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Impact of Industrial Waste Sludge on the Quality of Hand Pump Water (A Case Study of Jagadhri and Yamuna Nagar Cities in Haryana)

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ABSTRACT

From last few decades the amount of solid waste is increasing day by day in all over the world due to industrialization and urbanization. Several hazardous chemicals are dumped on lands. Dumping of industrial and municipal waste causes toxic substances to be leached and seep into the soil and affect the ground water quality. Disposal of industrial waste is the major problem and responsible for soil pollution. These industrial discharges, various pollutions from pulp and paper mills, sugar mills, distilleries, metal processing industries, starch mills, tanneries, textiles, fertilizers and pharmaceuticals pollute the water, air and soil. Yamuna Nagar and Jagadhri are the two twin cities in Haryana. Yamuna Nagar is the second biggest industrial city in Haryana All the industries discharge their solid as well as liquid waste on land and in water bodies without recommended treatment and pollute the soil, water and air. The hand pump water of Jagadhri and Yamuna Nagar colonies where the sludge of paper mill, sugar mill and metal industries are used for land filling is seriously polluted due to seepage effect of various contaminants from these wastes, the physic chemical parameters of the ground water samples and soil samples had been analyzed and compared with standard and permissible values supplied by WHO and ICMR for drinking water. The values of all the parameters are beyond the permissible limits.

Keywords: Industrial waste sludge, Hand Pump water, Solid waste

INTRODUCTION

The ecological changes have a direct impact on living organisms. Due to rapid growth of industrialization and urbanization the various contaminants enter the water bodies through many ways. Nearly 80% of the world diseases particularly in developing countries can be linked with soil and hazardous industrial waste. Ground water, a gift of nature, is about 210 billion m^3 including recharge through infiltration, seepage and evapotranspiration. Over 98% of the fresh water on the earth lies below its surface, the remaining 2% is what we see in lakes, rivers, streams and reservoirs. Today, human activities are constantly adding industrial waste, domestic and agricultural waste to ground water resources at alarming rate (CPHERI, 1972).

Ground water contamination is generally irreversible *i.e.* once it is contaminated; it is difficult to restore the original water quality of the aquifer. Executive mineralization of ground water degrades water quality proceeding an objectionable taste, odour and excessive hardness (Ahmed and Rabab, 2004).

Yamuna Nagar and Jagadhri are the two twin cities in Haryana. Jagadhri is famous for Meta industries and there are more the 800 units of metal industries. All these industries discharge their slid and liquid waste on the land without any recommended treatment. Yamunanagar is the second biggest industrial town in Haryana. There are many industries like paper mill, sugar mill, distilley, starch mill, cement plant, plywood etc. paper mill and sugar mill

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produce maximum amount of solid industrial waste in Yamunanagar (Herman, 1984). These wastes are used for land filling due to increasing urbanization which will have serious threat on groundwater due to seepage of various contaminants from these wastes. The various colonies in Yamunanagar and Jagadhri have been chronically polluted. Physico-chemical parameters of hand pump water of various pollution infested colonies around yamunanagar and Jagadhri have been investigated and compared with standard and permissible values as reported by W.H.O. (Clescexi Lenove *et al.*, 2005). The soil samples from different sampling sites have also been investigated by following standard methods (De, 2003).

Yamuna Nagar district of Haryana located in north-Eastern Part of Haryana State and lies between 29° 55' to 30° 31' north latitudes and 77° 00' to 77° 35° east longitudes. The district bounded in north by Himachal Pradesh, in the east by Uttar Pradesh, in west by Ambala district in south by Karnal and Kurukshetra district. Total Geography area of the district is 1756 sq.km and comprises 4% of total area of state. The populiton of the district is 1214205 as per 2011 census.

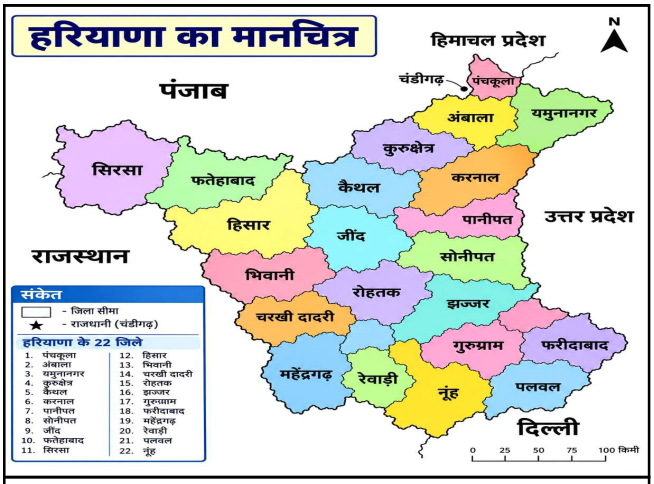


Fig. 1 : Map of Haryana

METHODOLOGY

All the chemicals used in the study were of analytical grades. All glass wares and sample containers were thoroughly cleaned and rinsed with distilled water. Standard methods for the examination of hand pumps water of different colonies (APHA, 1989) were adopted as reference. Sapless were collected at regular intervals from various strategic points. The various parameters like pH, alkalinity, total hardness, permanent hardness, temporary hardness, total solids, dissolved solids suspended solids, dissolved oxygen, bio-chemical oxygen demand, chemical oxygen demand and chloride contents were studied using the standard methods for the examination of water and waste water.

The soil samples were collected from different land filling areas and had been undertake to analyze the various parameters like pH, conductance, nitrogen, phosphorous, potassium and metal ions like Zn, Mn and Fe. The samples of soil for analysis had been properly prepared by through a 2mm (10 mesh) sieve, which was used for routine analysis. The soil samples were stored in a screw copped glass jars which were labeled. Instruments like spectrophotometer, conduct meter, pH meter and Kjeldahl assembly have been used.

RESULTS AND DISCUSSION

The principal threat to ground water comes from inadequately controlled landfills where leachate generated from the fill material is allowed to escape to the surrounding and underlying ground. The chemical composition of such leachate depends on the nature and age of the land fill and the leaching Tate. This leachate contains toxic chemicals. Solid wastes of industrial origin, however often contain a much higher proportion of toxic constituents, such as metals and organic pollutants. The most important cause of ground water pollution is unplanned urban development without adequate attention to sewage and waste disposal (Umisa and Khalilullah, 2004). Paper Mill, sugar mill and various metal industries are producing tons of solid waste, every day and pollution the soil as well as ground water. Due to increasing urbanization the population of Yamuna Nagar and Jagadhri is increasing at alarming rate and residents of various colonies are seriously affected due to these hazardous waste. The estimated annual waste production from various industries in Yamuna Nagar is around 2000 tons.

The protection of the biosphere and hydrosphere from pollution by various wastes is and extremely important problems of modern time. The analytical result of various water samples collected from pollution infested zone showed the heavy load of pollutants. In most potable wastes the pH should be seven,

The pH was observed in hand pump water of in various colonies in the range of 6.2 and 7.98. The high value of total hardness *i.e.* 260 to 920 ppm has been

reported that shows the hand pump water of these colonies has higher contents of inorganic acids, bases, salts etc. and hence the water is unfit for human consumption. The value of phenolphthalein acidity in the polluted zone is higher then the permissible limit *i.e.* 49 to 92 ppm which makes the water acidic which is not recommended for drinking. Solids in water are in the form of suspended and dissolved solids. Suspended solids represents the floating materials (bacteria and algae) and some dust particles. TS value (total solids) was observed in the range of 688 to 1029 ppm and TDS value was 363 to 762 ppm in the pollution zone due to solid waste which were very much higher then the permissible limit that is 500 ppm and makes the hand pump water contaminated due to seepage effect the chloride ions non biodegradable. These always appear in the constant range. The chloride contents in water bodies harm metallic pipes and structure. Chloride content was observed in the range of 13.64 to 58.22 ppm which is again higher then permissible limit. DO levels depend on the physical chemical and biological activates of water bodies. The analysis of DO plays an important role in water pollution activities. The concentration of DO in water depends on temperature (Garg *et al.*, 1990) pressure and concentration of various ions. Due to seepage effect of various contaminants from industrial waste the concentration of DO depletes. It was measured by Wrinkles method and was recorded in the range 4.9 and 7.2 ppm. Similarly BOD value was also high in the pollution zone.

It is due to the amount of oxygen utilized by micro-organisms in water sample. BOD also depends on the temperature, density of plankton and concentration of organic matter and other related factors. This amount of organic load is determined with the help of COD. The value of COD was observed in the range of 244 to 486 ppm in different samples shows the at maximum contamination in drinking water is due to organic load. The contaminated water have also shown the presence of number of bacteria and micro organism which causes number of diseases like gastroenteritis, diarrhea, respiratory illness, heart diseases and liver diseases etc. these diseases are severely effecting the health of residents of these colonies. Toxic effect of non biotic component is also effect the health. The presence of metals in the potable warder is a subject of serious concern due to the toxic properties of theses materials.

The various parameters studied for analyzing the soil samples from various land filing areas were pH, conductance, total nitrogen, phosphorous and potash shows that the quality of soil changed due to land filling with solid industrial waste. Conductance of the soil is due to presence of excess of soluble salt. High salts concentration of soil reduce nitrification and depress the solubility or organic matter. Soluble salts also affects the plant uptake of phosphorous, sodium, potassium and especially calcium depress the solubility of phosphate in soil. Chlorides and nitrate also have same effect. Conductance of the soil samples in land filling area is 0.30 to 5.44 mille mhos. *i.e.* very high which already indicates the sable contamination is maxim which well effect the ground water through seepage as well as fertility of the soil. Phosphorous and potassium are also the important constituents in the soil. Maximum amount of potassium and phosphorous was observed in Jagadhri area *i.e.* 210 potassium and 8.79 organic phosphorus which will effect the health of the people in this area. Iron, Zinc and manganese are very important element for plant growth, although needed in small amount. The amount of Iron in various samples is 11.43 to 127.50 which is very much beyond the permissible limit. This may seriously affect the health of people. Though Iron content in drinking water may not affect the human system as a simple overload but in long run prolonged accumulation of Iron in the body may result in homochromatosis due to which tissues are damaged. In some districts of Assam and Orison ground water have higher iron content ranging from 1 to 10mg/1 Color of some hand pump water in Jagadhri is light yellow due to the presence of excess of Iron.

Conclusion

The above data given for water quality of hand pumps water of various land filling areas in Yamuna Nagar and Jagadhri showed that the water is not fit for drinking as well as for bathing and for other domestic use due to presence of various toxic substances in it. Most of the parameters were found not in the permissible limit; however it/it's advisable to drink water of these hand pumps after boiling and filtration. Some imamate measures are needed to save the underground water from contamination due to solid waste and effluents from different industries located in Yamuna Nagar and Jagadhri.

It is essential to draw a master plan for the whole areas and different industries should disposed their waste at proper places after recommended treatment so that we can save our water bodies, soil as well as our

environment.

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