	29.0	-	712	-	0.20	-
Bhanpur4	TW	1.5	7.5	995	235	37.2	-	692	0.25	0.18	-
Bhanpur5	Tap water	1.2	7.4	810	-	30.1	328	472	-	0.24	-
Bhanpur6	TW	15	7.2	792	205	31.2	535	-	2.5	0.19	52

DRINKING WATER – SPECIFICATION (First Revision) IS-10500:1991. BIS, New Delhi, India
Test Characteristics for Drinking Water

Sr.no.	Characteristics	Desirable limit	Permissible limit
1	Turbidity (NTU), Max	5	10
2	pH Value	6.5 to 8.5	No Relaxation
3	Chlorides (as Cl) mg/L, Max.	250	1000
4	Nitrate (as NO3) mg/L, Max	45	No Relaxation
5	Total Hardness (as CaCo3) mg/L, Max	300	600
6	Dissolved solids mg/L, Max	500	2000
7	Iron (as Fe) mg/L, Max	0.3	1.0
8	Fluoride (as F) mg/L, Max	1.0	1.5

DRINKING WATER – SPECIFICATION
Bacteriological Examination

Ideally, all samples taken from the distribution system including consumers' premises should be free from coli form organisms. In practice, this is not always attainable, and the following standard of water collected in the distribution system is therefore recommended when tested in accordance with IS 1622:1981.

a) Throughout any year, 95 percent of samples should not contain any coli form organisms in 100 mL;
b) No sample should contain E. coli in 100 mL;
c) No sample should contain more than 10 coli form organism per 100 mL; and
d) Coli form organism should not be detectable in 100 mL of any two consecutive samples.

Source: Indian standard drinking water - specification (First Revision) IS-10500:1991. BIS, New Delhi, India

III. RESULTS AND DISCUSSION

The data revealed that the various physico chemical parameters were determined as per methods suggested by BIS-10500 and they were found to be under permissible limit but as shown above when we compare analysis reports of samples with drinking water specifications some parameters like turbidity, nitrates, total hardness and iron content of some samples are beyond permissible limits and the bacteriological analysis report of some of the samples of water was found to be contaminated.

The safety and acceptability of many widely used solid waste management practices are of serious concern from the public health point of view. All wastes produced were handled by their producers using simple disposal methods including terrestrial dumping in to both fresh and marine waters and uncontrolled burning. In spite of ever increasing industrialization and urbanization the dumping of solid waste, particularly in landfills remains a prominent means of disposal and implied treatment.

Alternative treatment technologies for solid waste management include incineration with heat recovery and waste gas cleaning and accelerated composting but both of these technologies are subject to criticism either by environmentalists on the grounds of possible hazardous emissions, failure to immobilize heavy metals by land fill operations, while key question concerning the effects of the various practices on public health and environmental safety remain unanswered.

IV. CONCLUSION

On the basis of the detailed physico-chemical and bacteriological investigation carried out in ground water in Bhanpur Bhopal in the year 2013-2014 the following conclusions drawn:

1. All parameters like total dissolved solids, sulphate, and fluoride among all the studied samples were found within the permissible limits of BIS and WHO.
2. Among all the studied samples of ground water four samples were found to be highly contaminated with bacteriological impurities. The organisms found in those samples were fecal coli form.
3. The presence of fecal coli form bacteria indicates contamination of water with fecal waste that may contain other harmful or disease causing organisms, including bacteria, viruses or parasites such as Giardia, the cause of beaver fever. Drinking water contaminated with these organisms can cause stomach and intestinal illness diarrhea and

nausea and even lead to death. The effects may be more severe and possibly life threatening for babies, children, the elderly or people with immune deficiencies or other illness.

4. Improper solid waste management gives rise to problems of health, sanitation and environmental degradation. WHO studies have indicated that 22 diseases are directly linked to improper solid waste management practices. Rodents and vector insects transmit various diseases like dysentery, cholera, plague, typhoid, infective hepatitis and others.

5. Special epidemiological studies have also shown that workers engaged in SWM services are exposed to high risks and frequently suffer from respiratory tract infections and are also gastro-intestinal parasites and worms. The organic component of solid waste provides food and shelter to disease carrying rodents and insects. Indian domestic waste contains human excreta, bio-medical waste and sometimes other toxic and hazardous wastes too. Improper management of waste can therefore spread several diseases.

6. Unscientific disposal of waste also contaminates ground water resources with heavy metal and other contaminants through leachate and pose a serious problem of environmental deterioration and health risk. It is therefore essential that all stages of solid waste management are handled carefully and health risks minimized.

7. This serious issue cannot be solved by the government only. It is ultimately up to us, to be informed, responsible and involved to the problems we face with water and soil contamination due to improper disposal of MSW. We have to preserve existing trees and plant new trees to help prevent soil erosion and promote infiltration of water into the soil and public awareness programs. These are just a few of the many ways by which we have the ability to combat contamination of water and soil.

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