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Environmental Surveillance of Landfills for Solid Waste and a Workable Approach Adopting to Make a Brick from Landfill Waste

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ABSTRACT- Rapid urbanisation and industrialization have resulted in two major consequences. The waste of resources and the accumulation of rubbish are two such examples. As people's living standards rise, they produce vast quantities of municipal solid waste. This waste is then either sent to landfills or burned openly, polluting the air across the city. For this reason, it is essential to develop and execute a reliable solid waste management system that would help lessen the environmental damage caused by municipal landfills. With this in mind, the current investigation was conducted to learn more about the issues surrounding MSW dump sites close to the Banvhare Dada Nuwakot disposal facility in Nepal. The purpose of this research is to monitor and analyse land-based municipal solid waste problems and to evaluate the practicability of municipal solid waste energy recovery. At the dump site, the atmosphere and air quality were monitored, as well as soil and water tests. The quantity of leachate elements in the subsoil is also being determined as part of this investigation to help in future site appraisal. Results from a physical and chemical analysis of municipal solid waste (MSW) collected from the landfill showed that the landfill's trash had a biodegradable fraction of 79 percent, a higher proportion of moisture levels, and a volatile solid content of 76 percent. Thus, bio-methanation of municipal solid waste may proceed. Cost effectiveness, resource conservation, reduced greenhouse gas emissions, and other benefits are all features of plastic soil brick. The "Eco-Bricks" or plastic soil bricks, also known as, are formed of plastic waste and may be utilised for construction but are otherwise hazardous to all living things. Compared to bricks made of fly ash, it improves compressive strength. Alkalis' water-absorbing capacity was significantly decreased by the usage of plastic soil blocks. Further study would enhance the quality and durability of plastic soil bricks because of their multiple benefits.

KEYWORDS- Physical composition of MSW; Chemical composition of MSW; Leachate Charaterization; Soil Characteristics; Brick Result.

I. INTRODUCTION

The recent rise in the volume of municipal solid garbage has been attributed to both the rapid expansion of the population and the ongoing pursuit of economic advancement and development. Since time immemorial, humans have been producing trash as a natural part of their daily lives, and this trend has been increasing in recent years. Urban areas around the world face a major dilemma due to an ever-increasing amount of solid garbage. The problem of solid waste has emerged as a major urban environmental issue due to the rapid growth in population, urbanisation, and industrialization, all of which are contributing to the rapid generation of solid waste.

Used plastics should be put to good use. It is now difficult for any essential sector, from agriculture to industry, to function properly without the use of plastic. Since this is impossible, the most realistic solution is to find new uses for plastic waste, such as in building structures and industries.

In addition to the aforementioned benefits, plastic soil brick also has the potential to save money, save resources, lessen the impact on the environment, and more. Eco-bricks or plastic soil bricks are created from recycled plastic that would otherwise be landfilled where it would represent a threat to wildlife.

Commercial and residential wastes created in municipal or notified areas in either solid or semi-solid form, excluding industrial hazardous wastes but including treated biomedical wastes, are referred to as Municipal Solid Waste (MSW) by the Ministry of Environment and Forest (MoEF).

II. OBJECTIVES OF THE STUDY

The purpose of this research is to examine the issues that have arisen because of municipal solid waste dumpsites and to look for workable solutions to these issues.

- To study the composition and the characteristics of solid waste.
- Studying the composition and quality variations of leachate generated by municipal solid waste.
- Utilization of solid waste from land fill to manufacturing of Bricks.

III. LITERATURE REVIEW

R. S. Kognole, Kiran Shipkule, el. [1]- The plastic waste is today's world's most serious problem. This is the most serious problem that humanity is facing. Plastics smaller than 50 microns are also a significant problem, with HDPE and PTE being the most hazardous pollutants. The presence of these polymers in the soil has a direct effect on its fertility. Many pieces of plastic trash are thrown into the ocean today. This plastic waste has a negative impact on marine life and lowers the quality of the seawater. We thus look for practical answers to the plastic waste issue. In order to create the bricks, we added plastic waste to the mixture.

Chattopadhyay et al. [2]- predicted that Kolkata's 3000 MT/day of municipal solid waste would rise to 3750 MT/day by 2025. At the moment, the city has a population of 4.4 million people.

Purdy and Mansour et al. [3]- concluded that clay barrier layers should no longer be employed as a cover layer over municipal landfills. The cracks in the debris pile could have been a way for rainwater to get in and a place for landfill gas to come out.

Gidarakos et al. [4]- determine there are several reasons why MSW composition studies are crucial. Some of these include the following: estimating material recovery potential; locating component production sources; facilitating processing equipment design; and estimating physical, chemical, and thermal characteristics of the trash. According to a survey conducted in the Crete area of Greece, 76% of all trash generated on the island is composed of biodegradable materials, paper, and plastic. There are some fundamental compositional differences between MSW from major Chinese cities and that from smaller, regional cities. For example, the former contains more inorganic materials than organic ones, the latter more uncompostable refuse than compostable, and the latter less combustible than incombustible (YongfengNie et al. 2004). Refuse samples from 33 cities were collected and analysed physically and chemically by Bhide et al. (1975). The average percentage of biodegradable material was found to be 37%, with plastics and glass making up less than 1%, and paper making up between 3% and 7%. Findings put the scale between 330 and 560 kg/m3.

Shannigrahi et al. [5]- Based on factors such as location, time of year, cultural norms, socioeconomic position, and food, MSW's physico-chemical qualities may vary greatly

Ramachandra and Saira Varghese[6]- Bangalore, India's Garden City, has a population of 6 million, and it has to deal with 3613 tonnes of municipal solid waste per day

Deepak Singh and Ramesh C. Sharma [7]- Srinagar town, a hill town in Uttaranchal with a population of 28,565, generated an annual average of 2856.5 tonnes of municipal solid waste (MSW)

Ivan W.C. Lau et al. [8]- determined that leachate from mature landfills had considerably reduced organic strength. Biological treatment of such leachate is futile because the organic remains in it are resistant to further biodegradation.

Owen A. O'Connor et al. [9]- the leachate from municipal landfills poses a threat to both local ecosystems and human populations. Low biological oxygen demand, high chemical oxygen demand, and the presence of heavy metals are some of the chemical characteristics of leachate. The following information was obtained through the analysis of landfill leachate from a municipal solid waste facility in Lyndhurst, New Jersey. Dissolved oxygen was 1.8-2.0 mg/l, oil and grease was 4.8 mg/l, suspended particles were 5.6 mg/l, total Kjeldahl nitrogen was 215 mg/l, total phosphorus was 1.53 mg/l, and COD was 6478 mg/l. Young landfills' leachates are more degradable because they include higher quantities of volatile fatty acids. Neither biological nor physical/chemical treatment methods are very effective in getting rid of the problem.

Keenan et al. [10]- for the low treatment effectiveness of landfill leachate. Using a modified anaerobic toxicity assay, we found that the leachate from the food waste reactors had high levels of toxicity. There were two main reasons for this: first, there were a lot of high molecular weight organic compounds, which are hard to break down, and second, the etc. had a negative effect on living things.

Michael and Donald Langmuir [11] - derivedat the State College (Pennsylvania) Regional Sanitary Landfill, which had been operating since 1962 using the trench method of waste disposal, the contaminated leachate had moved to depths of 50 feet or more in the soils beneath downslope cells. The specific conductance of the leachate generated by the garbage dump was 8445 mhos, the concentration of the Cl was 1890 mg/l, and the biological oxygen demand was 3300 mg/l. After 7 years of sinkage to a depth of 36 feet, the leachate below the cell still had a conductance of 6600 mhos, Cl above 9000 mg/l, and BOD below 40 mg/l. Research into leachate quality necessitates estimation of its damaging effects and designing a sustainable, cost-effective, environmentally acceptable way of treatment**.**

Slomezynska and Slomezynski [12]- has a high metal concentration, sometimes approaching the levels for leachates from landfills containing industrial wastes, including chromium, zinc, cadmium, copper, manganese, nickel, and lead.

Janet F. Rickabaugh and Riley N. Kinman[13] - municipal solid waste (MSW) is often disposed of by landfilling, despite the fact that other disposal methods exist. In 1971, practically every city in India used land dumping as a method of municipal solid waste disposal. Of the 23 cities studied between 1991 and 1999, 89.8% embraced land dumping, while just 1.6% used alternative methods, including palletization and vermi-composting.

Vieitez et al. [14]- state the organic percentage of MSW is unsuitable for burning because of its high moisture content (between 50% and 80%). According to Dixit (2004), the calorific value has to be more than 1200 kcal/kg for effective incineration, and if it's too low, additional fuel is needed, rendering the process economically untenable. While incinerators do assist in reducing trash volume, they also create new dioxin sources and account for around 70% of dioxin emissions (Gajghate et al. 2003).

Girija Devi and Kurian Joseph [15] - reported that aerobic composting is hindered at high moisture content above 50% because the wastes tend to ferment anaerobically producing odorous organic acids and sulphides.

Michael K. Stenstrom et al. [16]- conducted research on the anaerobic digestion of municipal solid waste and found that OFMSW produced 55–60% methane at a rate of 7.0 cu. ft–9.0 cu. ft gas/lb VS applied, depending on the feed concentration, which varied between 2.6 and 8% VS, and the hydraulic retention time, which varied between 15 and 30 days. When batch digestion of municipal waste was performed at room temperature for 240 hours

Rao et al. [17]- determined that the final biogas generation capacity of municipal waste was 0.661 m3/kg VS (1997) Using anaerobic reactors of 2 litre capacity, we tested the biodegradability of the key biodegradable components of MSW individually and found that food waste with inadequate seed (30% volume) remained blocked. The results of research into the microbial communities present in each kind of trash indicated that food waste did not include any cellulolytic or methanogenic bacteria.

Chun Man Lee et al. [18] - landfilling activities have been identified as a possible significant source of N2O. Although N2O concentrations in the atmosphere are around a thousand times lower than those of CO2, its radioactive forcing is roughly two hundred times higher. High levels of N2O (1.09 g/L) were found in a gas sample taken from topsoil dumped at the Likang landfill in China.

IV. METHODOLOGY

An experimental investigation of the HSAD process Fermentation of MSW was carried out in the laboratory using solidthe three-phase digester operated in batch mode. The experiment was conducted in a PVC reactor of15 cm in diameter with an overall height of 100 cm. Both the top and bottom of the reactor was capped with a PVC cap. A wire mesh was installed at the bottom.The reactor is to support a gravel pack of size 10-20 mm and to separate largeparticles from the liquefied leachate. The bottom cap was threaded and fitted.with a valve to collect leachate. The reactor was found to be slightly inclinedfrom the vertical stand, but it will not affect the digestion process.Experimental batch reactor configurationTwo sampling ports were provided on the side of the reactor collects digested waste samples for analysis once every 20 days using ascoop. A gas port is provided in the reactor fitted with a valve to allow for gas.

Withdrawal and measurement the gas flow is directed to a sodium chloride tank.saturated, water displacement, gas volume measuring device using a flexibletube. Gas flow was measured when an increase in the brine solution in theA graduated jar was observed. A schematic diagram of the reactor is shown

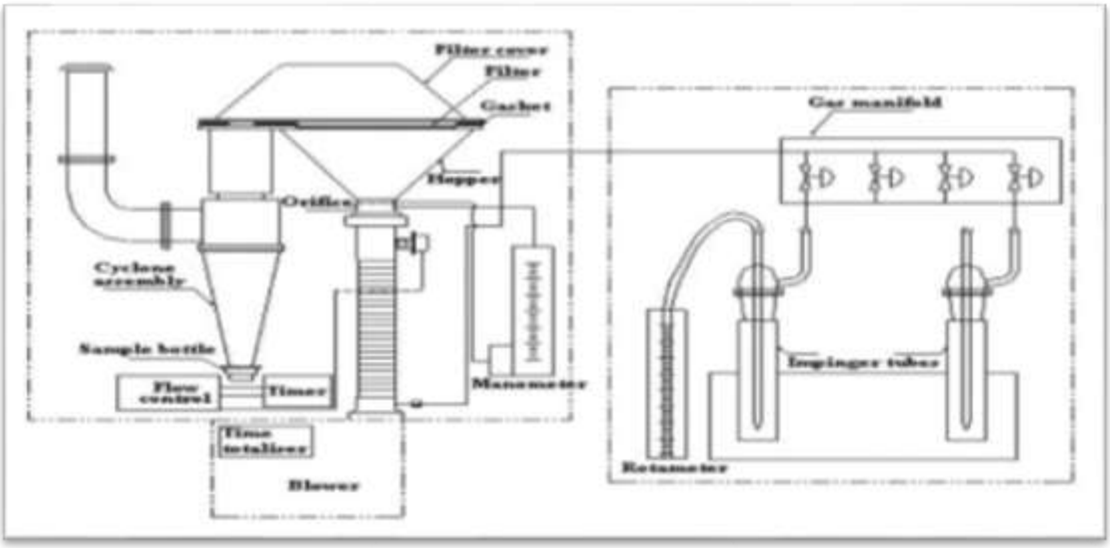

Figure 1: Schematic diagram of a batch reactor

A. Plastic Waste

Given that high-density polyethylene plastic breaks down into powder when heated or melted, we are making do with low-density polyethylene waste plastic (LDPE) for this endeavour. LDPE plastic, on the other hand, melts at high temperatures but hardens again at room temperature, so it can be used to hold soil bricks together.

The monomer ethylene, for its part, can be used to make the thermoplastic known as low-density polyethylene (LDPE). In 1933, Imperial Chemical Industries (ICI) used a high-pressure technique using free radical polymerization to create the first grade of polyethylene. Even now, the same technique is used in its production. It is estimated by the EPA that just 5.7% of LDPE gets recycled. Even though newer polymers provide some competition, LDPE is still widely used today. The value of the global LDPE market was estimated at $33 billion in 2013.

The United Nations estimates that 500 billion plastic bags are used annually throughout the globe, and that half of all plastic used is in single-use or throwaway goods like these. Eight million metric tons of plastic enter the seas every year; that's the weight of a trash truck being emptied every minute.

Municipal town panchayats collect trash from daily city cleanups, while campus cleaners collect only a small fraction of the total.

B. Soil

A soil's composition includes organic matter, inorganic materials, gases, liquids, and living creatures. The pedosphere, which is Earth's soil, serves four critical purposes: as a plant-growing medium; as a water storage, supply, and purification system; as a moderator of Earth's atmosphere; and as a home for species.

The soil is altered as a result of all of these processes.

A significant part of Earth's ecology is its soil. Soil processes have far-reaching effects on ecosystems across the planet, from ozone depletion and global warming to the loss of rainforests and water contamination. Soil is one of Earth's major carbon reservoirs and may be especially sensitive to human disturbance and climate change. As the earth warms, increased biological activity is expected to cause soils to release more carbon dioxide into the atmosphere, creating a positive feedback loop.

We dug up some dirt close to municipal solid waste and sieved it until we had a passing grade of 4.75 millimeters and a 90-degree angle. Soil particles smaller than 90 degrees fail to bond together effectively, reducing the bricks' strength, while soil particles larger than 4.75 millimeters cause cavities in the mix.

C. Proportion of the Mix

To produce bricks of a specific minimum strength and durability as cheaply as possible, mix design entails choosing

acceptable elements of plastic soil bricks and defining their proportional proportions.
Because the soil and molten plastic will not bind properly below a 1:2 (plastic: soil) proportion, and because the error due to shrinkage will be more noticeable at a 1:1 (plastic: soil) proportion, we can only use these two proportions when manufacturing plastic soil bricks to get the proper strength and shape.

D. Collection of Materials

- **PLASTIC-** I gathered waste plastic by cleaning our municipal solid waste, and i also met with an engineer from the municipal town of Nuwakot. I gathered waste plastic that had been collected each morning by laborers from the municipal town of Nuwakot.
- **SOIL -** I dug up some ground close to landfill and graded it, and it has been passing grade of 4.75 millimeters and a retention grade of 90mircon sieve

E. Combining

The graded dirt (4.75mm pass, 90° retain) should be poured into the pan as soon as the plastic has melted and well mixed using a trowel. The mixture is approximately 200 degrees Celsius, so proper protection gear is required to avoid injury. Before melting, the soil and plastic must be batched in the correct proportion. Melted plastic and graded earth.
Immediately, after finishing the mixing procedure, we should pour the mixture into the mould. Since the mixture begins cooling and hardening as soon as it is mixed, it must be placed into the mould and compressed as soon as possible. The international standard IS 1077:1992 says that the standard modular size for bricks is 190 millimeters by 90millimeters by 90 millimeters. This is the size of our molds. moulding and compacting the plastic-and-soil mixture.

F. Curing

There is no need for a curing phase since the bricks solidify and cool to room temperature immediately after being moulded. After thirty minutes, the brick is ready to be removed from the mould, and after an additional hour and a half, it will have cooled down on its own.

G. High-Quality Brick

Tobegin with, let's talk about colourgood bricks will all be the same shade of red. When there is consistency in colour, there is also consistency in chemical composition. A homogeneous dark black colour characterizes plastic soil bricks.

H. Crushing Power

The minimum crushing strength for a brick should be 5.5N/mm2. The compressive strength of the plastic soil bricks is 7.46 N/mm2. Bricks should have a consistent size and shape, and their edges should be clean and perpendicular to one another (5.4). The shapes of everyone's faces should be accurate. All bricks must conform to the size specifications set by Indian law. Bricks should have a fine, thick, compact, and homogeneous textur..Bricks with broken surfaces shouldn't have clumps of lime, loose grit, cracks, or cavities. A pair of bricks should make a distinct ringing sound when knocked together

I. Difficulty

They should be so tough that scratching them with a fingernail leaves no visible mark. Bricks with low heat conductivity and high acoustic insulation should be used. Bricks should not shatter if they are thrown flat on firm ground from a height of approximately 1 meter.

J. Physical Features Shape

Traditional bricks are strictly rectangular in form. All of its contours are clear and distinct. The bricks have a uniform and consistent surface. Figure 2 Shows the shape of bick

Figure 2: A Plastic Brick Used as Soil

K. Density

6.4% Most of what determines a brick's density, or weight per unit volume, is the type of soil and how it was made. Our bricks have a density of 1621.183 kg/m3, which is rather high. There are five kilos per square inch of bricks. We have manufactured plastic soil blocks that, on average, weigh 2.50 kg. Burned bricks of the highest quality weigh between 2.30 and 2.40 kg per cubicmetre.A Plastic Soil Brick is Weighed

V. RESULTS

Physical and chemical parameters of solid waste samples taken from of the Nuwakot disposal facility were analysed. In order to choose the best treatment methods, the waste sample characteristics were determined. Leachate generated at the disposal facility was gathered to determine the kind and degree of MSW's breakdown process. By gathering samples of soil, groundwater, and ambient air quality at and near the waste disposal facility, it was possible to evaluate any potential environmental issues related to the land-based disposal of MSW. In the lab, a high solids batches anaerobic fermentation process was used to turn the waste into energy as a suitable remedial solution for the solid waste problem. In order to anticipate the concentration of the leachate ingredient (salt concentration in units of EC) in the surface soil over time, simulation research was lastly conducted.
Displacements

A. Physical Characteristics of MSW

Table 1, below shows Physical Characteristics of MSW.

Table 2: Physical Characteristics of MSW

S. N.	Ingredients	Values (%)
1	Paper	5.71
2	Plastics	8.75
3	Garden trimmings and yard wastes	3.85
4	Organic fraction	56.5
5	Jute	0.95
6	Wood pieces	1.9
7	Stones, tiles and bricks	7.65
8	Glass	0.35
9	Metals	0.45
10	Cloth, rubber	4.5
11	Others	9.45

B. Chemical Composition of MSW

Table 2: below shows the Chemical Composition of MSW

Chemical Composition Of MWS		
Sl. No.	**Parameters**	**Values**
1	Moisture content (%)	58
2	pH	7.2
3	Volatile solids (%)	73
4	Total Carbon (%)	23
5	Total Nitrogen (%)	0.73
6	Phosph0111s as P205 (%)	0.44
7	Potassium as Koo (%)	0.82
8	CN ratio	29.79
9	Caloific value (kcal kg)	810

C. Leachate Characterization

In order to study the changes in leachate concentrations over time and to understand the decomposition processes of MSW in a landfill, the characterization of leachate samples was carried out at different periods. Leachate measurements for pH, TS, VS, TOC, COD, BOD and for the presence of heavy metals were made and the results are summarized. The variations in the concentrations of chemical parameters for the Two samples are plotted

It was observed from the results that, leachate collected during first sampling showed higher concentrations of pollutants for all the chemical parameters except chlorides and sulphates. This could be due to the surface water ingress into the waste materials that promotes solubilisation of pollutants from the actively decomposing waste mass into the leachates. Theconcentrations were much lower in old the leachate than the fresh leachate as was observed from sample II. Due to ageing of landfills, the concentration of pollutants decreases and leachate from such landfills has relatively lower organic strength.

D. pH

The pH value of leachate sample is 7.12 indicating alkaline nature of MSW. During second sampling, the pH value decreased from 7.12 to 6.5 and this may be due to the acidification of organic compounds during the first phase of decomposition process.

E. Total Organic Carbon

TOC is used as a measure of organic matter concentration in the leachate. The concentration of TOC in sample I was found to be 8607 mg/l. Such a high value in sample I is due to the accumulation of partially degraded organic materials. As the waste sample degrades, the concentration of TOC in the leachate decreases as observed in sample II.

F. Ammonia Nitrogen

Ammonia nitrogen has chiefly been produced by the decomposition of nitrogenous organic substances in the refuse. The concentration of ammonia nitrogen in the fresh leachate was found to be 2102 mg/l and it decreased to 1824 mg/l. Increase in ammonia nitrogen in fresh leachate may be caused by its production from the breakdown of organic nitrogen in the

leachate. As the leachate percolates through the soil its concentration decreases. It is retained in the soil by the base exchange process or under reducing conditions bacterial growth may also remove ammonia by bacterial assimilation and hence its concentration decreases in sample II.

G. Chlorides and Sulphates

Chlorides and sulphates have relatively high solubilities and the occurrence of high concentrations in the leachate is due to the direct leaching of Na, Ca, Mg and K salts of these anions from the refuse. The concentrations of chlorides and sulphates for sample I were 1526 mg/l and 3125 mg/l respectively and the values increased to 1705 mg/l and 4321 mg/l respectively during second sampling. As infiltration of water through MSW dissolves these ions in large concentrations, its value is high in the leachate samples as observed in sample I and sample II.

H. Volatile Solids

The variation in VS concentrations of sample I and sample II indicate stabilization of leachate organic matter as shown by the reduction of this parameter from 7658 mg/l in sample I to 4995 mg/l in sample II.

I. COD and BOD

The leachate samples were found to contain high levels of COD and BOD with concentrations of 12,230 mg/l and 6500 mg/l respectively. This is due to the presence of large amount of organic matter carried by the percolated water through the decomposed mass of solid waste. The biological degradation of organic substance slowed down at the later stage and the susceptibility of leachate to further degradation declines. This may be the reason for leachate to produce lesser concentrations of COD and BOD as wasobserved from sample II collected during second sampling.

J. Zinc and Cadmium

Among the heavy metals, Zn and Cd were observed in leachate samples because they are likely to remain active and more mobile in soils. The value of Zn was found to be 0.486 mg/l for sample I and 0.270 mg/l for sample II. Cd decreased from 0.051 mg/l in fresh leachate to 0.021 mg/l in old leachate sample.

K. Soil Characteristics

Here, the below table 3 and table 4 shows the physical, physic-chemical characteristics of soil samples before and after placing the solid waste respectively.

Table 3: Physical, physico-chemical and chemical characteristics of soil samples before placing the solid waste

Physical, physico-chemical and chemical characteristics of soil samples before placing the solid waste						
S.N.	**Characteristics**	**Top soil**	**30 cm**	**60 cm**	**90 cm**	**120 cm**
1	Soil Texture	Sandy Clay	Sandy Clay	Sandy Clay	Clay Loam	Clay Loam
2	Soil Colour	Pale brown	Pale brown	Greyish brown	Greyish brown	Greyish brown
3	pH	7.55	7.25	7.41	7.86	8.12
4	EC (dS/m)	0.63	0.41	0.12	0.12	0.09
5	CEC (meq/l00gm)	5.68	3.42	2.63	1.83	1.06
6	Organic Carbon (%)	0.17	0.09	0.052	0.21	0.003
7	Free caco (%)	8.46	8.56	9.03	8.17	5.45
8	Total Nitrogen (%)	0.12	0.007	0.003	0.0012	0.0013
9	Calcium (meq/100gm)	2.99	2.51	3.51	8.78	10.32
10	Magnesium (meq/100gm)	2.74	1.51	1.53	2.78	1.68
11	Sodium (meq/100gm)	0.98	0.77	0.003	0.08	0.05
12	Potassium (meq/100no)	0.09	0.06	0.073	0.14	0.11
13	Phosphorus (ppm)	2.71	1.93	1.51	1.36	1.23
14	Copper (ppm)	2.07	2.23	1.53	1.45	1.25
15	Manganese (ppm)	4.11	2.93	3.4	1.77	1.29
16	Iron (ppm)	6.15	5.43	4.15	2.93	3.18
17	Zinc (ppm)	1.75	1.23	0.78	1.01	0.83
18	Cadmium (ppm)	0.016	0.013	0.012	0.021	0.019

Table 4: Physical, physico-chemical and chemical characteristics of soil samples after placing the solid waste

Physical, physico-chemical and chemical characteristics of soil samples after placing the solid waste						
S. N.	**Characteristics**	**Top soil**	**30 cm**	**60 cm**	**90 cm**	**120 cm**
1	Soil Texture	Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Clay Loam	Clay Loam
2	Soil Colour	Dark brown	Dark yellowish brown	Light yellowish brown	Greyish brown	Greyish brown
3	pH	8.87	8.78	8.5	8.45	8.35
4	EC (dS/m)	2.75	2.46	1.63	1.38	4.25
5	CEC (meq/lOO gm)	16.25	20.23	1425	7.61	4.68
6	Organic Carbon (%)	1.7	1.62	0.92	0.89	0.62
7	Free CaC031%)	8.88	9.23	9.5	8.12	7.21
8	Total Nitrogen (%)	0.17	0.131	0.79	0.051	0.021

9	Calcium (meq/100 gm)	8.12	9.251	15.99	16.2	11.81
10	Magnesium (meq/100 gm)	2.3	1.78	2.01	3.54	2.02
11	Sodium (meq/100 gm)	1.38	1.05	1.35	1.37	0.99
12	Potassium (meq 100 gm)	0.11	0.19	0.22	0.21	0.19
13	Phosphorus (ppm)	3.25	1.36	5066	5.78	3.51
14	Copper (ppm)	3.78	2.36	1.67	1.99	1.13
15	Manganese (ppm)	4.68	5.23	3.96	4.81	3.42
16	Iron (ppm)	8.2	7.756	4.31	3.67	4.07
17	Zinc (ppm)	6.78	5.46	1.13	1.21	0.61
18	Cadmium (ppm)	0.028	0.017	0.011	0.114	0.018

L. Brick result

Bricks are put through the following tests to see if they are suitable for construction work. Test of absorption Brick is subjected to

M. Absorption Test

To see how much moisture, it can absorb in difficult circumstances. Dry brick samples are obtained and weighed for this test. After being weighed, these bricks are submerged completely in water for 24 hours. Next, weigh every wet brick and record its weight in dollars. The quantity of water absorbed will be determined by the weight difference between dry and wet bricks.

The plastic components cover the soil particles and do not absorb any, so the polymer soil bricks do not absorb any water.

N. Crushing Strength Test

The specimen lod and strength of different sample are shown in table 5.

Table 5: Specimen load acquired & Strength in compression

The bricks I made had a compressive strength average of 7.46N/mm2 Samples	**Specimen load acquired**	**Strength in compression**
Sample-1	101 KN	6.14 N/mm2
Sample-2	112 KN	6.73 N/mm2
Sample-3	118 KN	7.02 N/mm2
Sample-4	164 KN	9.94 N/mm2

The following figure 3, 4, 5, and 6 shows pH at different depth, magnesium at different depth, brick specimen load acquired , strength in compression espectively.

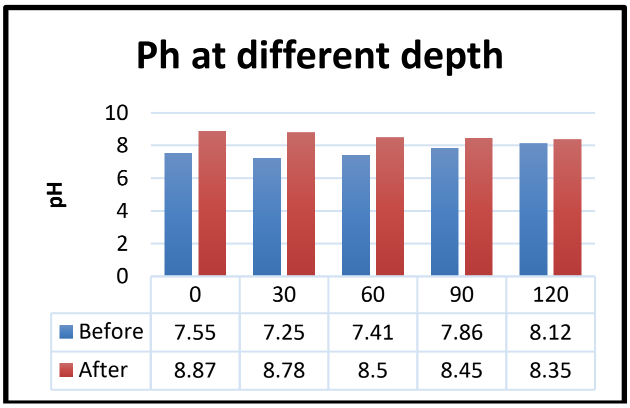

Figure 3: pH at different depth

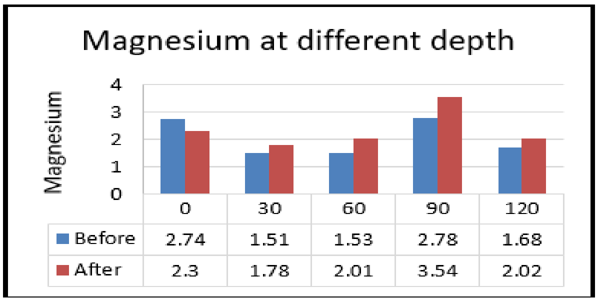

Figure 4: Magnesium at different depth

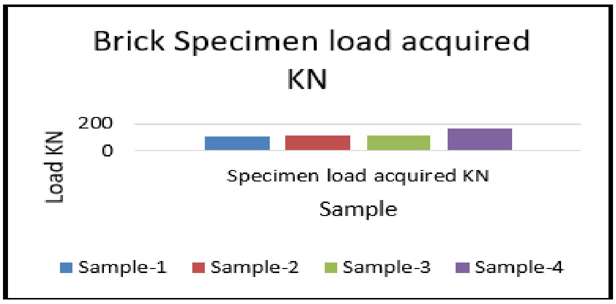

Figure 5: Brick specimen load acquired

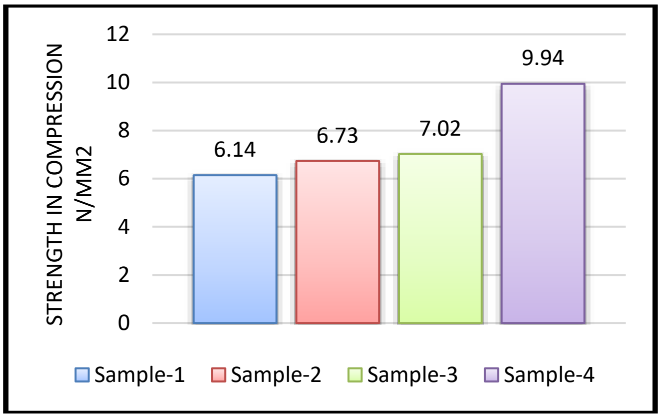

Figure 6: Strength in Compression of Brick

VI. CONCLUSIONS

The following are the salient conclusions drawn from the present study.

- Composition data of MSW showed that biodegradable portion constitutes to about 68.95% with volatile solids concentration of 67%. Hence, bio-methanation of MSW is a viable technique for converting waste to energy.
- Results of composition analysis also indicate that MSW has high moisture content with relatively low energy content which makes incineration process ineffective in managing solid waste.
- Leachate characteristic study showed high concentrations of TOC, total solids, volatile solids, chlorides, sulphates, COD and BOD for leachate from fresh MSW as it contains organic compounds that are readily amenable to biodegradation giving rise to increased concentration of the pollutants.
- During second sampling, the concentration of characterizing parameters of MSW leachate decreased because of stabilization of organic matter but the waste is in the acidogenic phase as BOD/COD ratio lies between 0.5-0.7.
- Among the parameters analysed to characterize the quality of leachate, chlorides and sulphates showed increased concentration during second sampling. High concentrations of the above two parameters are caused due to infiltration of water dissolving large concentrations of these ions from the refuse. This is again because of higher solubility nature of these ions.
- Soil quality study ofNuwakot site showed that soil texture has been altered up to a depth of 60 cm and soil colour has also been changed up to the same depth due to the deposition of leached constituents from the refuse by the percolating water.
- Physico-chemical characteristic study of soil shows that soluble salts from the refuse are carried by the infiltrating water and deposited at different depths which increase the pH of soil, salinity and CEC values of soil layers to a great extent. The increase in the above parameters is due to the accumulation of soluble salts and organic matter content of the refuse in the soil.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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