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Leachate Characterization and Assessment of Ground Water Pollution near MSW Dumpsite of Mavallipura, Bangalore

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ABSTRACT
Leachate and groundwater samples were collected from municipal solid waste dumpsite of Mavallipura which comes under Bruhat Bangalore Mahanagara Palike Bangalore. An attempt has been made to characterize contaminated dumpsite and its adjacent area to study the possible impact of leachate percolation on groundwater quality. Characterization of various physico chemical parameters was carried out on selected ground water samples as well as leachate obtained from the dump site. It has been observed that, in the ground water the concentrations of various parameters such as $Ca^{2+,}$ $Mg^{2+,}$ NO_3^-, TDS, TA are on the higher side than the prescribed limits. The result shows that the leachate analyzed for various parameters are also on the higher side. This study reveals that the most of the parameters are exceeding their acceptable limit and hence significant impact on the surrounding soil and ground water quality.
Key words- Municipal Solid Waste, Ground water, Leachate, physico chemical parameters

I. INTRODUCTION

In many metropolitan cities, open, uncontrolled and poorly managed dumping is commonly practiced, giving rise to serious environmental degradation. More than 90% of municipal solid waste in cities and towns are directly disposed-off on land in an unsatisfactory manner and often pose a threat to ground water quality and has resulted in many incidents of ground water contamination in India. Nearly all human activities generate waste, and the way in which this is handled, stored, collected and disposed of, can pose risks to the environment and to public health (Zhu et al., 2008). Landfills or dumpsites have been identified as one of the major threats to groundwater resources (Fatta et al., 1999; USEPA, 1984;). The dumped solid wastes gradually release its initial interstitial water and some of its decomposition by-products get into water moving through the waste deposit. Such liquid containing innumerable organic and inorganic compounds is called 'leachate'. This leachate accumulates at the bottom of the landfill and percolates through the soil. Areas near landfills have a greater possibility of groundwater contamination because of the potential pollution source of leachate originating from the nearby site. Such contamination of groundwater resource poses a substantial risk to local resource user and to the natural environment. Many approaches have been used to evaluate the contamination of underground water. It can be measured either by the experimental determination of the impurities or their estimation through mathematical modeling (Moo-Young et al., 2004; Hudak, 1998; Stoline et al., 1993; and Butwa et al., 1989). In the present study, the impact of leachate percolation on groundwater quality was estimated from an unlined waste dumpsite site at Mavallipura Bangalore. Various physico-chemical parameters like pH, TDS, TH, TA, fluoride etc., both leachate and in groundwater samples were analyzed in order to understand the possible link of groundwater contamination. Various remedial measures were discussed in order to reduce the concentration of pollutants in the groundwater.

II. MATERIALS AND METHODS

Sampling of leachate and ground water

In this study an effort has been made to study the extent of ground water contamination due to percolation of leachate on the surrounding soil and ground water in around the dump site. Six sampling points were selected within 0.5 km radius of the dump site from where the ground water samples were taken and leachate samples were collected from the existing leachate pond. Grab sampling has been employed to collect groundwater samples. The samples were collected in polythene containers of 2 liters capacity for physicochemical analysis after pumping out sufficient quantity of water from the bore well source such that, the sample collected served as a representative sample. The samples thus collected were transported to the laboratory by observing all precautions laid down in the Standard methods ((BIS-10500:1991). All the samples were analyzed as per the Indian standard and the results are presented in the form of graph as shown below.

III. RESULTS AND DISCUSSION

The results of physico-chemical analysis of the subsurface water samples are presented in the graphs. The fig. 1 shows the variation of p^H of all the bore-well water samples and was in the range 7.6 to 8.8. The temperature of bore-well water samples varies from 29.72C to 29.9 C.

Further, the Electrical conductivity (EC) is a valuable indicator of the amount of ionic materials dissolved in the water. The fig. 2 shows the variation of EC of bore-well water samples and it varies from 533 to 917 µmhos/cm which is far below the acceptable limits Turbidity of all the bore-well-waters ranges from 1 to 1.7 NTU, the values are under the limits of BIS.

The fig. 3 shows the variation of Total Dissolved Solid (TDS), it is seen that the TDS at bore-well varies from 320 mg/l to 641.9 mg/l. which is far above the acceptable limits of potable water highest TDS value of about 640 mg/l was recorded in bore well no. 3 which may be due to its location adjacent to the dumpsite yard. The ground water pollution from garbage in the vicinity of the dumping sites is detectable through increased TDS concentration of water. High concentration of TDS decrease the palatability and may cause gastrointestinal irritation in human and may also have laxative effect particularly upon transits (WHO, 1997).

The fig. 4 shows the variation of concentration of total alkalinity, total hardness, calcium hardness and magnesium hardness of the various samples collected from the bore-wells. It has been observed from the graph that total hardness (TH) of water samples varies from 205 mg/l to 368 mg/l, Calcium hardness in ground water samples ranged from 132 mg/l to 223 mg/l. Magnesium hardness in the bore-well water samples varies from 73 mg/l to 145 mg/l, and total alkalinity is varies from 217 mg/l to 255 mg/l which are under the slightly higher than acceptable limits of BIS. The hardness in water is mainly due to salts and the most common are carbonates and sulphates calcium and magnesium this can be due to indiscriminate disposal of MSW along with sewage.

The BOD is a measure of oxygen equivalent to the organic and non-organic matter content of water susceptible to the oxidation by a strong chemical oxidant and thus is an index of organic pollution. The fig. 5 shows the variation BOD and Dissolved Oxygen (DO), of the six water samples from the nearby bore wells of the dumpsite It can be observed that the DO ranges from 0.3 mg/l to 2.6 mg/l. and the BOD level ranges from 0.4 mg/l to 3.1 mg/l, The DO content has drastically reduced due to leaching/decomposition of organic matter from the nearby dumpsite.

The fig. 6 shows the variation of the concentration Fluoride in the bore-well water samples ranged from 0.4mg/l to 0.6 mg/l. Fluoride at low concentration in drinking water has been considered beneficial but high concentration may cause dental fluorosis (tooth mottling) and more seriously skeletal fluorosis.

The fig. 7 shows the variation of various inorganic pollutants like chloride, sulphates, sodium, phosphate and nitrate. It has been observed that nitrate is beyond the acceptable limits whereas sodium, phosphate, chlorides are well within the acceptable limits Higher concentration of nitrate is due to seepage of leachate through waste dumpsite which indicates deterioration of ground water quality. The fig. 8 shows the variation of the concentration of iron in the various bore-well water sample stations, it is found that the concentration of iron is well within the acceptable limits the variation range is 0.01 to 0,04ppm the desirable limit of iron concentration is 0.3ppm as shown in the graphs.

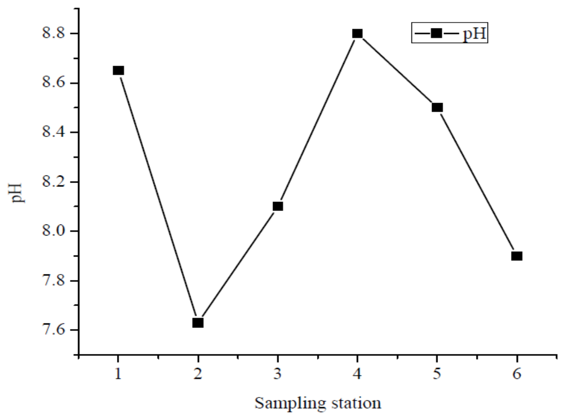

Fig. 1. Variation pH

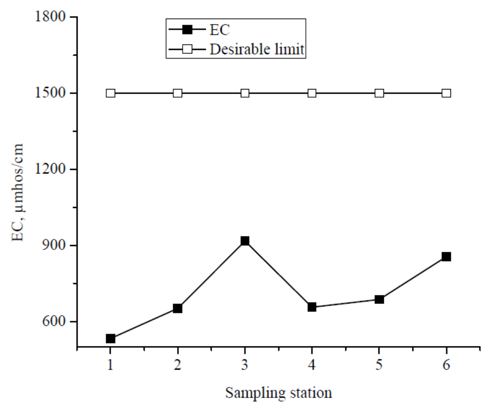

Fig. 2. Variation EC

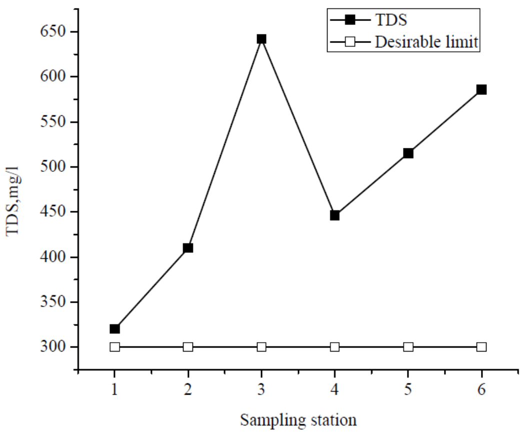

Fig. 3. Variation TDS

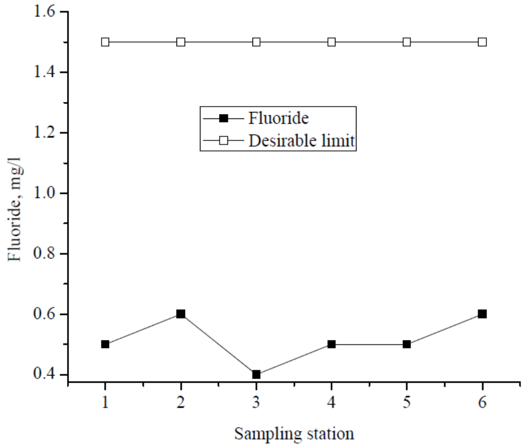

Fig. 6. Variation fluoride

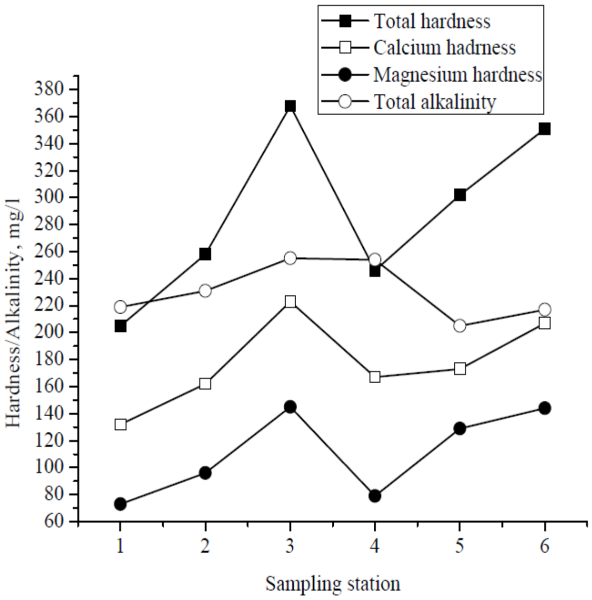

Fig. 4. Variation hardness and alkalinity

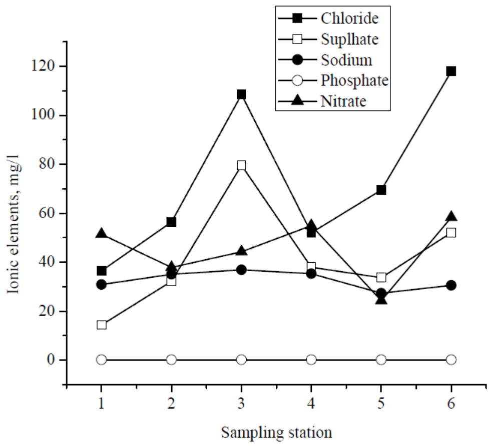

Fig. 7. Variation ionic concentratin

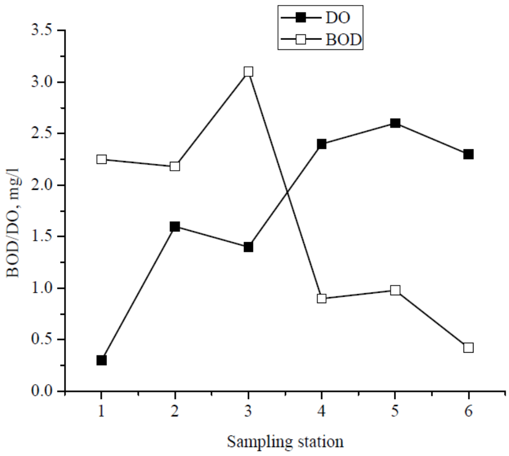

Fig. 5. Variation DO and BOD

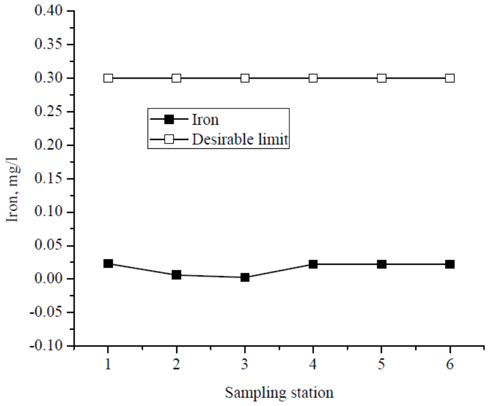

Fig. 8. Variation iron

Table. Leachate characteristicof mavallipura dumpsite

Parameters	Sample - leachate
Temperature (c)	30.3
pH	11.5
Turbidity (NTU)	27.08
EC (μmhos/cm)	18700.0
TDS (mg/ltr)	9700.0
Total hardness (mg/ltr)	1280.0
Calcium (mg/ltr)	510.0
Magnesium (mg/ltr)	770.0
Chloride (mg/ltr)	882.5
Sulphate (mg/ltr)	198.4
Sodium (mg/ltr)	300.0
Phosphate (mg/ltr)	2.15
Fluoride (mg/ltr)	3.0
Nitrate (mg/ltr)	297.0
Total Alkalinity (mg/ltr)	1050.0
Iron (mg/ltr)	1.7

IV. CONCLUSION

From the present study of the assessment of ground water in and around Municipal solid waste dumping site of Mavallipura Bangalore, it is found that some of the parameters like Total Dissolved Solid (TDS), Total Hardness (TH), Calcium, Magnesium and Nitrates concentration are above the acceptable limits of Indian Standard for drinking water (BIS- 10500:1991). The higher concentration of TDS in the water samples of bore well shows the penetration of landfill leachate has occurred to the subsurface water. Hence we can conclude that unless proper measures to control the contamination of leachate from the dumpsite are not taken there will be a serious to the subsurface water. The emphasis should be given to improve the waste management practices and construct properly engineered landfill sites to curtail the ground water pollution. Further, the continuation of the experimental investigations are needed on heavy metal pollution of subsurface water and as well as effects on soil have to be carried out.

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