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Analysis of Physico-Chemical Parameters of Municipal Solid Waste-A Case Study

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Abstract

The study was carried out to analyze leachate discharged from municipal solid waste landfill sites of Durgapur and Asansol City, W.B (India). Leachate samples were collected and analyzed for various physico-chemical parameters to estimate its pollution potentiality. The study focuses to develop the most suitable technique to reducing the adverse effect of leachate for the society. All the land filling sites of Asansol – Durgapur city are non-engineered low laying open dumps. They have no bottom line, leachate collection and treatment system. This study has been found that leachate contains high concentration of organic, inorganic and heavy metal constituents beyond the permissible limits. The data presented in this study indicates that the age of the land fill and seasonal variations have a significant effect on leachate composition. Unplanned dumping of municipal solid waste without proper management practices should be stopped or sum remedial measures are required to stop contamination.

Key words: *Land filling, leachate organic and inorganic constituent, surface water contamination.*

Introduction

Environmental degradation is increasing day by day and is primarily attributed to rapid industrialization and population growth. Amongst other solid waste and its management is a primary concern of today's environment. Proper solid waste management is required to have a safer environment. The generation of MSW, in terms of kg/per Capita/day has related with economic development. The per capita Generation of MSW has also increased tremendously with improved life style and social status of the population. Solid wastes are generally disposed of in a low lying area (Sanitary landfill) by the municipal authorities. Ministry of Environment and Forest (MOEF) has Municipal Solid Waste (Management and Handling) Rules 2000. These rules have specified many compliance for the management of solid waste for State Committee and Pollution Control Board which includes proper segregation of solid waste into biodegradable waste, recyclable and others i.e. non- recyclable waste are stored in colored bins at the source at generation and properly treated recycled and disposed to land fill areas .The municipal solid waste composition varies from place to place and also bears a rather consistent correlation with the average standard of living.

Generally in India, MSW is disposed of low-lying areas without taking proper precautions or operational controls. Therefore municipal solid waste management is one of the major environmental problems of India megacities. Inefficient management and disposal of MSW is an obvious cause for degradation of environment. Unscientific disposal causes and adverse effect impact on environment and human health.

Materials and Method

Leachate sampling

To determine the quality of leachate integrated samples was collected from different landfill locations. Leachate samples for the study were collected from all the land fill sites at Asansol and Durgapur. These sites are non-engineered low laying open dumps. Leachate samples are collected from base of the solid waste heaps where the leachate was drained out by gravity. Leachate samples were collected in January to Sep 2012. Surface Water samples were also collected from pond located nearby landfill areas in a 1lt plastic bottle.

Sample Analysis

Various physico-chemical parameters like viz pH, total solid (TS), total Suspended solid (TSS), total dissolved solids (TDS), turbidity, hardness, Biochemical oxygen Demand (BOD), Chemical Oxygen Demand (COD), nitrate, sulphate and Heavy metals like Iron(Fe), lead(Pb), chromium(Cr), cadmium(Cd), copper(Cu) ,zinc(Zn),nickel(Ni) and arsenic(As) were analyzed. Analytical Methods were according to standard Methods for examination of water and waste water specified by American Public Health Association. The pH was measured by electronic pH meter. Total solids (TS) were determined by properly Shaken unfiltered Samples and estimated by

gravimetric method. Total Dissolved Solid (TDS) was determined by filtered samples through whatmann filtered paper 44 and estimated by gravimetric turbidity was measured by turbidity meter by using optical properties at light. Chemical oxygen demand (COD) was determined by defluxion of same sample followed by titration with ferrous ammonium sulphate (FAS) was adopted. Biochemical oxygen demand (BOD) - Winker's method was used for estimating initial and final DO in the sample and BOD was determined. nitrate and sulphate was analyzed by Spectrophotometer water samples and Heavy Metals Viz iron ,lead, chromium, cadmium, copper, zinc, nickel and arsenic were analyzed using UV-VIS Spectrophotometer (APHA).

Result and Discussion

Surface water and lechate samples collected and analyzed for various physico-chemical parameters to estimate its pollution potential. It has been found that surface and leachate samples contain high concentration of organic and inorganic and Heavy Metal constituents beyond the permissible limit.

Color and Odour

The color of leachate samples were orange brown or dark brown associated with the leachate was a malodorous smell (very unpleasant smell) mainly due to presence of organic acids, which come from the high concentration of organic when decomposed. The high concentration of colour in land fill leachate is due to the presence of high organic substances.

pH

pH values of leachate samples of the land filling sites were 8.03 to 8.20 generally; the pH of a stabilized leachate is higher than that of a young leachate. Low pH is due to high concentration of volatile fatty acids. The pH of leachate increased with time due to the decrease of the concentration of the partially ionized free volatile fatty acids.

T.S., SS, and TDS

T.S values of leachate samples of the land filling sites were 5800.50 & 4950.30 mg/l., S.S. values of leachate samples were 250.60 mg/l to 200.50 mg/l and T.D.S were 4720.70 & 3725.80 mg/l. TDS comprises mainly of inorganic salts and dissolved organics.

Turbidity

Turbidity values of leachate samples of land filling sites were 95.20 NTU & 144.60 NTU. These values exceed the Indian permissible limit.

Hardness

Hardness of leachate samples of the land fill sites were 885.10 mg/l and 815.50 mg/l., the measured hardness values were higher than standard limit.

BOD

BOD is the measure of biodegradable organic mass of leachate and that indicates decreases with time. The values were 2000.50 mg/l and 1500.60 mg/l. The measure values were higher than the standard limit.

COD

COD represents the amount of oxygen required to completely oxidize the organic waste constituents chemically to inorganic end products. The COD values were 6020.40mg/l and 4500.20 mg/l. The measure COD values were higher than the standard limit.

Nitrate

The nitrate values for leachate at land filling sites were 32.10 and 49.00 mg/l. The measured nitrate values were considerably higher than standard limit. The United States Environmental Protection Agency has set a minimum 10 mg/l in public water supply.

Sulphate

Sulphate values for leachate at land filling sites were 220.70 mg/l and 95.30 mg/l respectively. The measured values were exceeded the permissible level (0.50 mg/l).

Heavy Metals

Heavy metals viz Iron, lead, chromium, cadmium, copper, zinc, nickel and arsenic values were higher than domestic solid wastes. Become of Industrial fly ash is mixed with the municipal solid wastes, the concentration of Heavy Metals is high.

Table 1. Physico chemical characteristics of wet and dry leachate samples

	Parameters	Wet season (Mean Values)	Dry Season (Mean Values)	Indian Standard Value
1	Colour & Odour(HU)	Orange Brown (400.70) Unpleasant)	Dark Brown (600.80) Unpleasant)	Disposal into Indian water
2	pH	8.20	8.05	5.5 to 9.0
3	T.S(mg/l)	4971.30	3926.30	2300mg/l
4	SS (mg/l)	250.60	200.50	100mg/l
5	TDS (mg/l)	4720.70	3725.80	2100 mg/l
6	Turbidity(NTU)	95.20	144.60	5 mg/l
7	Hardness (mg/l)	885.10	815.50	30 mg/l
8	BOD	2000.50	1500.60	30.00mg/l
9	COD	6020.40	4500.20	250mg/l
10	Nitrate	32.10	49.00	-
11	Sulphate (mg/l)	220.70	95.30	-
12	Heavy Metal (mg/l)			
(i)	Fe	180.00	122.00	-
(ii)	Pb	2.500	2.100	0.10 mg/l
13	Cr	10.00	7.00	2.0 mg/l
14	Cd	6.00	4.00	2.0 mg/l
15	Cu	9.00	7.00	3.00 mg/l
16	Zn	18.00	12.00	5.0 mg/l
17	Ni	5.00	4.00	3.0 mg/l
18	As	0.900	0.600	0.20 mg/l

Conclusion

All the land filling sites of Asansol and Durgapur cities are non-engineered low laying open dumps. They have neither any bottom liner nor any leachate collection and treatment system. Leachate samples of land filling sites were collection and treatment system. Leachate samples of land filling sites were collected and analyzed for various physico-chemical parameters to estimate the pollution potential. It has been concluded that leachate samples contains higher concentration of organic and inorganic constituents beyond the permissible limits.

- The measured leachate is sample need appropriate treatment to reduce the pollutants to satisfactory level.
- The pollutants concentration of wet season is higher than dry season.
- In discriminate dumping of Municipal Solid Waste without proper solid waste management practices should be stopped or some remedial measures were required to be adopted to prevent Contamination.

Remedial Measures

- Leachate management can be achieved through effective control of leachate generation.
- Engineered landfill sites should be provided with impermeable liner and drainage system at the base of the landfill which will not allow leachate to percolate into subsoil.
- All the leachate accumulated at the base of the land fill can be collected for recycling or treatment.

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