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Sugar Mill Waste Management through Composting

R. Jayashree* and R. Murugaragavan

Dept. of Soils and Environment, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu (625 104), India

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Corresponding Author

R. Jayashree

e-mail: jayashree.r@tnau.ac.in

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Abstract

In India approximately there are 705 registered sugar factories with annual production capacity of 180 lakh metric tonnes. India is the second largest producer of world's sugar after Brazil and largest consumer of the world, when Indian sugar industry has produced 100 lakh tonnes of press mud and 333 lakh tonnes of bagasses with 16-76 m^3 of waste water. Environmental issues in sugar manufacturing industries primarily, molasses, wastewater, solid waste and its by-products. About 0.30 ton of bagasse waste is obtained from one ton of sugarcane and in press mud, 3% is obtained for the total quantity of cane crushed. The waste materials can be recycled through composting and vermicomposting process by the utilization of spent wash from the molasses and it is rich in all nutrients including micronutrients.

Introduction

The solid waste generated from sugar industries were managed by utilizing the waste for production of energy as biogas, electricity, biofertilizer *etc*., the wastes from sugar industries were subjected to solid waste management through composting is a best option for recycling of these organic wastes. Composting is the decomposition of wastes by a group of microorganisms in appropriate environmental conditions. Composting of spent wash is carried out usually by applying press mud generated from sugar mills. The biological process is activated optimizing the different parameters and composting is facilitated by microbial cultures. Microbial culture as a catalyst, a specially developed and mixed culture of bacteria, actinomycetes and fungi.

Sugar Mill Waste Management

Molasses is produced in the last operational steps of separating sugar from the mother liquor in centrifuges. It has been found that average production of molasses is 4.2% of the cane crushed. Even though molasses is a commodity under excise control, it is often observed that molasses gets spoiled due to improper storing facilities provided by the factory. Even with the excise regulations and the consent conditions given by the Pollution Control Boards (PCBs), many industries still follow the practice of strong molasses in unlined pits locally termed as kutcha pits. During rainy season and also owing to groundwater table conditions, molasses gets diluted and becomes unsuitable for fermentation. This diluted molasses has a BOD concentration varying between 50,000 and 80,000 ppm, which are to be disposed off to factories conveniently, let it out to the natural water bodies thereby causing heavy pollution. However, such molasses serves as the raw material for the distillery industry

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E-mail: *bioticapublications@gmail.com*

and is transported to the distilleries unit at frequent intervals.

Sugar industry activities generate large quantities of organic solid waste and by-products (*e.g*., leaves from cane or beet, molasses from the final crystallization, press mud or cachaza, bagasse fiber from the cane, mud and soil arriving at the plant with the raw material, and lime solids from the juice clarification). Generated mainly from the primary treatment of raw materials, these waste materials may also present a risk from pesticide residues. The amount of waste generated depends on the quality of the raw materials themselves and on the initial cleaning in the field. The generation of higher quality waste can provide opportunities for reprocessing of otherwise discarded raw materials into commercially viable by-products (*e.g*., paper making and particle board manufacturing). Other solid wastes from the sugar manufacturing process include spent filter material (*e.g*., active carbon, resins from the ion exchange process, acids from chemical cleaning of equipment, vinasse or spent wash from the distillation of fermented molasses-sugar juice, and ashes from the steam boiler plant). Generally the solid waste generated in sugar factory can be broadly categorized as Bagasse and Press mud.

Bagasse

Bagasse is another form of solid waste produced after crushing shredded sugarcane and removing sugarcane juice. It is the fibrous waste obtained during the process of sugarcane juice extraction. Bagasse waste constitutes 50% cellulose, 25% hemicelluloses and 25% lignin. About 0.30 ton of bagasse waste is obtained from one ton of sugarcane. It has a calorific value of 1,917 kcal/kg and, therefore, it is presently used as a fuel for steam generation in sugar mills. However, bagasse can produce 0.3 tonnes paper per tonne bagasse and its calorific value of 2,100 kilocalories per kilogram (kCal/kg) at 50% moisture which is used as a fuel in boilers for steam and power generation. Where high pressure boilers are used, the saving of bagasse can be as high as 30% of the daily production which can be used for power generation during off season. About 90-96% of bagasse is consumed in this way and the rest of it is either sold to paper mills or hands pressing paper mills and card board manufacturing units.

Press Mud

Press mud is insoluble, takes long time for natural decomposition and generates intense heat with foul odor. The solid waste generated from filter cloth and scum, is known as press mud or filter cake, can be used for filling low-lying area with care not to pollute groundwater and considering its nutrient value as manure for the agriculture fields. Wax from the press mud can be extracted and may be recovered as a by-product. The recovered wax can be used in manufacturing of shoe polish and carbon paper.

Vermicomposting of Sugar Mill Waste

Vermicomposting is an alternative technology for converting sugar industry wastes into valuable manure. Earthworms (*Eudrillus euginae*) ingest, break and digest waste and converts into finer, humified, microbially active material by the activity of earthworms and microbes known as vermicompost. Vermicompost is increasingly considered in agriculture and horticulture as a promising alternative to chemical fertilizers. The nutrient content (N, P, K, Ca, Na) in vermicompost is generally higher than compost produced from without earthworms. The vermicompost is generally granular in shape due to earthworm fragmentation and decomposition of material.

Composting of Sugar Mill Waste

Approximately 3% of press mud is obtained for the total quantity of cane crushed. Press mud is spread in the compost yard to form a heap of 9' × 10.5' × 4.5' (L×W×H). Distillery effluent is sprayed on the heaps to a moisture level of 60% and the press mud heap is allowed overnight to absorb the effluent. Bacterial culture was diluted with water (1:10) and added @ 10 L/t. after 3 days. Depending on the moisture content of heap, the effluent should be sprayed once or twice in a week. This should be repeated for 8 weeks so that the press mud and effluent proportion reaches an optimum ratio of 1:3. The heaps are then allowed for one month curing. The bioinoculants such as *Azotobacter* can be added to enrich the compost for nitrogen and the introduction of phosphorus solubilizing microorganisms like *Aspergillus awamori* or *Bacillus polymyxa* will improve the available phosphorus content in the manure.

Bagasse Compost

All the sugarcane bagasse and leaves, press mud, sugarcane waste molasses can be used as the raw materials for composting. Sugarcane bagasse and leaves have to be shredded into small particles, so that more microorganisms work effectively on sugarcane waste and degradation will be faster.

Conclusion

The waste generated from agro-industries were managed through solid waste management especially composting process and it gives opportunities for rural youth and employment to the poorer and it improve the socio-economic status of the people and maintain the ecosystem free from green house gases.

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