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RESEARCH ARTICLE

GROUND WATER QUALITY PARAMETER IN URULI-DEVACHI: A CASE STUDY

Shital G. Rupanawar and *Sagar Gawande

Department of Civil-Environmental Engineering, Anantrao Pawar College of Engineering, And Research, Pune, MS, India

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ABSTRACT

At present the most serious problem of pollution is the direct result of human activity. Some metropolitan cities like Bombay, Calcutta, Bangalore, and Pune are showing typical urban pollution. Among these cities, Pune produces large quantity (1000-2000 mt/day) of Municipal Solid Waste (MSW). As there is no effective system to manage this daily mass generated as waste, it has become a major problem for Pune Municipal Corporation. Pune Municipal Corporation (PMC) disposes this solid waste at Urali Devachi Depot which is 20 km away from Pune city. Open dumps, commonly found in Asian countries, are land disposal sites at which solid wastes are disposed of in such a manner that poses threat to the environment through its susceptibility to open burning, and exposed to disease vectors and scavengers. The analytical data showed that concentration of all water parameters in leachate is objectionable, which is more than permissible limit of MPCB (Maharashtra Pollution Control Board). Leachate is a polluted liquid emanating from the base of the landfill, which contains innumerable organic and inorganic compounds generated due to which serious ground water contamination wasobserved in wells. Present paper is a case study of Uruli-Devachi (Open dump site), near Pune where daily1000–1200 tonnes of solid waste are disposed at Uruli-Devachi village, and the site was dealing with problems of frequent fires, smoke, flies, birds and bad odour. PMC was spraying the waste with water to prevent fires, resulting in even greater quantities of leachate generated due to which Serious ground water contamination was observed in wells.

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INTRODUCTION

In many Asian countries, solid waste disposal method still remains as open dumping for reasons such as, ignorance of the health risks associated with dumping of wastes, acceptance of the status due to lack of financial resources to do anything better and lack of political will to protect and improve public health and the environment. Many old land fillsand dumpsites existing throughout the developing countries pose a threat for human health."Leachate "refers to liquids that migrate from the waste carrying dissolved or suspended contaminants. Leachate results from precipitation entering the landfill and from moisture that exists in the waste when it is disposed. Contaminants in the buried refuse may result from the disposal of industrial waste, ash, waste treatment sludge, household hazardous wastes, or from normal waste decomposition.

***Corresponding author: Sagar Gawande,**
Department of Civil-Environmental Engineering, Anantrao Pawar College of Engineering, And Research, Pune, MS, India.

If uncontrolled, landfill leachate can be responsible for contaminating ground water and surface water. The composition of leachate varies greatly from site to site, and can vary within a particular site. Some of the factors affecting composition include:

- Age of landfill
- Types of waste
- Degree of decomposition that has taken place
- Physical modification of the waste (e.g. shredding).

Once ground water is contaminated, it is very costly to clean up. Today's landfills, therefore, undergo rigorous surveying, design, and construction procedures that provide many safeguards for the control of leachate migration.

Pune city contains lots of commercial industries, Hospitals, hotels, residential buildings as well as high population which generate 0.12 kg of waste per capita/day (Personal communication with PMC office Pune).

The municipal solid waste is heterogeneous in nature and contains papers, Plastics, rags, metals, glass pieces, ashes and combustible materials. In addition to these it also contains other substances like scrap materials, dead animals, discarded chemicals, and paints, hazardous waste generated from hospitals, industries and agricultural residues. The waste generated from biomedical waste, clinics, hospitals, nursing homes, pathological laboratories, blood banks and veterinary centres have also been disposed along with municipal solid waste at disposal site. This waste is hazardous to human being and environment.

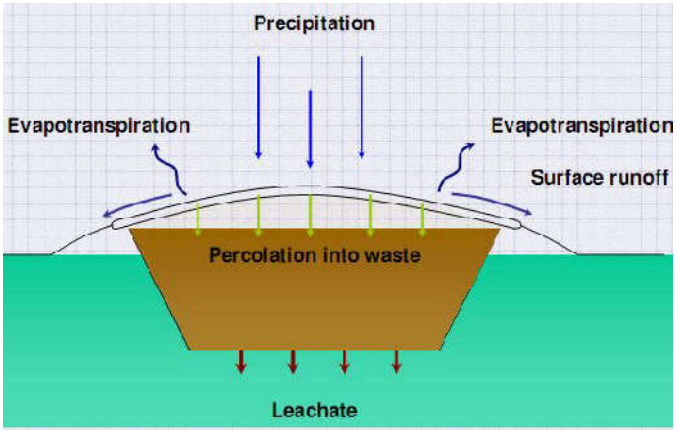

Figure 1. Outline of the process to generate leachate

Fig. 2. Well-water sample no. 1(W1)

Pune Municipal Corporation disposes this waste of pune city at mantarwadi (Urali-Devachi depot) which is 20 km away from pune city. Approximetly 1200-1300 metric tones of solid waste from pune municipal area is disposed per day at Mantarwadi (Urali-Devachi village). During the early period, MSW was conveniently disposed off at Mantarwadi disposal site in low lying areas with large open land space. The unscientific disposal of solid waste created lots of environmental problem in this area. It resulted into air pollution and ground water pollution problems. The Well water near to disposal site in Urali-Devachi village is now not safe for domestic use (drinking, outdoor bathing, propagation of aquatic life, industrial cooling and for irrigation).

It has been found that due to waste disposal the people living in this area face many environmental and health problems.

Table 1. Leachate and well-water characteristics

Parameter	Samples			
	W1	W2	W3	W4(L)
pH	7.22	7.26	7.23	8.14
Conductivity (µs/cm)	1749	1758	2450	21100
Turbidity (NTU)	02	02	04	>5.00
Alkalinity (mg/l)	160	156	186	2820
Total Hardness (mg/l)	850	720	1330	8100
Total Dissolved solid (mg/l)	907	886	1234	10710
COD (mg/l)	68	57	129	11920
BOD (mg/l)	17	13	32.15	2098
Chloride (mg/l)	489	430	628	1078
Calcium (mg/l)	172	168	316	3456
Magnesium (mg/l)	165	134	246	1129
Lead (mg/l)	11	14	17	29
Cadmium (mg/l)	<0.0005	<0.0005	<0.005	<0.0005
Iron (mg/l)	0.42	0.35	0.67	2.56

Table 2. Comparison of Leachate samples from 2014 and 2015 with corporation water sample

Parameter	L-2014	L-2015	CW	REMARK
pH	4.26	8.14	7.39	Increased
Alkalinity (mg/l)	10800	2820	20	Increased
Total Hardness (mg/l)	40200	8100	79.99	Increased
Total Dissolved solid (mg/l)	817	10710	64.40	Increased
COD (mg/l)	78350	11920	10	Increased
BOD (mg/l)	30100	2098	1.15	Decreased
Chloride (mg/l)	10212	1078	21	Increased

Fig. 3. Leachate Sample No.4 (W4)

Generation of Leachate

Leachate is known as the liquid collected at the bottom of the landfill. In general, leachate is a result of the percolation of precipitation, uncontrolled runoff, and irrigation water into the landfill, the water contained in the waste and also infiltrating

groundwater. It contains a variety of chemical constituents derived from the stabilization of the materials deposited in the landfill and from the products of the chemical and biochemical reactions occurring within landfill.

Landfill gas is the mixture of gases within a landfill. It mainly consists of methane (CH_4) and carbon dioxide (CO_2). These are the principal products of the anaerobic decomposition of the biodegradable organic fraction of the municipal solid waste in the landfill. Other components of landfill gas include atmospheric nitrogen and oxygen, ammonia, and organic compounds. *Landfill liners* are the materials used to line the bottom area and sides of a landfill. Liners usually consist of layers of compacted clay and geo-membranes designed to prevent migration of landfill leachate and landfill gas. Leachate generation depends on the availability of water, landfill surface conditions, waste conditions, and underlying soil conditions.

Effect of Leachate

Landfill leachate contains chemicals, biological and metal ions such as iron. It is both toxic and acidic, and has a distinct odor. Unless a landfill has a method of collecting and purifying the leachate, it will enter and contaminate ground water supplies. The health risks, if leachate is left untreated and allowed to contaminate groundwater supplies, include skin irritation, nausea, vomiting, and headache, while chronic exposure can lead to anemia, kidney damage, prostate cancer, lung cancer, memory loss, coma, headaches and depression. The people residing in these areas are using well water for drinking, domestic and for agricultural use. It is observed that the people living in this area having health and hygienic problems such as allergic, asthmatic, bronchitis, skin irritation and gastro intestinal diseases.

Techniques used in Uruli Devachi Landfill project

Wastes are openly dumped and then odofresh solutions are sprayed on dumped waste for reducing odour. For faster decomposition process (45 days) they spray Effective Microorganism Solution (2 kg Molasses +100 liter water for 7 days). Due to these techniques used in Uruli-Devachi Landfill Project more leachate were generated.

Sample well water and Leachate comparison trend

The above table Shows the Leachate sample value of pH is Increases. The Heavy Metal of leachate sample Contains such as lead, cadmium and iron are increases. The BOD and COD contain are increases. The above table shows comparision between analysis of leachate sample from 2014 & 2015.

The increased value of parameters like hardness, alkalinity & heavy metals contained indicates worsen condition of leachate in a year. Also the decreased value of BOD emphasis the reduced activated of organism. Samples of leachate and groundwater were collected from the following locations.

Sample I: Well water (well located 500 m away from the landfill site; Figure.1). Sample II: Well water (well located 800 m away from landfill site; Figure 2). Sample III: Well water (well located 1200 m away from landfill site. Figure 3). Sample II: Leachate sample collected from landfill storage tank.

Conclusions

Government of India has laid down the Municipal Solid Waste (Management and Handling) Rules 2000 for all Municipal Councils and Municipal Corporations. It is now binding on them to dispose of Municipal Solid Waste [MSW] in a scientific manner. Scientifically designed landfill is one of the most effective ways for proper disposal of MSW. Selection of site for landfill is important to avoid environmental, ecological, social and economical problems.

For Indian environment ground water depth, soil at selected site and water supply well are important criteria. Concentration of all parameters found in well water is exceeds the limit so it is not safe for drinking, commercial used, irrigation and industrial purpose. These leachates have corrosive activity which is also dangerous for human health. So the dumping ground not only affect environment but also damage the property in the vicinity area. The current practices needs to improve for managing waste. Year by year the Ecosystem is losing life and conditions are becoming worst for the living things. It is the call of time to addressed the issue on Priority basis.

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