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Comparative analysis of ethanol fuel production from sweet sorghum and sugarcane.

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Abstract:

World's population goes on increasing and the standard of human life is improving day by day, which interns increases the need of energy more . The increase in energy consumption particularly in past ten years has raised the fears of exhausting vital natural resources. As India having large number of automobile sector the cost of petroleum fuel goes on increasing which results it in to increase in emission of harmful gases such as CO, CO_2 , NOx, SOx, which there by leads to air pollution . As India needs more fuel for the transportation it exports fuel from other countries by which it affects the economic fact, so as an alternative India should use bio fuels for better environment and nature .[1.]

Using the ethanol as a fuel in IC engines reduces greenhouse effect effectively by reducing CO, CO_2, NOx, SOx. Ethanol can be used as a fuel in internal combustion engine in two ways, as a straight fuel and as a blended fuel. For low blends of ethanol there is no need of engine modification. Thus use of ethanol provides great hands in reducing dependent on petroleum fuel. As India needs more fuel for the transportation it exports fuel from other countries by which it affects the economic fact, so as an alternative India should use bio fuels. From the study it is concluded that with the use of ethanol as an alternative fuel reduces dependent on crude oil and it also useful in concern of harmful gases.

Introduction:

Bio-ethanol is simply ethanol is a renewable energy source which is made by fermenting the sugar and starch components of plant. It is produced from the agricultural resources such as corn, sugarcane, potatoes, rice, beetroot and recently using grapes, banana, dates and other wastes. This is due to the decreasing in amount of fossil fuels, alternative energy sources need to be renewable, sustainable, efficient, cost effective, convenient and safe

The increase in consumption of fossil fuels as economies grow and the nearing depletion of such fuels has prompted a search for their alternatives worldwide. Bio fuels have emerged as a substitute to the fuel oil, especially for oil-importing countries and serve a multitude of purposes. The most important advantage of these fuels is that they are renewable, and are being seen as sustainable sources of energy which is a good sign .

Some studies have also pointed out that bio fuels help reduce environmental emissions, so apart from addressing the problem of the rising import cost of fuel oil. Among liquid fuels, there are mainly two types of bio fuel: alcohols (ethanol and butane) and diesel substitutes (such as biodiesel and hydro-treated vegetable oils).

In India, the ethanol production is mainly done using sugarcane as feedstock. Transport has been identified as a major polluting sector in INDIA and hence the use of bio fuels is important in view of the tightening of emission norms.

Production of ethanol from sugarcane:

Sugarcane is a tropical grass that forms lateral shoots at the base to produce multiple stems, which has typically 3 to 4 m (10 to 13 ft) height and about 5 cm (2 in) wide in diameter. The stems grow into cane stalk, which when mature has around 75% of the entire plant. A mature stalk is has 11–16% fiber, 12–16% soluble sugars, 2–3% no sugars, and 63–73% water present in it. A sugarcane crop is very sensitive to the climate, soil type, irrigation, fertilizers, insects, disease control, varieties, and the harvest period. The average yield of cane stalk is 60–70 tons per hectare per year in India. However, the figure can vary between 20 and 170 tons per hectare depending on knowledge and crop management approach which is used in sugarcane cultivation. Sugarcane is a cash crop, but it is also used as livestock fodder.

It is a long duration crop which requires about 10 to 15 and even 18 months to mature, depending upon the geographical conditions. It requires hot and humid climate with a temperature of around 21°-27°C and 75-150 cm rainfall.

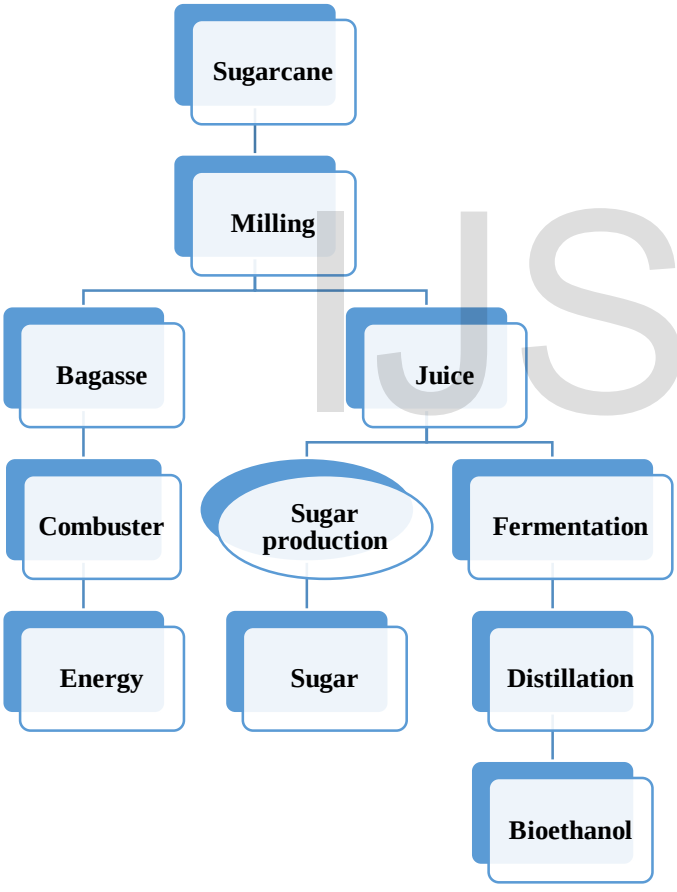

Figure 1: steps for ethanol production from sugarcane

Production of ethanol from sweet sorghum:

Ethanol demand is increasing day by day in the present time due to its blending in automotive fuels, which is desirable for getting clean exhaust and fuel sufficiency. The higher cost of cultivation of sugarcane, highly sensitive molasses rates, and ultimately instabilities in the price of ethanol which have created grounds to search for an alternative source for ethanol production. Sweet sorghum has shown a much more potential as a raw material for fuel-grade ethanol production due to its rapid growth rate and early maturity, greater water use efficiency, limited fertilizer requirement, and wide adoptability of sorghum. Ethanol producing companies, research institutions, and governments can coordinate with farmers to develop value-added utilization of sweet sorghum. Fuel-grade ethanol production from sweet sorghum syrup can significantly reduce India's dependence on foreign oil and also minimize the environmental threat caused by fossil fuels which is beneficial for India.

Sweet sorghum originally had three utilizations: (1) grain production, (2) sugars and (3) forage. Sorghums however, are a special kind of crop and are quickly drew the attention of farmers and breeders all over the world. sorghums is special as it has high photosynthetic efficiency, high resistance to drought and also a unique adaptability to production in difficult soils both in tropical, subtropical and temperate areas.

Sorghum is now known and improved for highly diversified utilization. It fulfills the so-called “6F’s”:

1. Food (grain and sugar);
2. Feed (grain and forage biomass);
3. Fuel (production of ethanol);
4. Fiber (production of cellulose, paper);
5. Fermented products (beer, methane);
6. Fertilizer (organic manure from byproducts).

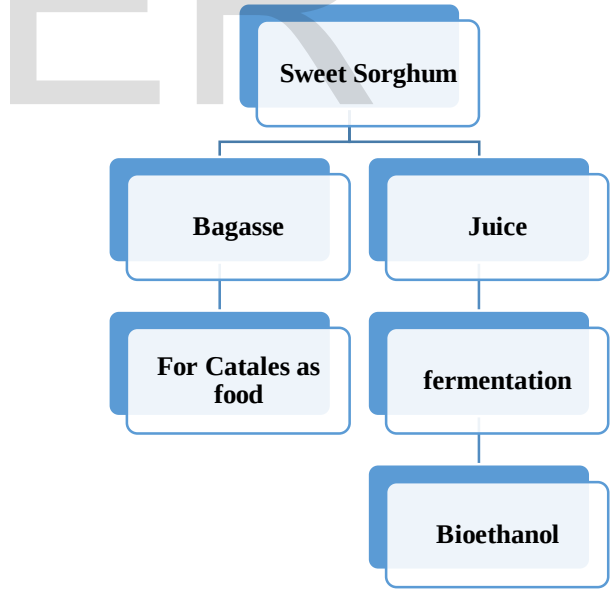

Figure 2: steps for ethanol production from sweet sorghum

Comparison between Sugarcane and Sweet sorghum:

In the below given table the comparison is shown of time taken for production , its season of growing , water required for growing of both sugarcane and sweet sorghum .its proportion of sugar content in it and how much ethanol can be extracted from the juice .

Characteristics	Sweet sorghum	Sugarcane
Crop duration	4 to 5months	12–14 months
Growing season	All seasons (if water is available)	One season
Water management	Less water required ; can be grown as rain-fed crop (8,000 m^3 ha^{-1})	It Requires water throughout the year (36,000 m^3 ha^{-1})
Crop management	easy management; less use of fertilizer	Requires good management, more use of fertilizer needed
Sugar content on weight basis	8–12 %	10–14 %
Ethanol yield from juice (l ha^{-1})	2,475–3,500	4,350–7,000
Harvesting	Very simple; manual and mechanical harvesting .	Harvested mechanically.

Table 1: Comparison between sweet sorghum and sugarcane

Conclusion:

From the study it is concluded that with the use of ethanol as an alternative fuel reduces dependent on crude oil and it is also useful in concern of harmful gases.

The proper proportion of ethanol with gasoline leads to the increase in fuel efficiency and also considerable reduction in harmful exhaust gases. Since the cost of ethanol is much less compared to the gasoline, ethanol fuel can substitute gasoline in future.

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