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Sugarcane Industry Waste & Bio-Ethanol Production

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Sugarcane yields around 10 to 12 tonnes of dried leaves as garbage per acre every harvest. This garbage has a carbon content of 28.6%, a nitrogen content of 0.35 to 0.42%, a phosphorus content of 0.04 to 0.15%, and a potassium content of 0.50 to 0.42%. The integration of sugarcane garbage into the soil affects the physical, chemical, and biological aspects of the soil. Soil EC is reduced, water holding capacity is improved, soil aggregation is improved, and soil porosity is improved. Sugarcane garbage integration reduces soil bulk density, increases infiltration rate, and decreases penetration resistance. Direct integration of chopped waste enhances nutrient availability, resulting in soil fertility. Sugarcane waste is easily composted by fungus such as Trichuris, Aspergillus, Penicillium, and Trichoderma. The addition of rock phosphate and gypsum speeds up decomposition.

Industrial Waste of Sugarcane:

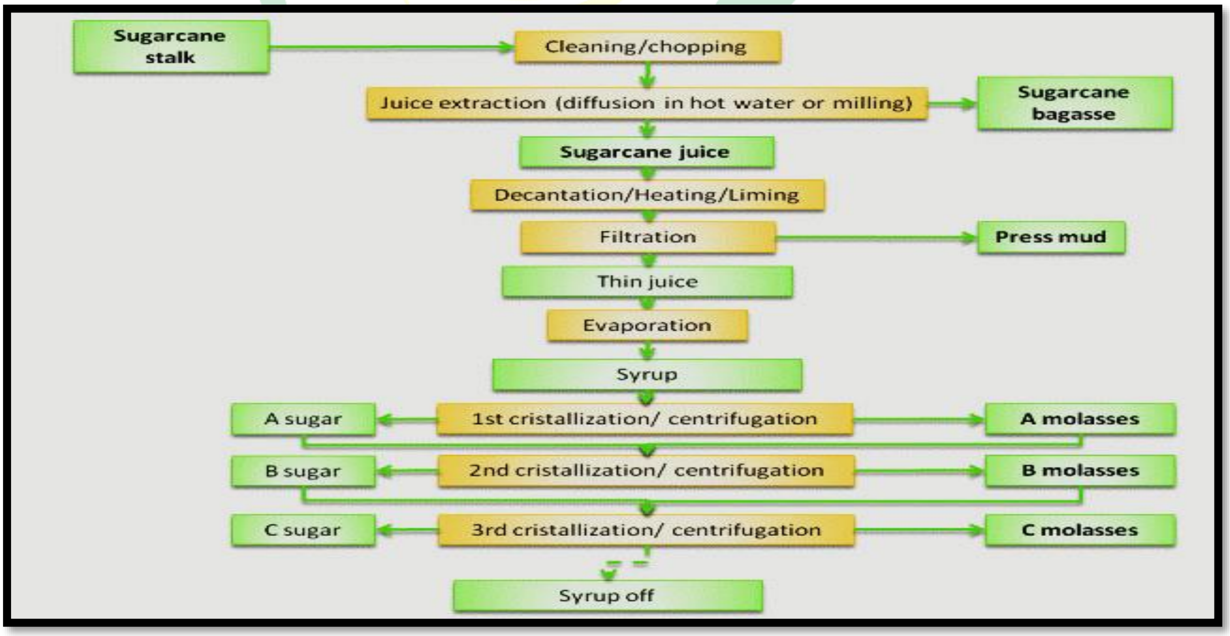

Figure 1: flowchart Diagram displaying by-products and sugar production

Every year, a sugar mill generates not just sugar but also massive volumes of sugarcane waste by-products. Sugarcane waste by-products are created in four stages, from harvest to final processing: sugarcane bagasse, dry leaves, sugarcane press mud and sugarcane molasses.

1. **Bagasse**

   Sugarcane bagasse is a ***fibrous substance*** made mostly of cellulose. It is manufactured in vast quantities all around the world. It is a type of waste material produced by the sugar industry. It is most typically found in the paper industry. Sugarcane (Saccharum officinarum) is grown in large numbers in tropical regions. In 2017, over 1.84 billion tonnes of sugarcane were produced globally. It is used in sugar and ethanol mills. However, it cannot be eaten totally by those mills since around 30% pulpy fibrous residue is created after use in those mills. Bagasse is the name given to these remnants. Bagasse is used in a variety of purposes, including the paper industry, as feedstock, as biofuel, and so on.

Name of the Content	Percentage (%)
Cellulose	26–47
Hemicellulose	19–33
Lignin	14–23
Ash	1–5

Table 1: Chemical Composition of Bagasse

figure 2: Sugarcane bagasse

2. **Press Mud**

Sugar press mud, sugarcane filter cake mud, sugarcane filter cake, or sugarcane filter mud are all names for press mud. It is the byproduct of sugarcane juice filtering. In general, a plant generates 10 ton of sugar and 1 ton of sugar press mud. The sugarcane business emits a large quantity of press mud, which pollutes the environment. Sugarcane press mud is an excellent material for composting and producing organic fertilizer.

Figure 3: Sugarcane press mud

3. **Molasses**

Molasses is also called *treacle syrup* which is obtained by sugar crystallization from sugarcane. It is discarded as a byproduct of the factory. It will cause major water contamination if released directly without treatment due to its vast volume, high acidity, and complicated makeup.

figure 4: Molasses

It is a non-toxic, biodegradable organic waste liquid that comprises a variety of organic materials and trace elements. It has become a high-quality raw material for fertilizer composting due to its high utilization value. The lighter grades of sugarcane molasses are edible and utilized in baking, confectionery manufacturing, and the production of rum.

Bio-Ethanol Production:

Bioethanol is a liquid biofuel generated through fermentation of a variety of feedstock, including maize, soybeans, wheat straw, woodchips and, more recently, microalgae. Bioethanol is a sustainable biofuel that is also oxygenated (35% oxygen), potentially lowering automotive emissions. Bioethanol may be used directly in automobiles and behaves similarly to conventional fuels because bioethanol has a high-octane rating, it allows for higher engine compression ratios, which improves engine economy and performance. However, as compared to regular gasoline, the fuel has a poor volumetric energy density, which means that cars require more bioethanol per km (by up to 50%) when compared to gasoline.

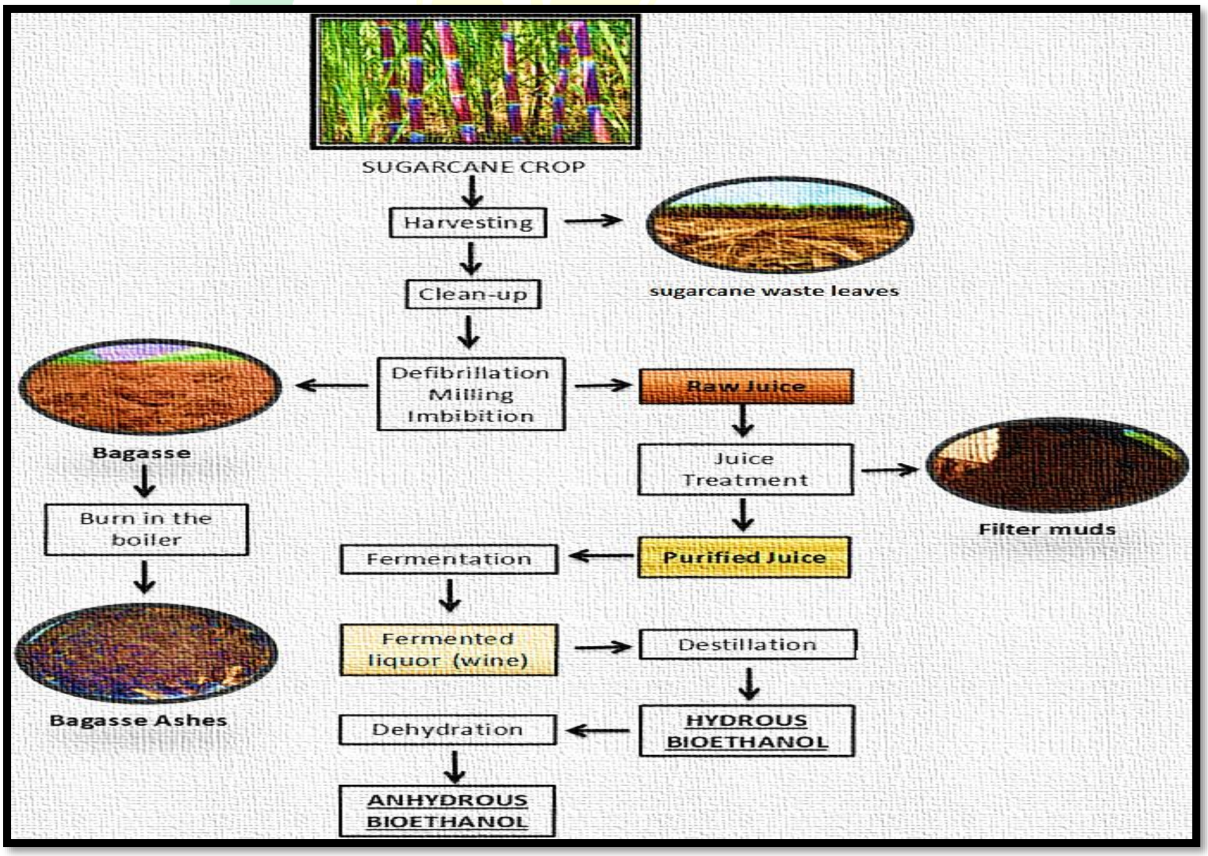

Figure 5: Bio-ethanol production process in sugar industry

Ethanol Policy of India

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With the National Policy on Biofuels (NBP) in 2009, the Government of India began an ethanol blending programme (EBP) to accomplish sustainable development objectives, energy security, employment, a cleaner and healthier environment, and greenhouse gas emissions reduction. NBP-2009 aimed for a 20% ethanol mix in fuel by 2017. *The GOI supported 10% (E10) mandated ethanol blending with petrol/gasoline across all cane-growing states under the Ethanol Blending Programme (EBP)*. One reason was that ten million liters of E10 biofuel/ethanol might save Rs. 28 crores in currency and about 20,000 tonnes of CO_2 emissions.

The recently proposed National Biofuel Policy, 2018 of India aims to achieve a national average of E20 for petrol and B5 for diesel by 2030. The new EBP requires ethanol to be manufactured directly from molasses, juice, and damaged food grains such as broken rice and wheat. To minimize extra sugar output, the GOI has also permitted ethanol manufacturing directly from sugarcane juice. This approval allows it to be blended with petrol, saving a significant amount of money on crude oil imports. The sugar industry will require greater biomass varieties for this.

India's Target: The Indian government has moved the objective for *20% ethanol blending* in fuel (known as E20) from 2030 to 2025.

Way forward:

Ethanol is a less polluting fuel that provides comparable efficiency at a cheaper cost than petrol. Fossil fuels generate more energy than certain biofuels. For example, 1 gallon of ethanol provides less energy than 1 gallon of petrol (a fossil fuel). If India decides to emphasis on ethanol created from trash, it has a tremendous chance to become a global leader in sustainable biofuels policy. This would provide significant climate and air quality advantages, as these wastes are now frequently burnt, adding to smog.