"LEACHATE ANALYSIS OF MUNICIPAL SOLID WASTE COLLECTED FROM SUKALI DUMPING SITE, AMRAVATI (MAHARASHTRA)"

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Abstract : Lifestyle of unconcern people created various environmental problems. Solid waste management is one of them. To take into consideration the probable effect of leachate formed due to unscientific land filling at the solid waste dumping site on the quality of ground water, leachate analysis is necessary. As there was no facility for leachate collection and treatment, leachate was prepared in laboratory from the solid waste sample collected from Sukali dumping site, Amravati city. Physico-chemical analysis of leachate showed the higher values than permissible limit indicating the contamination of groundwater due to leaching of mineral ingredients and heavy metals. Heavy metal analysis of leachate showed the presence of Mn, Fe, Pb, Co, and Cu above the permissible limit.

Keywords: Solid Waste Management, Leachate, unscientific land filling.

Introduction:

We have entered twenty first century, the beginning of a new millennium. The past century is a story of astounding advancement in technology and tremendous achievements in the economic well-being of many nations of the world. But human development can become a curse, was realized when more richness created more waste. Technology has provided many answers but it is unable to give solution for how to get rid of this waste.

Due to degradation of Environment and adverse impact on public health and life style, solid waste management has become top priority. Solid waste management has emerged as one of the greatest challenges facing municipal authorities worldwide especially in developing countries. (Babatunde B.B. *et al*. 2013)

The term "Municipal Solid Wastes" applies to those Solid Wastes generated by households and to solid wastes of similar character derived from Shops, Offices and other Commercial Units. (Cointreau, 1982).

Solid Wastes in cities are classified into the following groups (NEERI, 1983).

1. Urban Solid Wastes: Putressible (decomposable) wastes generates from food, slaughter houses, canning and freezing industries etc.
2. Rubbish: Non-putressible is either combustible or non-combustible wastes.
   Combustible waste includes- paper, wood, cloth, rubber, leather and garden wastes while Non-Combustible wastes include- metals, glass ceramics, stones dirt, masonry, paints and some chemicals.
3. Ashes and residues: cinders and fly ash of the combustion of solid fuels for heating and cooking or from the incineration of Solid Wastes by Municipal and apartment house incinerators.
4. Large waste, demolition and construction rubble: pipes, lumber, masonry, brick, plastic, roofing and insulating materials, automobiles, furniture, refrigerators and other home appliances, trees, tiles etc.
5. Dead animals: household pets, birds, rodents, zoo animals etc. and also anatomical and pathological wastes from hospitals.

Uncontrolled and illegal waste has increased pollution of rivers and underground aquifers. It is also increasing the economic burden. (Lokmat Daily, Sunday, 6th Nov.2016)

According to Anon, 2007, solid waste management is one of the important seven accepted components of sanitation.

Urbanization, the main cause of solid waste generation:

Solid waste is inextricably linked to urbanization and economic development. As countries urbanize, their economic wealth increases. As standards of living and disposable incomes increase, consumption of products and services increases, which ends up during a corresponding increase within the amount of waste generated. (World Bank, 2012)

National Status related to Solid Waste:

India is among the top 10 countries generating the highest amount of MSW in the world. (Abazeri Marium, 2014).

Urban India generates 3 million trucks piled high with garbage every day. According to statistics, more than 70 percent of the collected urban waste is dumped straight into the landfill. As much as 43 million tonnes of solid waste is collected annually, out

of which only 22-28 percent is treated, while the rest is left untreated and dumped at the landfill sites. (The Hitavada, Sunday, September 10, 2017)

In India once waste has been collected, the majority of MSW is sent to unsanitary landfills or open dumps where waste is disposed of and bulldozed over or cover with debris. (Abazeri Mariam, 2014)

The average waste collection efficiency for municipal solid waste in Indian cities ranges between 70 to 90% in metropolitan cities, whereas in several small and medium sized cities the solid waste collection efficiency is below 50%. Around 70% of the Indian cities lack adequate waste transportation capacities (Jha *et al*., 2003)

Central Pollution Control Board (CPCB) noted that average collection ranges from 50 to 90 percent and out of collected waste 94 percent is disposed of without any scientific management practices which result in severe pollution of ground water and surface water through leachate as well as air through uncontrolled burning of waste.

Role of Individual in Solid Waste management:

According to the corresponding provisions of the constitution, it is stated that every citizen has responsibility and duty to maintain the natural environment, clean atmosphere and protect forest and wildlife. [Article 51 A(f), (g) of the constitution of India (42nd Amendment Act , 1976)]

The operational efficiency of solid waste management depends upon the active participation of both the municipal agency and therefore the citizens; therefore, socio cultural aspects mentioned by some scholars include people participating in decision making. (Sharholy *et. al*., 2008)

Problems rose due to Solid Waste:

Following problems occur in the vicinity area due to SW:

1. The chemicals from solid waste disposal site pollutes underground water, rendering it unfit for consumption (Samsudin *et al*., 2006 ; Singh *et. al*.,1999)
2. Solid waste is a large source of methane, a powerful GHG that is particularly impactful in the short-term. (World Bank,2012)
3. Uncollected waste can provide breeding areas and food to potentially disease carrying vectors such as insects and rodents, with their associated health and nuisance issues.

(World Bank, 2012)

4. The high temperature and humidity favors rapid bacterial growth and decomposition of waste that causes bad smell and odor which invite different diseases as well as disturb the aesthetic beauty of the area (Sharma, 2005)
5. The open burning of waste causes air pollution ; the products of combustion include dioxins, which are particularly hazardous.(Harilal *et al*., 2007)
6. Solid waste has the potential to degrade air, soil and water.
7. Heavy metal (such as Cd, Cr, Fe, Cu etc.) pollution in soil occurs due to dumping of solid waste in soil.
8. The improper solid waste disposal leads to serious health hazards such as development of vector habitats, transmission of diseases like Dengue, Chikenguinya, Malaria and Swine flu.

Environmental Impact of Solid Waste:

Disposal of MSW without taking proper scientific methods is a major environmental problem. (Mor *et al*.,2006)

Lack of data of treatment systems by authorities is reported together factor affecting the treatment of waste (Chung and Lo, 2008).

One of the greatest consequences of landfills and open dumps is the contamination of ground and surface water due to leachate which contains nutrients, metals, salts and other soluble or suspended components and products from the decomposition of waste. (Australian Environmental Protection Agency, 2009)

The usual and the most neglected cause of water pollution are uncontrolled dumping of Municipal Solid Waste (MSW). Infiltration of water by rainfall, water already present in the waste, or water generated by biodegradation, cause the leachate to leave the dumping ground laterally or vertically and find its way into the groundwater thereby causing contamination. (Kumaravel *et. al.*, 2003).

Need of Solid Waste Management :

Managing solid waste well and affordably is one of the key challenges of the 21st century, and one of the key responsibilities of a city government. It is almost always in the top five of the most challenging problems for city managers. **Amravati** also known as "Ambanagari" is a city in the state of Maharashtra, India. It is the 8th most populous metropolitan area in the state. It is the administrative headquarters of the Amravati district. It is also the headquarters of the "Amravati Division" which is one of the six divisions of the state.

Due to the establishment of Nangaonpeth MIDC, near Amravati immigration of people into the city is increasing for the employment. So, there is increase in the urbanization in the city. This results in expansion of the city from all the corners / direction. All these are increasing the volume of solid waste of the city which is a grave concern not for the environment but also for the health of people of the city.

MATERIALS AND METHODS:

Leachate preparation and Collection in the laboratory:

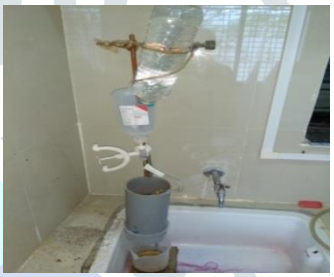
To take into consideration the probable effect of leachate formed due to unscientific land filling at solid waste dumping site on the quality of ground water, leachate analysis was necessary. As there was no facility for leachate collection and treatment, leachate was prepared in the laboratory.

Leachate preparation carried out as:

1. After removing plastic, metals, glass, tetrapacks, gravels Solid waste sample was crushed, ground with the help of mortar and pastel.
2. then passed through mesh having sieve size of 2 mm.
3. Then PVC pipe having diameter 4 inch, length 14.5 inch was taken. End cap was fitted to it's one end. Two Small holes were drilled at the centre of the end cap with the help of nail.
4. Burette stand was taken; rod of another burette stand was tied to the upper end of this burette stand to increase its height. The PVC pipe was then fitted at the centre of the burette stand.
5. 1 kg of ground solid waste powder was filled up in the PVC pipe.
6. Empty saline bottle was taken and cut into L – shape from its bottom side.
7. Distilled water bottle of 1litre capacity was taken. Its lid was removed and tiny hole was made with the help of pin by hammering it into the lid.
8. this bottle having tiny hole at its lid was tied at the uppermost side of the burette stand. Tiny hole was also made with help of pin at bottle's bottom side for removing air.
9. Lid portion of the bottle was pierced into the L – shaped cut of the saline bottle. Water from the distilled water bottle was allowed to pour into the empty saline bottle.
10. Flow of water dropping from the saline bottle was adjusted at 5ml per minute.
11. Beaker of 1000 ml capacity was put below the PVC pipe to collect leachate. Pouring of water was continued for 8 days by tying of fresh distilled water bottle every day when water was over from that bottle.
12. When beaker was filled with leachate, it was emptied into the empty distilled water bottle.
13. In this way leachate was collected for 8days. It was then analysed for it's physico-chemical analysis.

Leachate preparation and Collection in the laboratory

Plate 3.17 : Grinding and Screening of solid waste in 2mm seive.



3.18: Leachate preparation assembly and collection in beaker

Physicochemical and Heavy metals analysis of Leachate :

Following parameters were selected for analysis of leachate -

A. Physical parameters:- Colour, Conductivity, TDS, Turbidity

B. Chemical parameters :- pH, Alkalinity, Total hardness, Ca Hardness, Mg Hardness, Chloride, Sulphate, T. PO^4 , NO_3 COD ,BOD, Org. Carbon.

C. Heavy Metals :-Cd, Fe ,Co, Cr., Mn, Cu, Pb, Ni, Zn.

The Physico-chemical analysis was carried out using the Book, Standard Methods for Examination of Water and Waste Water by APHA AWWA, which is the standard manual for analysis. (APHA-AWWA 19th edition), Trivedy R. K., Goel P. K; book "Chemical and Biological Methods for water Pollution studies", Environmental publications (1986) and NEERI Manual.

OBSERVATIONS AND RESULTS:

Table : 1 Physical parameters of the leachate

Sr. No.	Parameters	Concentration levels
1.	Colour	Blackish brown/ Dark coloured
2.	Conductivity µS/cm	21.7
3.	Total Dissolved Solids(mg/l)	15235
4.	Turbidity.(NTU)	458

Table: 2 Chemical parameters of the leachate

Sr. No.	Parameters	Concentration levels
1.	pH	7.21
2.	Alkalinity (mg/l) as $CaCO_3$	8,340
3.	Total Hardness (mg/l) as $CaCO_3$	5440
4.	Chloride (mg/l)	5680
5.	Sulphate (mg/l)	1100
6.	Nitrate (mg/l)	1520
7.	Total- PO_4 (mg/l)	29.6
8.	COD (mg/l)	463
9.	BOD (mg/l)	112

Table : 3 Heavy Metals in Leachate

Sr. No.	Heavy Metals	Concentration levels mg/lit
1.	Nickel (Ni)	2.269
2.	Manganese (Mn)	7.624
3.	Cadmium (Cd)	3.957
4.	Zinc (Zn)	3.471
5.	Iron (Fe)	7.164
6.	Chromium (Cr)	1.132
7.	Lead (pb)	5.247
8.	Cobalt (Co)	0.965
9.	Copper (Cu)	4.147

CONCLUSION:

Leachate experiment was conducted and analysed for physico-chemical characteristics and heavy metals content. Physico-chemical analysis of leachate showed the higher values than permissible limit indicating leaching will takes place periodically from the dumps and there will be contamination in groundwater due to leaching of mineral ingredients and heavy metals.

Heavy metals analysis of leachate showed the presence of manganese (Mn), iron (Fe), lead (pb), cobalt (Co) and copper (Cu) above permissible limit except zinc (Zn) indicating possibility of heavy metals from the dumps.

Thus from the physico-chemical and heavy metals analysis, it is concluded that present solid waste management system is not sustainable and scientific. There is urgent need to run it in scientific and sustainable manner to avoid the further deterioration of groundwater and environment of nearby villages.

Periodically, it is expected that the groundwater may get deteriorated to the large extent causing severe health impacts on the common consumers. So, there is need to collect the leachates and treat them separately or provision should be made at the dumping site that the leachates generated should not percolate and mix with the groundwater.

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