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Utilization of by Product & Using Advanced Machine for Solid and Liquid Waste Management- Hotels

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ABSTRACT

The concern on large quantity of the waste being produced both in the form of food and liquid waste, the concept of waste management becomes one of the keys focuses of sustainable development principles which is based on policies, and practices that are resource conserving, follow standards that can be met in the long term, and respect values of equity in human access to resources. It is estimated that people in rural India are generating 0.3 to 0.4 million metric tons of organic/recyclable food waste per day and that 88% of the total disease burden is due to a lack of clean water, sanitation, and improper food waste management. In the absence of proper disposal of food and liquid waste they are leading to vector borne diseases such as diarrhoea, Malaria, Polio, Dengue, Cholera, Typhoid, and other water borne infections such as schistosomiasis. Close to 88% of the total disease load is due to lack of clean water and sanitation and the improper food and liquid waste management-which intensify their occurrence. Hotel garbage management is poor. Poor collection and transportation of municipal food wastes are caused by a lack of acceptable infrastructure, underestimated trash creation rates, inadequate management and technical capabilities, and inefficient collection and route design. This research aims to classify the types of trash generated in hotels and restaurants, as well as their sources, harmful impacts on the environment and human health, and existing waste treatment strategies.

Keywords: - *Food Waste, Hotel Waste, Waste to health, Rural Area, Industrial Waste*

INTRODUCTION

Food waste is a growing environmental and social concern in India, particularly in urban areas where rapid urbanization and changing lifestyles have significantly increased the volume of municipal solid waste. Food waste, often categorized under non-liquid discarded material, originates from domestic households, commercial centers like hotels and restaurants, agricultural activities, industries, and public services. It is generally composed of heterogeneous substances and is commonly referred to as garbage, refuse, or trash. In India, the volume of food waste has increased drastically—from an estimated 6 million tons in 1947 to around 48 million tons by 1997. This sharp rise highlights the need for a robust and sustainable waste management system.

Unfortunately, more than 25% of food waste generated remains uncollected, and nearly 70% of Indian cities lack the proper infrastructure to transport or treat it effectively. Additionally, most of the existing landfills are poorly designed and managed, lacking protective measures such as proper lining to prevent contamination of soil and groundwater. As a result, mismanaged food waste contributes to various environmental problems, including air and water pollution, greenhouse gas emissions, and health risks for local communities.

Food waste includes both biodegradable and non-biodegradable components. Organic waste—such as leftover food from hotels, vegetables, fruits, and leaves—is the most manageable portion, especially if composted properly. However, waste also includes toxic items like old medicines, batteries, chemicals, and non-biodegradable plastics and packaging materials that severely harm the environment. The consumer market's growth has introduced a significant volume of plastic and other non-recyclable materials into the waste stream, further complicating the issue.

Effective waste management follows the principles of Reduce, Reuse, and Recycle. Reducing waste at the source can be achieved by optimizing consumption habits—such as taking only the required amount of food, using glass instead of plastic, or minimizing packaging materials. Reuse practices like repurposing paper for rough work, using treated wastewater for gardening, and adopting solar energy systems can significantly lower the load on waste treatment facilities. Recycling, particularly of biodegradable waste, helps in generating useful by-products like manure and biogas, thereby completing nature's cycle and offering additional revenue streams.

Food waste management also involves understanding the various types of waste: domestic and institutional waste (including food, paper, and plastics), construction and demolition debris, biomedical waste, and industrial waste. The materials found in food waste include paper, packaging, glass, metals, plastics, textiles, rubber, wood, and even electronic waste. Each category requires specific handling, segregation, and disposal methods for efficient management.

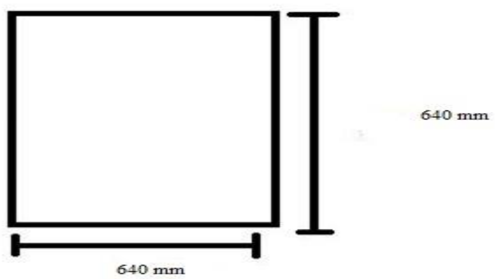
In rural areas, initiatives like the Total Sanitation Campaign (TSC) play a vital role in promoting waste management practices. By encouraging Panchayats to adopt systems for composting, drainage, and wastewater reuse, rural communities can significantly improve public health and environmental conditions. TSC provisions also allow the use of a portion of the project budget for capital investment in waste management infrastructure. With proper planning, execution, and community involvement, rural areas can serve as models for sustainable food and liquid waste management systems.

STUDY AREA

The study focuses on the effective management of solid and liquid food waste generated primarily from hotels and commercial establishments in urban and semi-urban regions. Particular emphasis is placed on areas experiencing rapid urbanization and growth in the hospitality sector, where food waste generation is significantly high due to increased consumption and changing lifestyles. Hotels, restaurants, and catering services contribute a major portion of biodegradable waste, such as leftover food, vegetable peels, and organic matter, which if not managed properly, leads to environmental degradation, foul odor, pest infestations, and water pollution.

Additionally, the study examines selected rural areas where food and liquid waste management systems are underdeveloped or absent. In these regions, the implementation of basic waste treatment solutions like compost pits, soakage pits, and drainage systems is crucial. The study aims to identify practical and low-cost methods that can be adopted by local governing bodies such as Panchayats, under schemes like the Total Sanitation Campaign (TSC). These rural zones serve as pilot locations for replicable waste management models. The combination of urban hospitality centers and rural communities provides a comprehensive understanding of challenges and opportunities in food waste management, making it easier to develop sustainable solutions tailored to varying geographic and socio-economic conditions.

DESIGN AND CALCULATION



$M/I = \sigma b/Y$ ……………………s. (1)

F = force acting on total frame including roller and polypropylene sheet with motors

Weight of Hopper = 2kg approx.
Weight of Rotor = 2Kg
Weight of organic waste = 1Kg
Other Dead weight = 5Kg
Total weight = 10 Kg

Pd = Perpendicular distance of the frame which is 610 mm.
The distance is assumed to be 610 mm including full set up, because here we are creating a prototype model, hence some of the Assumptions needs to be considered.
The material used for fabricating frame is Mild steel. The cross-section of = 20 * 20 * 3 mm Square-Type because it is easily available in the market
We know
$M / I = \sigma b / y$
M = Bending moment
I = Moment of Inertia about axis of bending that is; Ixx y = Distance of the layer at which the bending stress is consider
(We take always the maximum value of y, that is, distance of extreme fiber from N.A.) E = Modulus of elasticity of beam material.

Bending moment (M) =force *perpendicular distance
= 10Kg *9.81 * 305
Ear perpendicular distance is taken in center from both the side so hence we will calculate it in the center
= 29920.5 N/mm
I = b(h3) / 12
= 20*(20^3) / 12
=13333.33 mm4
M = 29920.5 N/mm
I = 13333.33
Sigma b = unknown ?
Here y is considered as half of the support parameters because yielding takes place
Y = 20 / 2 = 10 mm
Sigma b = 32.961 N/mm2
The allowable shear stress for material is σallow = Syt / fos
Where Syt = yield stress = 210 MPa = 210 N/mm2
And fos is factor of safety = 2
So σallow= 210/2 = 105 MPa = 105 N/mm2 Comparing
above we get, σb < σallow i.e 32.961 < 105 N/mm 2
So, design is safe.
Comparison of mild steel against all materials for constructing of our structure

Table 7.2. Mechanical properties of common metals and alloys (typical values at room temperature)

	Tensile strength (N/mm^2)	0.1 per cent proof stress (N/mm^2)	Modulus of elasticity (kN/mm^2)	Hardness Brinell	Specific gravity
Mild steel	430	220	210	100–200	7.9
Low alloy steel	420–660	230–460	210	130–200	7.9
Cast iron	140–170	—	140	150–250	7.2
Stainless steel (18Cr, 8Ni)	>540	200	210	160	8.0
Nickel (>99 per cent Ni)	500	130	210	80–150	8.9
Monel	650	170	170	120–250	8.8
Copper (deoxidised)	200	60	110	30–100	8.9
Brass (Admiralty)	400–600	130	115	100–200	8.6
Aluminium (>99 per cent)	80–150	—	70	30	2.7
Dural	400	150	70	100	2.7
Lead	30	—	15	5	11.3
Titanium	500	350	110	150	4.5

Consider mass of 1 kg of wet waste is taken for calculation consideration.
So, Mass = 1 kg * 9.81 = 9.81N
The following data are considered on the basis of exerted data from research papers etc. and are according to standards and some of the data are assumed to be noted.
Amount of moisture content in peels(x)- 80 % = 0.8 Specific heat of orange
peels (cps)- 3.81 KJ/Kg.
Specific heat of air (cpg)- 1.005 KJ/Kg.
Latent heat of water (hw) - 2257 KJ/Kg.
Initial temperature of peels (T3)- 30 ^{0}C.
Final temperature of peels (T4) - 90 ^{0}C.
Initial temperature of air = 33^{0}C.
Temperature of air at inlet of compartment (T1) - 130 ^{0}C Temperature of compartment at
outlet (T2) - 50 ^{0}C.

Mass Flow Rate of Air Required (Ma):
By Energy balance equation we can calculate the mass flow rate
Ma*cpg (T1 – T2) = Mp *cps (T3 – T4) + (xhw)
Ma * 1.005 * (130 – 50) = 5 * 3.81 * (90 – 30) + (4 * 0.8 * 2257)
Ma= 104.0472 Kg/ hr = 0.0289 Kg/sec
Finally mass flow rate of air 0.1 Kg/ sec selected.
Density of air at 130 degree= ρ = 0.8646 Kg/ m3
Volume flow rate of air = Mass flow rate / density of air
= 0.1 / 0.8646 = 0.11565 m3/sec
= 244.94 CFM = 245 CFM
So exhaust fan of minimum discharge 245 cfm must be selected.
For the fan of 245 cfm discharge, 160 mm
diameter fan is used.

Air velocity (v)= Air discharge/ area of duct = 5.86 m/s

Electric Heater Selection:

Heater is required to heat the supply air up to 130 ^{0}C from the atmospheric temperature of about 33 ^{0}C.

So, Wattage W= h * Area of heater * (130 – 33) = 58.95 * π* 0.016*1* (130 - 33)

W= 179.61 Watt = 180

Minimum power of electric heater must be greater than 180 Watts.

We can use either heater or coil for heating of organic wastage so as per the calculation 180 watts of power is required.

Furnace Capacity:

1 kg of peels having volume approximately 0.01 cubic m

So volume of furnace is for compatibility is taken as 1ft * 1ft * 1ft

V= 1* 1 * 1 cu.ft = 0.028316 cubic m

Rotor selection

Rotor selection for cutting

Given

Assume blade dia varies from 50mm – 100 mm min-max

Diameter for blade =100 mm

Weight of organic waste to be powered =1kg

Torque required for

Torque=force*radius of wheel

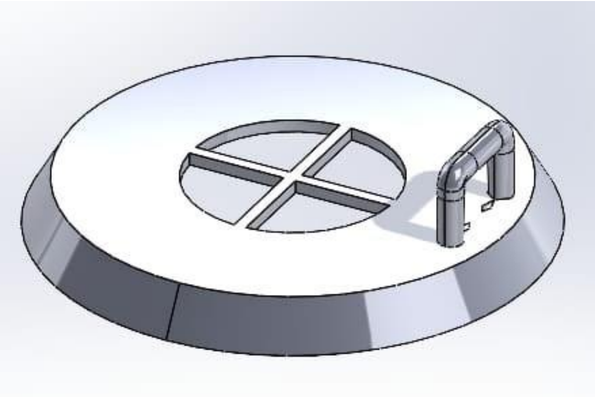
= 1*9.81*50

= 490.5 N/mm

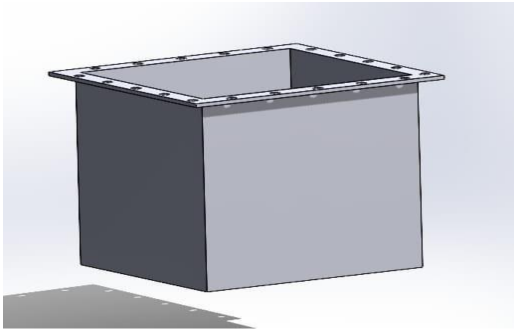
= 4.905 Nm

On the above basis following components are purchased on the market availability survey.

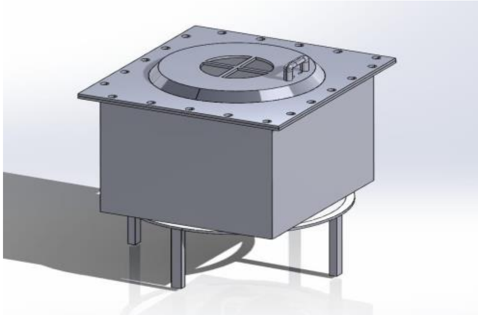
RESULT AND DISCUSSION AND MODEL PHOTOS



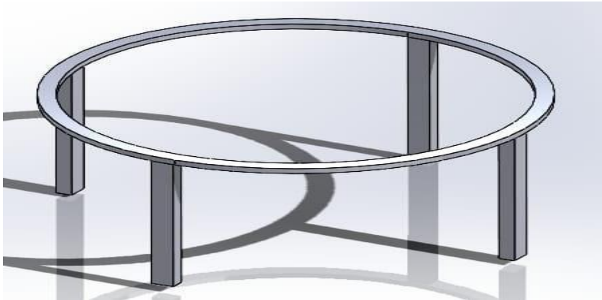
Outer Cover



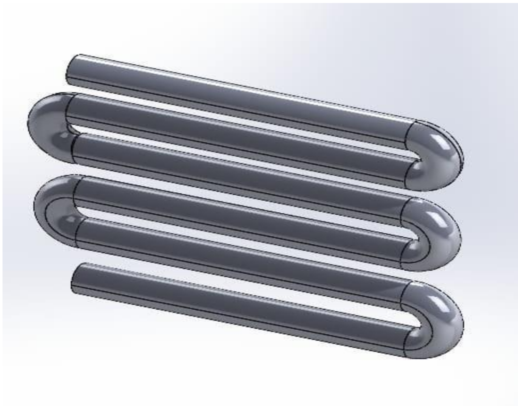
Outer Cover of Tank



Side View of Model



Stand of Model



Heating Coil

Model Photos

CONCLUSION

There are in the rural area the waste management is important because without waste management the people is suffering from different type of dieses.

The waste disposal needs immediate attention and strict monitoring.

Many new techniques have been implemented for storage, collection, transfer and transportation.

Land is scarce and public health and environmental resources are precious. The current SWM crisis in India should be approached holistically; while planning for long term solutions, focus on the solving the present problems should be maintained.

In India especially in rural areas, waste is a severe threat to the public health concern and cleanliness.

Though, the form of waste both food and liquid generated in rural areas is predominantly organic and biodegradable yet becoming a major problem to the overall sustainability of the ecological balance

REFERENCES

[1] M. Wadhwa, Utilization of fruit and vegetable wastes as livestock feed and as substrates for generation of other value-added products.
[2] Experimental investigation of solar drying for orange peels by forced convection.
[3] Sethi, A.P.S. 2012. Effect of tomato pomace on the performance of broilers. In W.S. Dhillon, A.S. Dhatt, P.P.S. Gill & N.P. Singh, eds. Proceedings national seminar on new frontiers and future challenges in horticultural crops. pp. 219. Punjab Agricultural University, Ludhiana. 15−17 March 2012.
[4] Angulo, J., Mahecham, L., Yepes, S.A., Yepes, A.M., Bustamante, G., Jaramillo, H., Valencia, E., Villamil, T. & Gallo, J. 2012b. Nutritional evaluation of fruit and vegetable waste as feedstuff for diets of lactating Holstein cows. Journal of Environment Management, 95: 210−14.
[5] Wadhwa, M. & Bakshi, M.P.S. 2013. Nutritional evaluation of urea molasses multi-nutrient blocks containing agro-industrial wastes in buffaloes. Indian Journal of Animal Sciences, (in press).
[6] Saravanan, P., Muthuvelayudham, R. & Viruthagiri, T. 2012. Application of statistical design for the production of cellulase by Trichoderma reesei using mango peel. Enzyme Research, Article ID 157643, pp 7.
[7] Salajegheh, M.H., Ghazi, S., Mahdavi, R. & Mozafari, O. 2012. Effects of different levels of dried tomato pomace on performance, egg quality and serum metabolites of laying hens. African Journal of Biotechnology, 11: 15373–15379.
[8] Ravi Kiran, G., Suresh, K.P., Sampath, K.T., Giridhar, K. & Anandan, S. 2012. Modeling and Forecasting Livestock and Fish Feed Resources: Requirements and Availability in India, National Institute of Animal Nutrition and Physiology, Bangalore.