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Impact Study on Waste Dumpsite and Rehabilitation to Landfill

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ABSTRACT: This paper presents the impact of open dumping of solid waste on surface water and soil due to the open dumping of solid waste. The solid waste of dumpsite consists of everyday items, food waste, yard waste, containers and product packaging and other miscellaneous wastes. The compounds contained in the waste may be harmful to human and environment. The method for analyzing the dumpsite consists of collection and laboratory testing of soil and water samples from the dumpsite. The water samples were analyzed by parameters like pH, BOD, COD, DO, Fe, Cl and in a similar way soil samples are also tested by various parameters. Thus the impact study was conducted and suitable landfill was designed. Landfill is found to be the best alternative for ultimate disposal of solid waste.

KEYWORDS: MSW, waste Dumpsite, sustainable, impact study, Landfill.

I. INTRODUCTION

Solid waste which consists of everyday items which predominantly includes food wastes, animal wastes, containers and yard wastes, and other various organic and inorganic wastes from residential, agricultural, commercial, and industrial sources. The major sources of municipal solid waste are broadly classified as Residential sources, Commercial sources, Industrial sources, Institutional sources, Municipal services, Agricultural sources, Construction and demolition sites, Medical sources, E-waste.

The management of municipal solid waste due to the rapid increase in urbanization has become a serious concern for government departments, pollution control agencies and public in most of the developing countries. Municipal solid waste is produced in an estimated 7.6 Million tons per day in developing countries. Open dumps are used for decomposing these wastes creating considerable nuisance and environmental problems. Improper management of municipal solid waste results in ecological impacts like land degradation, water and air pollution. The dumped solid waste produce leachates which contain variety of chemicals like detergents, inorganic chemicals and complex organic chemicals and metal.

This study focuses on the Land disposal of solid waste and how the current practice of open dumping could be improved to sustainable landfills. The main objective was to study the impact on water and soil around the dump site and design a sustainable landfill.

Landfill is considered to be the most viable and cost effective method of solid waste disposal in the developing countries. In sustainable landfills the negative impacts of the products on the environment will be minimal.

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II. SOURCES OF SOLID WASTE

The major sources of solid waste are found to be:

- **Residential sources:** Residences and homes include food waste, paper, cardboard, metals, textiles, leather, ashes, special waste and household hazardous wastes.
- **Commercial sources:** Commercial services and buildings hotels, restaurants, markets, office buildings etc. The typical waste products are paper, plastics, food products, metals, glass, wood etc.
- **Industrial sources:** The waste generators are light and heavy manufacturing, fabrication plants, construction sites, power and chemical plants.
- **Institutional sources:** The waste generators include schools, colleges, prisons, military barracks, government centers etc. The waste generated includes wood, paper, metals, electronic equipment etc.
- **Municipal services:** The major wastes are developed from street cleaning, parks, beaches, recreation centers, waste water treatment plants.
- **Agricultural sources:** The wastes produced from crop farms, orchards, vineyards etc. includes spoiled food waste, pesticide containers, and other hazardous waste materials.
- **Construction and demolition sites:** The sites include construction of new roads and buildings, renovation sites and demolition sites. The major waste produced are steel, concrete, wood and dust.
- **Medical sources:** The wastes produced from hospitals, medical stores and other health facilities.
- **E-waste:** The electronic and electric wastes includes electric devices and appliances which are out of use.

III. IMPACT OF WASTE

3.1 Impact on environment:

The major impacts on environment includes:

- Groundwater contamination
- Surface water contamination
- Air pollution
- Blockage of surface water drainage
- Risk of fire due to burning
- Slope failure

Environmental impacts pave the way for developing infectious diseases, obstruction of drains and loss of biodiversity. A waste dump may contain inert materials, bio reactor materials as well as chemically reactive materials. Biological reactions occurring in a waste dump leads to the evolution of landfill gases and eventually liquids. At first the reactions occur aerobically and later it becomes anaerobically due to the depletion of oxygen. Chemical reactions occurring in

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the waste dump includes dissolution and suspension of waste materials, evaporation and vaporization of chemical compounds. Another problem related with these gases are it leads to climate change and greenhouse effect. Chemicals in the dump site can leach out into the soil and contamination occurs in the soil. They can also reach nearby surface water, rivers and other water bodies. This will also change the levels of chemicals present in water. Air pollution from the dump site leads to the release of toxic substances that can even contribute to acid rain.

3.2 Impact on human health:

Due to the improper handling of solid waste, many health problems can occur. Many diseases like Cholera, diarrhea, dysentery, plague, jaundice, and other gastrointestinal diseases may arise. Other major impacts include:

- Low birth weight
- Cancer
- Congenital malformations
- Nausea and vomiting
- DNA damage
- Lung cancer
- Mercury toxicity
- Chronic damage to the brain
- Fatigue
- Asthmatic bronchitis

Improper disposal of waste can greatly affect the health of the growing population living nearby to dump sites or landfills. The workers and other employees involved in this operation are in a high risk with their lives. Exposure to this kind of wastes cause skin irritations, blood infections and even reproductive issues.

3.3 Impact on animals and aquatic life:

Marine pollution occurs when harmful pollutants enter into the water bodies. Animals who consume grasses near contaminated landfill are also affected. When a toxic waste harms one organism, it is destroying the entire food chain of aquatic life. The major impacts are:

- Increase in mercury level in fish
- Plastic found in oceans consumed by birds
- Increase in algal population in rivers and sea
- Decrease in quality of water in rivers.
- Increase in breeding of mosquitoes
- Excessive growth of bacteria.

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IV. METHODS OF WASTE DISPOSAL

The population is growing day by day which leads to a rapid growth in the rate of waste generation. So we need to take adequate steps for the proper disposal of wastes. The evolution of planned and engineered waste disposal facilities arises. The waste management essentially comprises of collection, transport, disposal and incineration of wastes. The 3 R principle can be used for sustainable waste management. The three R stands for Reduce, Reuse and Recycle. The main idea behind this principle is to reduce the quantity of waste production, to reuse the waste products or by-products and to recycle the left out products.

There are modern waste disposal methods to get rid of these wastes which includes:

4.1. Incineration:

It is a process of burning waste. It generates heat which can be used as energy. Incinerators convert waste products into heat, gas, steam and ash. Incineration is carried out on a small scale by individuals and on a large scale by industries. It is used in the disposal of solid, liquid and gaseous waste. It is considered as a practical method for the disposal of harmful hazardous waste. Combustion in an incinerator is not always perfect due to the emission of gaseous pollutants. Incineration reduces waste volume up to 90% of its original amount. If organic waste is incinerated the resulting ash can be used as nutrients.

4.2. Landfill:

The items which can't get rid of by other methods are disposed in a landfill. It remains a common practice in most countries. In a landfill, a protective lining is provided beneath the waste to prevent harmful chemicals leaking into the soil and groundwater. This lining serves as a barrier between wastes and groundwater. The layers in the landfill are compacted and are coated with an earth layer. Landfill can be created in places with low groundwater level. To maintain a sustainable landfill, skilled labors are required.

4.3. Waste compaction:

The waste materials like plastic bottles, cans, cardboards etc. can be compacted into blocks. These compacted waste can be send for recycling. This can prevent oxidation of metals. This also reduces the air space. So that transportation and positioning can be made easily.

4.4. Composting:

This is the process of decomposition of organic wastes by microorganisms by allowing waste to stay in a pit or compost for a required period of time. The wastes are buried under soil and left to decay under action of microbes such as bacteria or fungi. So that nutrient rich manure is formed. By composting the nutrients are replenished back to the soil. Enrichment of soil and water retention capacity is also increased. In an agricultural view, it is the best alternative to chemical fertilizers.

4.5. Disposal in Ocean/Sea

Wastes having radioactive nature are disposed in oceans far from active human habitats. The discharge is directly to marine waters rather than indirectly through rivers and groundwater. Organic material such as uncontaminated sewage sludge, inorganic forms of nutrients and some acids may be neutralized by the ocean waters.

V. DUMPSITES TO SUSTAINABLE LANDFILLS

In a sustainable environment, the solutions for problems is done in a responsible and environment friendly approach. So that future generations can exist and solve their problems by their own in a sustainable manner. While each generation manage its own waste, the emissions to the environment are affordable without moving to further treatment. The processes, control and use of products and residues will be optimal in a sustainable landfill. By this we can also

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decrease the negative impacts of landfills. The major treatment of waste can be obtained when the waste in a landfill is stabilized.

The closing of open dumps and converting it into sustainable landfills is the primary option available. If the dumpsite is situated in an area where ground water pollution is not found as a major issue dumpsite can be upgraded to sustainable landfill. The procedure to evaluate an open dumpsite includes studying the conditions of site and its surrounding environment.



Fig 1: Kalamassery open dump site

VI. IMPACT STUDY ON WATER

The collected water sample from a nearby waterbody to the dumpsite was examined in the laboratory. The important characteristics of sample collected was compared with the Indian standards.

Table -6.1 Characteristics of water sample collected

Sl No	Parameters	Units	Obtained Values
1	pH	-	6.49
2	Chloride	mg/l	11.99
3	DO	mg/l	5.1
4	BOD	mg/l	4.6
4	COD	mg/l	38
5	Iron	mg/l	1.7

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Table -6.2 Drinking water standard

Sl no	Parameters	Units	Desirable limit	Permissible limit
1	pH	-	6.5	8.5
2	Chloride	mg/l	250	1000
3	DO	mg/l	≥ 6	-
4	BOD	mg/l	30	100
5	COD	mg/l	nil	-
6	Iron	mg/l	0.3	1

The **Table 6.1** and **Table 6.2** shows the obtained value of water sample collected from the waterbody near to the dumpsite and the drinking water standards respectively.

The obtained value of pH is 6.49 while, as per IS 10500: 2012, the desired value for drinking water is 6.5 to 8.5. This shows that the collected sample is little acidic in nature.

The amount of chloride present in the collected sample is 11.99 mg/l. As per IS 3025(part 32) the desirable limit of chloride is 250 mg/l and permissible limit of chloride is 1000 mg/l. Thus it indicated that the presence of chloride is below the desirable limit. Hence the water is potable for drinking.

As per IS 10500:2004, the drinking water should contain a DO level more than 6 mg/l. The obtained value is 5.1, which shows that the amount of dissolved oxygen present in the sample is not sufficient.

Also the COD for given sample is 38 mg/l, while COD for drinking water should be nil.

As per IS 3025(part 53), the desirable limit of iron content is 0.3 mg/l and permissible limit of iron is 1 mg/l, if no alternate sources is present. The value of collected sample is 1.7, which is greater than the permissible value.

Thus it is clear that the leachate from the waste dumpsite have very little impact on the groundwater source to a particular limit.

VII. IMPACT STUDY ON SOIL

Table -7.1 Characteristics of soil sample collected

Sl no	Tested parameters	Sample 1(mg/kg)	Sample 2(mg/kg)
1	Soluble chloride content as Cl	2770	864
2	Iron as Fe	364	354
3	Zinc as Zn	25	30.2
4	Ph at 25 degree Celsius	7.50	8.25

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Table -7.2 Characteristics of uncontaminated soil samples

Chemical constituents	unit	Maximum allowable concentration
Chloride	mg/kg	4000
Iron	mg/kg	15900
Zinc	mg/kg	5100
pH	-	6.25-9

The parameter Chloride in the soil sample from the dumpsite is within the allowable concentration in uncontaminated soil. Slight variation in pH is visible. Among the metal present in the soil sample, it is found that iron and Zinc is within the permissible limit.

VIII. CONCLUSION

In this paper we had conducted the impact study on waste dumpsite and checked the present condition of the dumpsite. The conditions required for a sustainable dumpsite is evaluated to rehabilitate the dumpsite. According to our studies, landfill is considered to be a reliable and cost effective method for the waste disposal. In most of the countries, landfill is the most dominant method. To maintain the waste disposal sites, effective management of landfill is required. The impact study conducted on water and soil samples collected from Kalamaserry dumpsite proves that the waste materials dumped into the dumpsite have a high potential to pollute the environment. It has an adverse effect on soil and nearby water bodies. With respect to the current situation, it is necessary to rehabilitate the contaminants. Since the treatment of huge amount of waste is not possible, the construction of landfill has become essential. A safe and sustainable landfill has proper management with affordable cost and labor.

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