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DISPOSAL OF FOOD WASTE AT SOURCE-AN INNOVATIVE APPROACH

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Abstract

The major role in creating the unhygienic conditions at dumping sites and nearby area of the residential colonies is the biodegradable matter. In India usually peoples collect it beside their residences. After some time pet animals like dog used to eat it. In some of the metro cities or mega cities in India a proper waste management system is adopted still the results are not promising as it is costly and labor dependant system. The present waste management system proved to be very uneconomic as it includes collection, transportation, and other subsequent steps. In the present system the waste is not disposed off and treated scientifically, it is just dumped at some place away from the city. Therefore attempt is made to develop such a innovative mechanism which will be cost effective, automated and user friendly. The research is based on the guidelines provided by department of economic affairs, ministry of finance, GOI. This technology takes care of the guidelines given by MSW (Management and Handling rules 2000) notified by Ministry of Environment and forests GOI in September 2000. In this technology biodegradable waste is treated using the process steps in anaerobic digestion. The operation is fully automatic, just put the waste press button and go away. The recovered energy in anaerobic digestion process is used to heat the digestion chamber and combustion unit and flue gas generated is escaped at sufficient height in the atmosphere. It is needed to segregate the waste at source by putting three bins one for biodegradable one for plastics items and one for combustibles. The only limitation of the process is to avoid the inerts, biomedical waste and hazardous waste to put into system.

INTRODUCTION:

The domestic waste is of variable nature causing to think of finding new approach for its safe disposal and treatment as the present system is economically nonviable, labor dependant and creating unhygienic conditions.

Generally 70% waste produced in kitchen is biodegradable 7% plastics 10% combustible items and 3% inerts Accordingly the quantity of waste generated per household is 0.5 kg /day. It was thought to make equipment for a single house, but it may not be an economical solution, therefore we decided to make such equipment which can take care of 40-50 residences. Peoples are not interested to put their hands in waste even it is generated by themselves, showing the need to make the equipment user-friendly and atomized. In India the common practice in most of the cities is to throw the waste behind compound wall or to store it beside roads which creates unhygienic situations as it is spread by the domestic animals showing the need to dispose it off safely The report of the committee to “Evolve road map on

management of waste in India,” Ministry of Environment and forest put forward the decentralization of services to optimize economics, presenting the need of sustainable and integrated process. Department of Economic Affairs, GOI, presented position paper pointing the selection of system and equipments according to local conditions. Supreme Court of India provided guidelines to dispose of biodegradable waste by using anaerobic digestion process.

Present technology is designed developed and operated keeping in view the facts mentioned above. The equipment developed can be used for group of 40-50 houses (a colony or flat scheme). It is user-friendly and fully automated, making it interesting to public. It is purely a waste disposal unit; however any energy if recovered can be utilized for some gainful purpose which is not the view behind developing this technology.

This unit is a combination of anaerobic digester, hydraulic press and incinerator. Biodegradable waste is put into digester, plastic waste is put into hydraulic press

converting the free plastic into dense tile, and combustibles are put into incinerator. Automated Kitchen waste disposer

This is purely a waste disposal unit not aiming to recover energy. Considering the scarcity of land in future we thought of disposing the waste by one who generates it, at the source where it generates and at the time when it generates. We tried to make the equipment user friendly, so that optimum utilization should be achieved. The present unit can be operated for 30 to 40 houses for kitchen waste.

Kitchen waste disposer unit includes feed hopper with hydraulic cylinder pre – digester cum enzyme activation tank cutter anaerobic digester and gas hopper. The above technology is based on the proved principle of anaerobic digestion. The only difficulties in such type of digester is in feeding of the waste, creating chocking of feed pipe which is overcome by the hydraulic pressure Stainless steel cutter is fixed in the pipe at a depth of 300mm from top of tank (i.e. 300mm below water level) so that no waste should come in contact

with oxygen, attempting full anaerobic digestion.

The energy recovered in the form of biogas is utilized into incinerator to burn the combustible and flue gas is again supplied to digester to maintain the temperature.

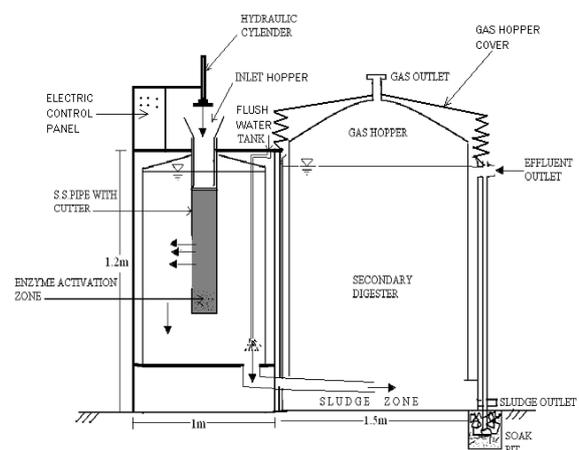


Fig.1- Automated Kitchen Waste Disposer

COMPONENT PARTS OF PORTABLE AUTOMATED KITCHEN WASTE DISPOSER.

The kitchen waste disposer has following component parts.

Pre-digester with feed hopper.

Secondary digester

Enzyme activation chamber cum feed pipe

S. S. Cutter

Hydraulic feed unit and power pack

Gas hopper with cover.

Flush water tank

Electric control panel.

The construction details material, use and operation of the above components is discussed below.

1) Pre-digester with feed hopper

As pre-digester is all the time in contact with water, it is decided to use the multilayer HDPE tanks considering the possibility of rusting of GI. Tanks and its cost. A 300lit 4 layer HDPE tanks readily available in the market is used as pre-digester. The pre-digester is holding feed pipe with Enzyme activation chamber and cutter.

2) Secondary Digester

Secondary Digester is meant to retain the quantity of waste for a sufficient long period up to 5-6 days the volume required for this tank is larger. Four layer HDPE tank is used as secondary digester. The inlet pipe is inserted up to the centre of tank to feed the waste in centre, where microbial activity takes place and the waste is

converted into mixed gas and sludge. Secondary digester holds the gas hopper in which the gas is collected and circulated again in the secondary and pre-digester maintaining the temperature of the tank up to 70° to 80° through heating coil made up of G.I. pipe. The capacity of this digester is 1000 lit.

3) Feed pipe cum enzyme activation chamber.

Feed pipe is made up of stainless steel material as it remains in contact with water, considering the possibility of rusting. A cut of size 0.2mx 0.3m is made in the pipe to take the waste in pre-digester. In the bottom zone of pipe enzymes can be added as per the requirement which mixes with the waste enhancing the microbial activities.

Stainless steel cutter.

Some larger size waste is put into the hopper, there is a possibility of chocking of feed pipe. Also larger sized particles take more time to become soluble. To overcome this problem a stainless steel cutter with very sharp edges is fitted inside the feed

pipe which converts the supplied waste into regular size of 5cm x 5cm. Hydraulic feed unit and power pack.

Feeding kitchen waste to the preliminary digester is one of the complicated activity. Existing feed systems are unsuitable for continuous use. In the beginning we have used a shredder type mechanism to crush the waste and run it for 4 days. After 4 days the supply pipe gets choked and feeding gets stopped this is because there was no force which drive the waste forcefully into digester. Then we thought of changing feed system with some new technique.

It is then decided to feed the waste by using hydraulic pressure through punch in the feed pipe which creates pressure on the waste surface and insert it inside, achieving the mixing of the waste with enzyme enhancing the microbial process. This is a acts specially designed part of unit. Figure below shows a feeding device. Bottom punch as a lid for feed pipe.

4) Gas hopper with cover.

For collecting the generated biogas a 1000 lit HDPE tank is used. It is kept inverted position into secondary digester with the generating of gas it moves upward up to its full extent. This hopper is covered with a plastic cloth, so that it will be invisible to the people. This reduces the possibility of mosquito breeding as are not directly open to the atmosphere.

5) Flush Water tank

Flush is operated when the water level of the secondary digester goes down. There is no need to used water during every feed. It is to be operated once or twice in week water flush is provided on the mouth of the inlet of the secondary digester unit making it easy to transfer the waste in a secondary digester.

6) Gas burner and Heating Coil.

A specially design gas burner is used to burn the biogas. It is made up of G.I. material. G. I. coil is put inside the drum which is continuously heated through the bio gas burner. Once the pipe gets heated put on the air blower, making the air hot, which is then supplied the secondary digester and

then to the pre-digester through heating coil. From pre-digester flue gases are escaped to the atmosphere at sufficient height.

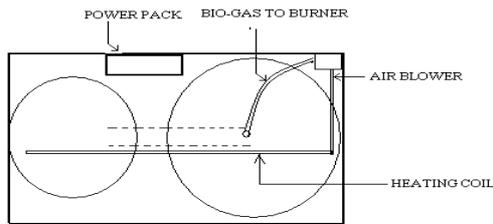


Fig.2- Gas burner and Heating Coil.

7) Electric Control Panel.

To make the equipment fully automatic a timer used to electric control panel to control the motion of feed plunger. The Plunger goes 500mm inside the feed pipe which takes the waste to 200mm below water level making it easy to go outside the feed pipe and finally the plunger get stopped at the mouth of feed pipe acting as a hopper lid. All these activities are controlled by the electric control panel automatically making it user friendly.

SALIENT FEATURES OF WASTE DISPOSER UNIT

Following are the important feature of the portable, automated Kitchen Waste Digester.

- 1) It is fully automated, portable unit.
- 2) Peoples will take interest in operating it as easy to operate
- 3) Anaerobic digestion being a proven technology makes itself sustainable.
- 4) Waste is disposed off by the one who generates it.
- 5) No skill /training is required to operate.
- 6)Hydraulic Pressure reduces the chances of clogging of supply pipe.
- 7) Stainless steel cutter converts the larger size waste into uniform size.
- 8) Recovered biogas energy is utilized to heat the digestion chamber, enhancing the digestion activity.
- 9) The gas hopper cover keeps it clean.

OPERATION OF ANAEROBIC DIGESTER

The operation of this unit is fully automatic. One has to put the waste in inlet hopper press the button and go away, rest of the things will be taken care of automatically. Water is to be added once or twice in a week to maintain the water level in the tank.



Fig.3-Full view of kitchen waste disposer

OPERATION OF INCINERATOR

Incinerator is used to burn the paper waste, cardboards, wrappers etc generated in the household. The process is enhanced by using the biogas generated in the anaerobic digestion process. The flue gases generated is supplied to heat the digestion chamber to enhance the digestion process through heating coil.

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