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Composting of Sugarcane Bagasse with Kitchen Waste, Press Mud, and Cow Dung

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Abstract - *India is the vast producer of sugarcane with calculated produces of around 300 million tons in the marketing year 2009-2019. Sugar-distillery produces sugar and ethanol, it's includes in agro based industries. There are recently 500 sugar factories in the country with around 300 molasse based alcohol distilleries factories. These contains sugarcane waste, bagasse, press mud and bagasse fly ash. These waste should be disposed properly. There are various disposal techniques applied in practice. It is better to use environment friendly and convinient methods to reduce cost and harm to the environment. Various methods of degradable waste performed like composting by using vermicomposting, anaerobic composting and aerobic composting. Composting is an effective process of waste disposal, possess recycling of organic matter. Composting is one of the most efficient technologies for solid waste treatment. The organic residue in solid waste can be biodegraded and stabilized by composting and the final compost products could be applied to soil as the compost or soil conditioner. The present review paper contains the following topics: Composting of pollutants and various industrial trash, Physio chemical nature of raw press mud, Biochemical changes during composting, Microorganism and composting, Factors controlling composting and properties of the compost and its application in soil.*

Key Words: **Composting, Aerobic method, Bin, Innoculum**

1.INTRODUCTION

In India, sugar industry with 732 sugar factories. In Maharashtra 732 sugar factories. Ahmednagar is one of the largest districts in Maharashtra. There are 173 sugar factories in Maharashtra, and 18 sugar factories in Ahmednagar District. The sugar produce in 2018-2019 is 3.95 Lakh Qtl, the crushing capacity of Dr. Baburao Bapuji Tanpure Sahakari Sakhar karkhana Ltd.Rahuri, Maharashtra in 2019-2020 is 4250 Ton/Day. About 3.6 - 40% kg of press mud is received after 1 ton of sugar cane crushing.

First step to manufacturing sugar is Harvesting, there are two type of harvesting Manual and Mechanical. In manual man power required and in mechanical machinery is used. After harvesting the first step is transporting sugar cane to sugar factory. After that second step is receival and storage sugarcane. Sugarcane stored in cane yards. After storing, sugar cane wash by water pump and after washing it send to cutting process and it cuts into small pieces.

After cutting process it can send to shredder for shredding. In shredding process can removes leaves and node of sugar cane. After shredding the cane is forward to crush for hard structure coming out. In crushing no juice extracted. After this process it send to milling tandems machines to extract juice from cane. The cane transferred in milling tandems and after passes from machine it gives juice and cane residue which is called bagasse and it is use to generating fuel and electricity. After that clarification process carried out in this process, we can remove non sugar. After clarification process juice are send to filtration process. And in the filtration process, juice is filtered and mud is separated from juice. And after the filtration next step is Evaporation, in this process juice evaporated to obtain super saturated solution. Juice preheated in 107- 110 degree celsius. In this process two type evaporator use single effect evaporator and multi effect evaporator. Next step is crystallization and separation. There are three step of crystallization nucleation, initiation and elongation. After that it can transfer to crystallizer. Next step is centrifugation in this process sugar separates from molasses. And last raw sugar and molasses obtained. After this all, sugar transfer to sugar driers and it packaging.

COMPOSTING

As we are quite familiar with compost and composting terms. Today, different innovative ec0fridendly yet economical and user-friendly technologies and researches are coming forward day by day. In account of economy, availability and requirements there should be a proper technique to minimize the burden on MSW plant and environment. Composting can be carried out in two ways, aerobically and anaerobically. Compost is organic material that can added in soil to help plant to provide nutrients. Kitchen waste, yard wastes are also use for compost. Waste is collected from city, town and dumped

in landfill which causes many problems to environment. For composting, avoid adding meat, fishes. Green autotrophs should be added for composting. By composting nutrient rich compost with recycling and reducing solid waste can be done. In the presence of oxygen this process is done thus it is called as aerobic process. The mould or structure in which composting process is to be done should be such that 70% of the area is open to allow air inside. Ventilation is key component required for this process. Water produces during the process called 'Leachate' should be drained off at the bottom of the bin. This leachate can be used as a fertilizer when diluted with water at 1:20. There will be no chances of flies and insects as temperature is up to 70 degree causes pathogen killing thus no bad odour can affect the surrounding.

During composting process microorganisms possess predictable pattern. Each microorganism bulk required different characteristics such as density, temperature. Therefore, if such conditions created by their own metabolism; other bulk of microorganism carries the composting process forward. In this process there is loss in organic material resulting low degradable produces biomass rich in humid material. A compost is a soil enhancer. On site compost is possibly contains high carbon and humus as compared to other. This process includes four stages: Pile formation, Thermophilic stage, mesophilic stage, maturation stage. The period of compost is depends upon the type of material used which eventually carries temperature, moisture content, density in variety. It is the recycling process thus it includes infinite number of microorganisms. There are two types of microorganisms developed in composting process one is useful and other is harmful which is hazardous to plants and human also. The benefit is this process inactivates harmful microorganisms and promotes growth of useful microorganisms. This is done by controlled temperature and moisture content and right C:N ratio.

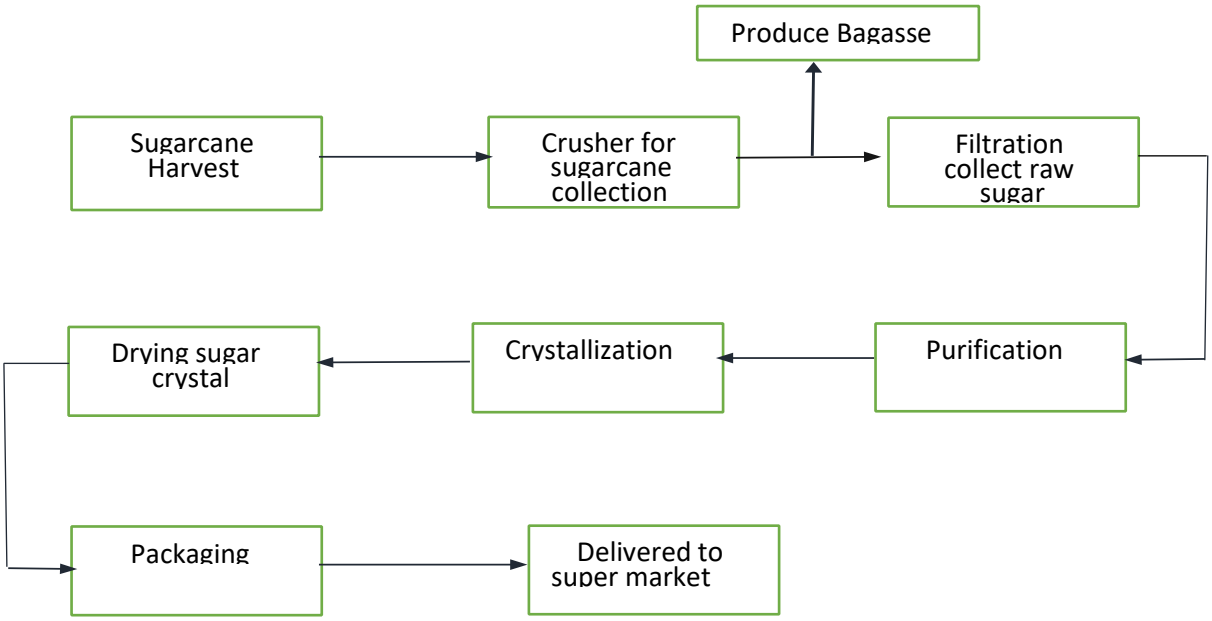

Fig. Flow Chart for Sugar Manufacturing

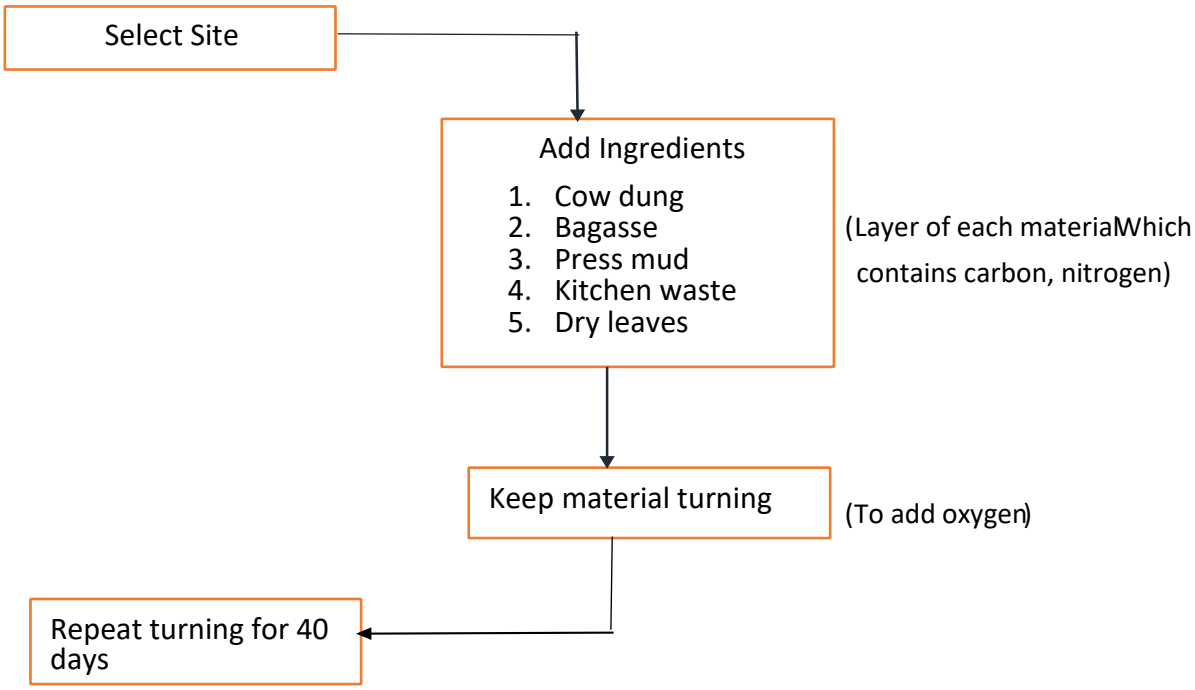

Fig. Flow chart for composting process.

1.1 MATERIALS

Cow Dung: Cow dung is undigested matter of cattle. It is use as fertilizer, fuel, building material, and for paper making. It consists of lignin, cellulose and hemicellulose and also consist mineral i.e nitrogen, potassium, iron, magnesium etc. Dry animal dung, it produced less environmental pollution. It's cheaper than other fuel. No cash required for purchase cow dung. In fresh cow dung 60 to 80 % moisture are present, and in dry cow dung 6% of moisture are present. It is also collected for biogas. The cow dung which is use to composting with press mud, bagasse, and kitchen waste, in there the 50% of cow dung use for composting.

Press mud: Press mud is major sugar industrial waste. Per annum production of press mud in India only is 3.6 to 3.9 million tonnes. Lignin present is press mud has structural complexity which causes slow degredaion. Due to lack of management ideas, it is directly burnt in the air. When such types of organic waste release in the soil it locks up the nutrients in the soil. As a result C:N ration decreases and it is not beneficial for the crops. After purification of sugar cane juice the large amount of press mud produce, and it's not easy to dispose. Press mud is light in weight, dark brown to black in colour, it's also soft and spongy. 60-85 % of moisture are present in press mud. Nutrient content in press mud is 1.15-3% N, 0.60-3.50% P, 0.3-1.80% K. A good fertilizer known by its nutrient content. Press mud use for soil conditioner, soil fertilizer. To improve the property of crop and field it is necessary to decrease lignin and cellulose contents**.**

Kitchen Waste: Kitchen waste are produced in hotel, restaurant, household. It contains high moisture. It is easily stable. It's biodegradable. In kitchen waste contains carbohydrates, protein and small lipid molecule is biodegradable compound. Kitchen waste is left over matter after cooking, like vegetable peeling, scrap from people plate. Its moisture content 70%, therefore the 20% of kitchen waste are mix or use for composting.

Dry Leaves: The leaves growth is limited. It is good for composting. it is better than fertilizer. Dry leaves falling from trees and it causing large amount of leaf waste. It contains 9.08 % of moisture. The 47.41% carbon and 0.94% nitrogen present and its C/N ratio is 50.44%. For composting with bagasse 10% of dry leaves are use. Dry leaves contain high C/N ratio. And low moisture content. For fast decompose leaf are cut in small pieces.

Bagasse: After crushing sugar cane the remaining material are left is called "Bagasse". Bagasse is the dry residue after extracting all cane juice. It is used as biofuel, energy and production of heat. It is the dried and pulp like material which is fibrous. It is also use for manufacture of building materials. Bagasse contains the cellulose 45-55%, Hemicellulose 20-25%, Lignin 18-24%, Ash 1-4%. After crushing of 10 tonnes of sugar cane the sugar factory produces 3 tonnes of wet bagasse. It contains high moisture, is 40-50%. Normally, bagasse contains 50% of water**,** but dry bagasse contains

39% of cellulose, 37% of hemicellulose, 21% of lignin and 3% of ash. I t is 100% compostable. The 10% of bagasse is use for composting.

2. FACRORS AFFECTING THE COMPOSTING PROCESS

- **Moisture:** When moisture content is very high, anaerobic conditions set in. The optimum moisture content is known to be between 50 to 60%. Higher moisture content used in mechanically aerated digesters. In anaerobic composting the moisture content used will depend upon the method of handling and it is carried out in the open or in closed container. Moisture content is water present in compost that is determine in percentage. Moisture content is determine by drying sample of compost to remove water and weighted as dried sample.

  1. Wt. of empty container. (W1)

  2. Wt. of wet sample and container. (W2)

  3. Drying the sample.

  4. Dried weight of sample. (W3)

  5. Subtract the dried wt. from the wet wt. of sample. Moisture Content =100*((W2 – W3)/(W2 – W1))

- **Temperature:** Temperature is main factor considerable in this process. At initial stage there is higher temperature. This will break the fats, proteins and carbohydrates. It should not exceed 70 degrees as at this only some species will survive. When composting process begins aerobic decomposition takes place causes heat generation with air intake and evaporation of water. Temperature started lowering after first stage by 40 degrees. Under properly controlled temperature to rise beyond 70 celcius in aerobic composting. During anaerobic composting heat release is small after a period as pathogens killed. Temperature is the important parameter in composting and it can be controlled by indirect methods like 1) Lowering the heat production by turning the stack. 2) Decreasing heat by wetting the stack. 3) Areating by turning.

- **Carbon/Nitrogen (C/N) Ratio:** All organic matter is made up of amount of carbon(C) is combined with less amount of nitrogen (N), the balance between the carbon and nitrogen is known as the carbon to nitrogen ratio. This ratio is important in this process and it can not be controlled during composting. Ratio can be regulated at the initial starting stage only. The C/N ratio of 30 is most favourable for composting. Depending upon environmental condition an optimum value 26-30 is generally considered. The C/N ratio considers the nitrogen in the MSW may vary from sample. C/N ratio is less than optimum carbon.

- **pH:** It is the important defines the efficiency of compost. It varies from sub-acidic to neutral and alkaline due to ammonia formation i.e. 4.5-8.1. pH value connected with microbial activities during composting. At the 7-8 range of pH there is degradation of fibres and at 6.0-9.0 pH there is greater degradation of carbohydrates. At high temperature microbial activity decreases. There is rise in decomposition of fatty acids with increased pH.

- **Bulk Density:** Due to reduction in particle size during composting bulk density increases. It affects on aeration to the heap of the compost and it causes heat emission in environment.

- **Inoculum:** It is activity involves addition of bacteria into material to be composted. To accelerate the microorganism growth for decomposition inoculum is spread on the prepared compost bed. As it affects the decomposition. Studies shown that it promotes metabolic activities and also self-heating.

- **Turning and Aeration:** Frequent turning of prepared heap of compost material is to be done to aerate the process. Either mechanical or manual turning is required as per the quantity of the compost. Aim of the turning to not only reduce temperature of compost but the hygienization. Aerobic process is developed in the middle of the biomass and at the bottom of the biomass it started by turning the biomass around the middle of the aerobic process area. Turing exchanges cold area to the hot area to activate the cold area of the biomass. Hygienizaton while composting is not only occur due to temperature but also by chemical compounds that inactivates the pathogen. Hygienization may not be evenly affects the pile, outer part of always cooler than the inner one and thus it prevents rise in temperature.

- **Chemical variation during composting:** Mature compost contains humus like component which has structural chemical composition mainly due to decomposition of lignin. Various small chemical components and polysaccharides of biomass are fully decomposed during composting.

- **Cost of composting:** It includes storage, handling of material, preparation etc. Operation cost depends upon the method of composting. Handling of crop waste can increase the transportation cost while on site composting will save expenses.

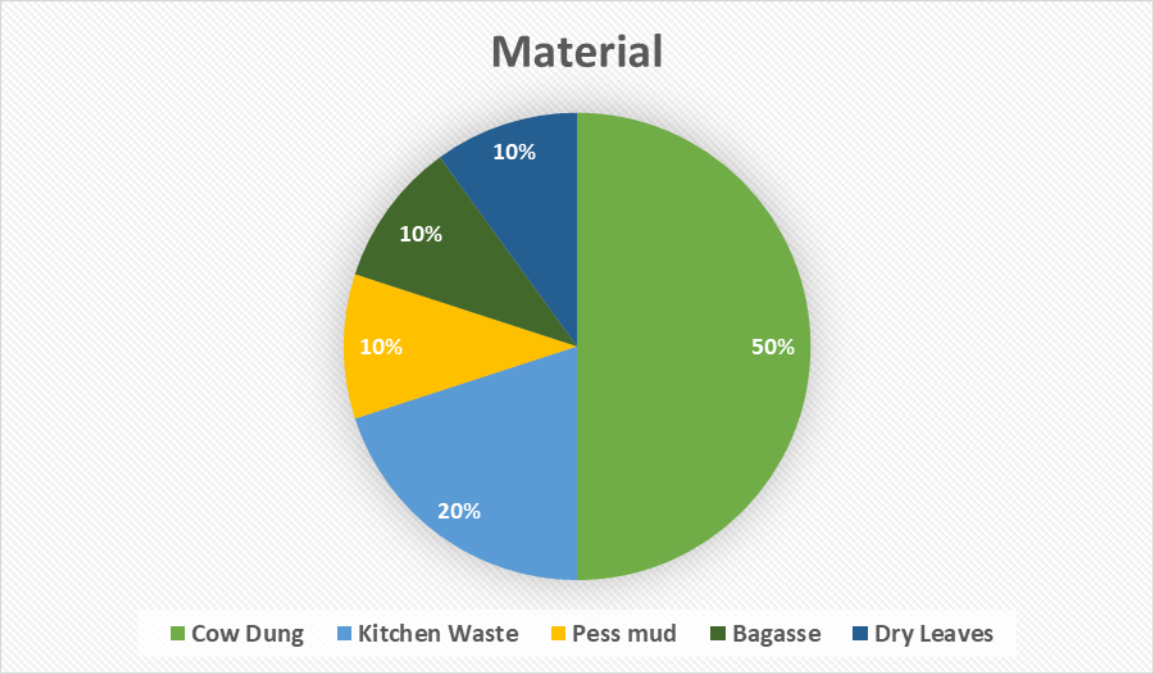

Chart -1: Name of the chart

Fig -1: Name of the figure

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