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Economics of Molasses to Ethanol in India

Scientific Note

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Index Entries: Ethanol; molasses; economics.

INTRODUCTION

India is one of the largest producers of molasses. During the year 1990–91, 5.81 million metric tons of molasses were produced. During the same year, 1106 million liters of ethanol (95% v/v, i.e., rectified spirit) were produced. About 55–60% of ethanol produced is used for the manufacture of various industrial chemicals. This is mainly through the ethanol-acetaldehyde route and the ethanol-ethylene route. The balance of 40–45% production is used for manufacturing potable liquors.

Sugar-cane molasses in India generally has 38–48% (w/v) content of fermentable sugars. Depending on the content of fermentable sugars and fermentation practices followed, a yield of about 200–290 L of 95% (v/v) ethanol is obtained from 1000 kg of molasses.

Out of approx 250 distilleries in India, about 200 follow a conventional batch-fermentation process, whereas others follow a continuous-fermentation process. All the ethanol produced is with a concentration of about 95% (v/v) rectified spirit.

At present, sugar-cane molasses movement and allocation, i.e., quota allotted to various companies as per assessment of their requirement, as well as price are controlled by the government. Similarly, the selling price of ethanol as well as its movement and allocation are also controlled by the government.

Table 1
Capital Cost of Project[a]

Plant and machinery	$1.2 m
Storage and auxiliaries	$0.9 m
Utilities	$0.4 m
Effluent treatment plant	$0.8 m
Total	$3.3 m

[a]Capacity: 50,000 LPD 95% (v/v) ethanol.

Table 2
Variable Cost of Production[a]

Item	Requirement/kL of ethanol	Price $/U	Cost $/kL
Molasses	4 Mt	15.00	60
Steam	2 Mt	11.00	22
Electricity	100 kWh	0.07	7
Water	15 m^3	0.20	3
Chemicals	As typically required	-	3
Total			95

[a]Typical plant size: 50,000 LPD of 95% (v/v) ethanol.

DATA AND DISCUSSION

Molasses-to-ethanol plants in India are generally of a capacity ranging from 20,000 to 120,000 L/d. The typical size is 50,000 L/day (LPD).

Table 1 shows the cost of a project to manufacture 50,000 LPD ethanol. This cost relates to a plant with a continuous-fermentation system and with a distillation plant made of stainless-steel AISI 304. The cost basis for carbon steel is $0.60/kg and that for AISI 304 is $3.50/kg.

Table 2 shows the variable cost of production of ethanol from molasses. It can be noted that this is as low as $95/kL for 95% (v/v) ethanol. The costs are on the basis of the year 1992. The on-stream factor is about 80%.

Many of the distillery plants employ anaerobic methanogenic digestion for treatment of slops. In the process, they obtain biogas that is fired in their boilers. This brings down the cost of production to $77/kL for 95% (v/v) ethanol.

Rates of interest on capital borrowed are quite high in India at about 20% per annum. The cost of capital overheads for a plant of 50,000 LPD capacity is given in Table 3. Considering the variable cost of production and capital overheads, the total cost of production for 95% (v/v) ethanol is as low as $156/kL.

Table 3
Cost of Capital Overheads, per Year for 50,000 LPD Plant

Interest at 20% p.a.	\$0.66 m
Depreciation and maintenance at 10% p.a.	\$0.33 m
Total	\$0.99 m
Cost of capital overheads/kL ethanol	\$75
Cost of manpower/kL ethanol	\$4

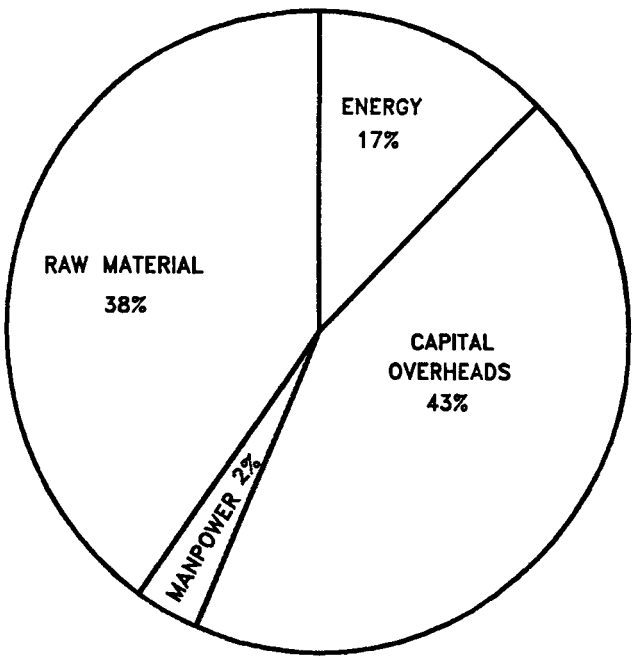

Fig. 1. Cost of production of ethanol.

Distillery plants that are attached to sugar factories require lower investment when they draw power and steam from the facilities of the parent factory. When ethanol is used for manufacture of industrial chemicals, value-added tax included in the price of molasses is reimbursed. In such cases, the cost of production is reduced to a mere \$111/kL. The relative contributions of various elements of the cost of production are depicted in a pie-chart in Fig. 1.

It is likely that in tune with the liberalization policies of the government of India, movement and price of molasses and ethanol will be decontrolled in the near future. Market forces will then set the prices. However, it is expected that based on the existing supply-and-demand profile, the cost of ethanol may increase by 20–50% over the present cost.