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Study of an impact of Municipal Wastes on the Underground Water Resources

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Abstract- The groundwater is a precious natural source of drinking water. It is the natures gift to all human beings. The groundwater is the part of the natural water present within underground aquifers. About more than 98 % of freshwater is stored in the groundwater in pores and fractures of rocks. The groundwater is also an important source for industries and an agriculture, it also plays an important role in supporting lands and their ecosystems. The protection of groundwater quality is an importance task. If it gets polluted, it becomes difficult, to rehabilitate. The rate of groundwater flow and the microbiological activities can affect its purification. The risk of groundwater pollution is increasing both from disposal of waste materials and from widespread use by industry and agriculture of potentially polluting chemicals in the environment. Now a day due to rapid urbanization poses the problem of solid waste management, which leads to environmental nuisance, health hazard and its consequence. Due to urbanization, industrialization, tremendous population produce a larger amount of solid wastes. The open dumping of these solid wastes can deteriorate the quality of groundwater. In this paper, how the groundwater quality gets deteriorate due to of municipal wastes which makes unfit for drinking purposes.

Key-Words: Groundwater, Solid wastes, Dumping, Municipal Wastes, Urbanization

I. INTRODUCTION

The runoff with toxic pollutants, get entered into the surface water sources may pollute them. Polluted surface sources may have a serious effect on sustainable development. The improper management of Municipal Solid Waste poses a serious danger to the community. During raining liquid formed from the dumped solid wastes may infiltrate and pollute the ground water sources. infiltrating into the ground, may pollute the aquifers. [1].

In India about 85 % of the water for domestic use while over 50 % of groundwater used for irrigation purposes. Groundwater plays crucial role in the natural resources and socio-economics. [2]. The increase in use of groundwater has poses problems mainly the depletion of groundwater resources.

Municipal Wastes

Municipal waste comprises of all the wastes, solid discarded as useless or unwanted from human activities. Municipal waste consists of highly heterogeneous mass of discarded materials from commercial, industrial, agricultural and mining activities. Municipal solid waste (MSW) is generally consist of non-hazardous components but sometimes hazardous. e.g. Packagings, cloths, glass, plastic bottles, newspapers, paints, batteries, industrial dust, ash, tyres, metal cans and containers, dead animals, medical waste, abandoned vehicles, insulations, sewage and sludge. In India MSW is generated ranged from approx. 100-500 g/person. 13-20 % of it is recyclable. [3]

The Causes of Groundwater Contamination

Human activities

Industrial activities: Spills of industrial chemicals, improper disposal of waste, and leakage from underground pipes and tanks

Agricultural activities: Use of fertilizers and pesticides, which can introduce nitrates into the groundwater

Mining activities: Improper waste disposal, which can introduce toxic metals like arsenic into the groundwater

Road salt: Runoff of salt and other chemicals from roads and highways

Septic systems: Leaking septic systems can contaminate groundwater

Petroleum products: Leaky tanks or pipelines containing petroleum products can contaminate groundwater

Natural processes
Decaying organic matter: Can move in groundwater as particles

Substances in rocks or soils: Substances like iron, manganese, arsenic, chlorides, fluorides, sulfates, or radionuclides can dissolve in groundwater {4,5].

Groundwater contamination can cause health issues, such as cancer, liver damage, and gastrointestinal disorders.

Water quality index
Groundwater quality depends on recharged water quality, precipitation and geochemical processes.

The groundwater comes in contact with rock surfaces therefore contains high minerals as compared to surface water sources. It is a hectic to clean contaminated aquifers and takes several decades to remove the contamination. Pollutants in the surface water may be same or different from the groundwater pollutants. An agricultural run-off, industrial effluents, municipal sewage are the main sources of organic and inorganic pollutants. [6,7,8].

The standards for potability in India is set by Bureau of Indian Standards, World Health Organization (WHO), Indian Council for Medical Research (ICMR).

Table1: Water quality index

Sr. No.	WAQ	Grade	Water Quality Rating
1	Below 50	A	Excellent
2	50-100	B	Good
3	101-200	C	Poor
4	201-300	D	Very Poor
5	Above 300	E	Unsuitable for drinking purpose

Material and Methods
Study area: The study area was the dumpsite of the municipality

Water analyses
The physical parameters Odour, Taste, Colour, Turbidity.

Chemical parameters pH, dissolved oxygen (DO), total dissolved solids (TDS), total hardness (TH), total iron, nitrate, nitrite, chloride.

Heavy metals - copper, zinc, and lead.

Soil sampling and analysis
The soil samples were collected from the dumpsite. About 50 g of the soil samples taken at the depths 0-50 cm, from sampling sites were collected at different locations. The samples were collected by using a soil auger, air dried, sieved and stored in sampling bags.

The following constituents were analysed organic content, nitrogen (N), phosphorus (P), sodium (Na),

calcium (Ca), magnesium (Mg), cyanide (Cn), copper (Cu), lead (Pb), silver (Ag) and mercury (Hg).

Results and Discussion
Physico-chemical parameters of water samples
pH

pH of the water sample is depending on the concentration of carbon dioxide, carbonates and bicarbonates. The pH of most of the water sample collected was within 6.5 to 8.5 except the sample collected inside the dump. The sample at dumpsite had a pH of 8.4 which is alkaline.

Total dissolved solids (TDS)
Presence of total dissolved salts in water affects its taste. The highest concentration of TDS was 1145 ppm. TDS includes inorganic salts and small amounts of organic matter. TDS increase in hardness and corrosion and it depends upon the type of rocks present under the ground surface. The permissible limit for TDS as per WHO upto 500 ppm. [9].

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Hardness

Carbonates and bicarbonates of calcium and magnesium are responsible for hardness in water. Hardness as per the WHO standards is 500 ppm. Excess hardness may cause scales in boilers used in industries. In this samples, the minimum hardness was 110 ppm and the maximum was 417 ppm

Dissolved Oxygen

The obtained value of 1.132 mg/l was an indicates an oxygen depletion in the ground water. The DO was less than 1.02 mg/l which showed that the water body were unsafe for human consumption.

Total Alkalinity

Alkalinity of water is due to the presence of carbonate, bicarbonate, calcium, sodium and potassium. The alkalinity at dump sites were found in the range of 721-833 mg/l which is greater than the value prescribed by Indian Standards 600 mg/l.

Nitrate

Nitrate due to its high mobility will not stick to soil particles. Higher concentration of nitrate leads to a disease called blue baby syndrome or methamoglobinemia in children. Here nitrate concentration in the samples was varied from 10 ppm to 18 ppm and found to be within the permissible limit of WHO (50 ppm).

Chloride

Chloride concentration is mostly associated with sodium chloride which is a common constituent in groundwater sources. Chloride values of water samples varied between 97 ppm and 896 ppm. Chloride concentration in many ground water samples exceeded the WHO permissible limit of 250 ppm. The contamination of groundwater with fertilizers and disintegration of rocks causes increased chloride conc.

The concentrations in ppm of heavy metals at dumpsite soil

The concentration of the metals reported in this study showed higher mean values of Pb and Na. Lower values of Hg, Ag and Cu. Generally, the concentrations of the heavy metals showed variations compared as previous studies.

Table 2: The concentrations in ppm of the heavy metals at dumpsite soil

Site	Depth	Cu	Pb	Hg	Ag	Cn	Ca	Na	N
1	0-50 cm	2.23	14.2	0	1.32	12	12.25	14.225	11.23
2	0-50 cm	5.25	3.56	0	0.96	10	15.24	25.05	25.2
3	0-50 cm	6.88	22.54	1.2	ND	11	17.41	22.09	35.2
4	0-50 cm	22.22	23.22	1.02	ND	44	21.58	29.23	24
5	0-50 cm	10.32	20.22	0	ND	11	ND	45.2	25
Average		9.38	16.748	0.44	0.456	17.6	13.296	27.159	24.1262

II. CONCLUSIONS

This study has showed an inverse relationship with the increasing distance from the margins of the dumpsite. The accumulation of solid wastes are potential threat for contamination of leachate in the near future. The waste reduction, segregation of waste, waste management, composting, recovery of toxic household wastes, could causes reduction in toxicity. This in turn will reduce the pollution of ground water. If organic wastes are not separated and dumped which results in the pollution of soil as well as the under-ground water sources.

The wastes separated into wet and dry waste. The wet waste can be made into compost using microbes and composting. The recyclable wastes can be sent to the recycling centers and non-recyclable can be used as feed for boilers in cement factories.

The study concludes that pollution is caused by the improper disposal of solid waste over a long period of time. Hence the continuous efforts in monitoring of groundwater resources will required to minimize the groundwater pollution. This study has revealed that the groundwater quality around the dump site will not suitable for drinking and domestic purposes as per the WQI, BIS standard.

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