ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

IARJSET

International Advanced Research Journal in Science, Engineering and Technology

AGNI-PANKH 16

Jawaharlal Darda Institute of Engineering and Technology, Yavatmal

Vol. 4, Special Issue 3, January 2017

Sustainable Solution for Vegetable Waste Generated At District Agriculture Produce Marketing Centre

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Abstract: India is one of the largest agriculture based country, which cultivates large amount of fruits and vegetables. Out of this, 30 % of the fruits and vegetables grown in India get wasted annually due to lack of adequate cold storage facilities and refrigerated transport. Fruits and vegetables account for the largest portion of that wastage. With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. In vegetables and fruits markets, tonnes of Wet/Organic garbage generated daily. It contributes to Waste for market. These waste materials are useless to mankind in their present condition. But by Bioprocessing, in a improved way, this vegetable waste materials can be utilized to produce the economical or commercial viable products i.e. biofuel, biogas & manure and also with other applications as effective solution of waste management without damage to environment. Nowdays reaserchers and industries are now fully engaged in a number of projects involving the technology of waste to fuel with a view to overcome the disposal problems. Increase on worlds energy demand and progressive depletion of oil reserves motivate the search for alternative energy resources, especially for those derived from renewable materials such as Biomass. Biomass is most attractive alternative among the fuel sources and sustainable energy resource. This technology deals with 'waste to wealth' for production of viable sustainable products to recover energy from waste and fulfill the energy demand as possible.

Keywords: Vegetable waste, Bioprocessing, Manure, Biogas.

I. INTRODUCTION

India is the second largest producer of the fruits (81.285 million tonnes) and vegetables (162.19 million tonnes) in the world, has been bestowed with wide range of climate and physio-geographical conditions. Fruits and vegetables account for the largest portion of that wastage. 18% of india's fruit and vegetables production valued at Rs. 13300 crore is wasted annually. About 30 % of the fruits and vegetables grown in India get wasted annually due to lack of proper cold storage infrastructure which is a cause of concern.

In the State, Maharashtra, has a potential for processing upto one lakh metric tonnes but there is no infrastructure. Almost 30 % of the fruits and vegetables produced by farmers is wasted following lack of food processing units across Maharashtra. At every District's, established Agriculture Produce Management Centre (APMC), after selling the products by farmers and vendors, large amount of vegetables get wasted due to transportation, storage and physical changes in it. Sometimes in farm at the time of harvesting waste is generated. The amount of waste generated is also depends on season change. However due to inefficient infrastructure not all this waste gets dumped in dumpsites daily. Accumulating of this waste increase the transmission of insects, rats and animals releasing bad odour and also increases health problems in that area. At this stage, managing this organic biomass is necessary. This market waste fruits and vegetables is very attractive and alternative cheap raw material can be used as sustainable energy resource for viable products.

There are many methods for managing the wet/organic waste such as landfill, dumping, composting, feed in digester of biogas. But in all this methods, whole waste cannot be get utilized which is again get accumulating increases the chances of environmental pollution. This methods required more landfill which caused infertility in soil of existing lands and it is not get totally free of odour. Also retention time required for biogas and manure production is more. Due to increasing global population and large use of fuel sources and other products in the past few years, there is need to found a new technique which will best option for saving the existing fuel resources for future generation. Therefore, we have to adopt possible

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changes in technique which replaces the traditional methods of managing waste and utilized this waste for energy generation to minimize the negative environmental impact generated by the worldwide utilization of fossil fuels. In this paper, we describes the improved novel technology with its viable applications as an environmental concern, waste management and use of sustainable energy economically.

II. COMPOSITION OF MUNICIPAL SOLID WASTE IN INDIA

In India, the biodegradable portion dominates the bulk of Municipal Solid Waste. Generally the biodegradable portion is mainly due to food and market yard waste. Below figure shows that organic / biodegradable waste contains large portion of wastage.

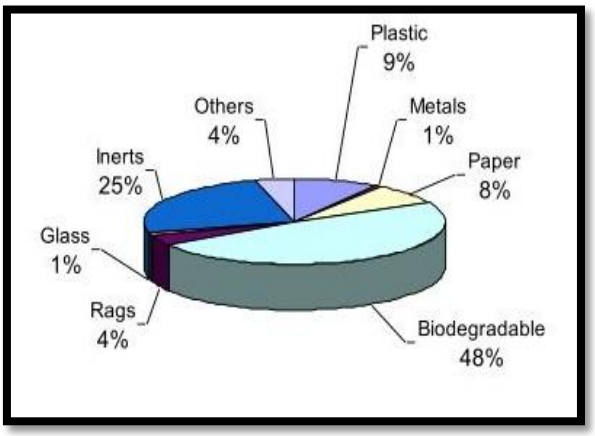

Fig. 1. Municipal Solid Waste (MSW) composition (%)

Table I depicts the composition of Fruits and Vegetable Waste.

TABLE I COMPOSITION OF FRUITS AND VEGETABLE WASTE

Moisture (%)	80-89 %
Organic matter (%)	60-70 %
C : N Ratio	1:20 to 1:30
Solids (%)	Max. 30 %
Liquid (%)	Min. 70 %
Volatile solids	Three-fourth of total solids

III. EQUIPMENTS

1. Shredder for cutting the waste vegetables
2. Hydraulic Press for compressing the waste
3. Mixer for vigorous mixing of the waste
4. Pipeline for supply liquid extract to biogas

IV. PRINCIPLE

1. Separation of liquid / solid fraction of waste
2. Chemical / Bio-chemical degradation

V. METHODOLOGY

In this technology, the waste vegetables is collected from vegetable markets, municipalties markets, from APMC centres.

1. Shredding of Vegetable Waste
Waste Vegetables are get shredded for reducing the size of bulky and leafy vegetables with the help of shredder incorporated with worm gear.

2. Compressing the Vegetable Waste
After shredding, the bulk of vegetables is compressed by hydraulic press with pressure about 125-150 psi. Due to pressing, the liquid extraction takes place. Also volume of waste bulk is get reduced.

3. Supply the Liquid Extract to Biogas Plant
Extract juice is directly get supplied to the anaerobic digester of biogas plant where biogas is produced by methanogenesis reaction. Here retention time required for biogas production is less because extract supplied to biogas is already in liquid form and there is no need of adding water in it. This liquid extract can also be used for ethanol production.

4. Mixing of Compressed Residual Solid Waste
The compressed residual waste is then get mixed with trichoderma viride fungicide to avoid fungal reactions and protection against fungi & pathogens. Then this waste is mixed vigorously for 15 to 30 minutes. It continues for 1 hour or more. The speed of mixer is 10-20 rpm.

5. Spreading and Drying the Waste Mixture for Manure Production
After mixing, the moisturized mixture is spreading and drying in open land. Culture is added to it for fast degradation of waste. After 7 to 8 days, the waste is break down into humus substance. After that the screening of this dry waste is done to remove any stone or bulk substance and to get desirable size of compost. This compost is rich in nutrients used as organic fertilizer and soil amendment in farm.

Fig. 2. Biogas flame

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Dry and wet manure is obtained in this process which is depend on moisture content. The products obtained in this process is completely odour free. Time required for initial operation is 15 to 20 minutes. It is easy to operate. Full utilization of waste takes place with zero discharge.

Fig. 3. Manure production

VI. ADVANTAGES

1. Cost saving comparably than the traditional methods
2. Volume of waste reduced in size
3. Transformation of Waste into usable energy
4. Economically feasible process
5. Less area, power & time is required
6. Technically good and full utilization of waste
7. Non-polluting and ecofriendly process

VII. MATERIAL BALANCE

Waste collected - 100 kg/batch
1. Shredding – Size reduce only – 100 kg (solid + moisture)
2. Pressing – Volume of waste is reduced
a) 40 kg Extract + 5 % solids directly supplied to biogas
b) 50 kg (we) – comprises with (solid + 30 % moisture)
3. Manure production – about 20-25 kg
Biogas – 30 kg of juice gives about 200 litre/day of biogas at atmospheric conditions

VIII. APPLICATIONS & RESULT

1. Two or more products are obtained in this process which is ecofriedly
2. Micronutrient rich manure is main product and Biogas is bye-product
3. Biofuel can be produced from waste extracts
4. Solid and liquid is get separated and Odour free products

IX. COMPARISON AT A GLANCE

TABLE II COMPARISON BETWEEN TRADITIONAL METHODS AND INNOVATIVE TECHNOLOGY OF WASTE UTILIZATION

Sr. No.	Compost formation from organic waste	Biogas produced from organic waste	Recent technology benefits
1	Spraying of water at regular interval for wetability and progress of reaction	Dilution with water for mixing and initiation of reaction	No need of water hence water saving
2	Soil is required to added for manure production	Gobar or wet dung is added to digester. (if required)	liquid extract directly supply to digester
3	Waste is added or burried in soil without any treatment	Incoming waste direct feed to plant without any treatment	It consist of shredding, compressing and mixing of waste
4	It causes soil contamination where it is processed and chances of generation of bacteria and fungi, weeds	Some slurry is again get wasted due to overflow of sludge from digester	Waste is fully utilized without harmful the environment with full discharge, non polluting
5	One product at a time i.e. compost	One product at a time i.e. biogas	Two or more products is obtained i.e. Biogas, manure
6	Releases odour	Releases odour	Completely odour free products
7	It takes 6 to 8 weeks for manure production	It takes 2 weeks for biogas production	Takes less time than traditional methods

X. UTILITY TO SOCIETY

1. Vegetables yard will clean and free of obnoxious odour
2. Improve site safety through better waste management and keeps the environment clean and fresh
3. Waste management from public areas / societies can reduce overall health risks
4. Work opportunities, large employment are created for thousands of people in rural and urban areas to earn income
5. Market, municipal & domestic waste can utilized which resulting into reduce landfills
6. Convenient technology used at any waste site i.e. Farm
7. Possible to reduce the need for chemical fertilizer

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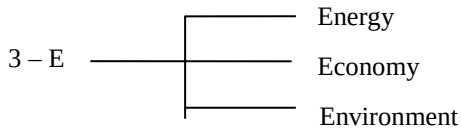
8. This will help to accomplish 'Swaccha Bharat' Mission

XI. CONCLUSION

From above, It is concluded that this is revolutionary technology for value added products and energy generation with environmental protection through decentralised waste management.

In short, it is Wealth from Waste.



ACKNOWLEDGMENT

It is a matter of great pleasure by getting the opportunity of highlighting a fraction of knowledge. This would not have been possible without the guidance and help of many people. This project would not have been success without enlightened the ideas timely suggestion and been interest of our most respected guides **Dr. Vilas S. Sapkal** (HOD & Prof. of Department of chemical Technology) and **Dr. Rajiv S. Sapkal** (Prof. of Department of chemical Technology), S.G.B.A.U., Amravati, and **Dr. Anant B. Marathe** (Principle & Prof. of Hanuman Vyayam Prasarak Mandal college of Engineering & Technology), Amravati, Maharashtra, India. Without their best guidance this would have been an impossible task to complete. Last but not the least; we would like to express our thankfulness to teaching and non-teaching staff, our friends and all our well wishers.

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