

PROJECT PROFILE

ON

RECTIFIED SPIRIT FROM
SUGARCANE JUICE

Month & Year
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RECTIFIED SPIRIT FROM SUGARCANE JUICE

1. Introduction

Although alcohol is produced from molasses which is the mother liquor resulting from the separation of crystalline sugar, the present project aims to produce alcohol directly from cane juice without separation of sugar. It is envisaged that under this process with the direct fermentation of cane juice without separation of sugar, the yields would be higher. The present project profile analyses the cost effectiveness of adopting such a procedure and discusses in brief the viability of the proposal.

Marketing of rectified spirit would not pose any problem as the demand is very much higher than the supply as per the statistics available with the All India Distilleries Association or the Directorate General of Technical Development. Moreover, molasses is always in short supply to the distilleries for conversion to spirit and therefore the requirements of spirit can be met in the commercial institutional market.

2. Market

Rectified spirit has uses in the pharmaceutical industry, chemical industry and the petrochemical industry. Currently, the demand is more than the supply.

3. Packaging

Rectified spirit is transported in tankers of 12 kilolitre capacity.

4. Production capacity

- The plant will be in operation for three shifts a day.
- The plant will operate to a capacity of crushing 1000 metric tonnes of sugar cane per day or 3,00,000 metric tonnes per annum.

5. Sales revenue

- The production of rectified spirit per annum on full capacity utilisation is 31.5 million litres.
- At an ex-factory selling price of Rs. 30000 per kilolitre, the total sales revenue will be Rs. 9450 lakhs on full capacity production.

6. *Production process outline.*

- **Basis and presumptions**

- a) It is assumed that one metric tonne of sugarcane will yield 105 kilograms of sugar at an yield rate of 10.5%.
- b) For alcoholic fermentation, the sugar concentration in the juice is to be concentrated to around 18%, the juice with a specific gravity of around 1.3. This liquor will now be termed as the “mash”.
- c) Nutrients such as urea are to be added to assist in the anaerobic fermentation process. The level of urea to be added is approximately 100 grams per kilolitre of the mash. In addition one kilogram of super phosphate is to be added per 10 metric tonnes of the mash to improve the fermentation efficiency. The pH of the mash is also adjusted to 5 by the addition of sulphuric acid to the extent of one litre per 10 kilolitres of the mash. This helps in the prevention of growth of bacteria and wild yeast.
- d) *Sacchomyces cervisiae* is the yeast used in the fermentation process.
- e) The procurement price of sugarcane inclusive of transport is assumed at Rs.2000 per metric tonne.
- f) The selling price of alcohol is estimated at Rs.30000 per kilolitre. This includes a basic price of Rs.27000 per kilolitre, Rs.2000 as administrative charges, and Rs. 1000 as taxes. No excise duty is levied.

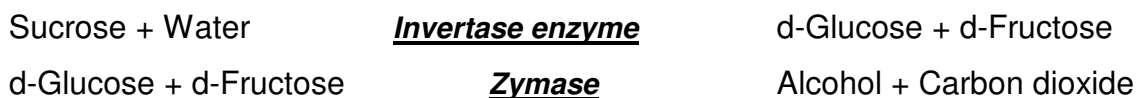
- **Process Technology**

The sugarcane juice after extraction is filtered and collected in receiving tanks. It is then pumped through weighing tanks into large vacuum concentrators and concentrated to about 18% sugar concentration through application of steam and vacuum. The liquor with a specific gravity of 1.3 termed as the “mash” is used for the anaerobic fermentation process. The mash is taken to pre-fermentor tanks and ingredients such as urea, and super phosphate are first added and mixed. The pH is also regulated to around 5. The mass is then pastuerised in the tanks itself through alternate passage of steam and cold water. The pasteurized liquor is transferred into fermentation tanks and the required quantity of yeast

slurry is dosed into these tanks. The Arroyo process is adopted which involves the clarification and pasteurization of the mash before fermentation. The advantage of this process is that the fermentation time can be reduced to around 30 hours and also it makes it possible to have a higher alcohol content of around 13% to 15% in the fermented wash.

Although according to Gay Lussacs equation, the yield of spirit should be 51%, industrial applications reveal a recovery of 48% spirit and 47% carbon-dioxide. Glycerol and succinic acid yields are 4% and the remaining 1% is residual waste. Thus in industries, the fermentation efficiency actually obtained does not exceed 90% on the basis of total sugars charged in the fermentor.

The principal reactions in alcohol fermentation are as follows:



A small amount of glycerol is always formed in alcoholic fermentation.

The fermentation process is exothermic and the heat evolved is around 106 million K cal per 1000 gallons or 4546 litres of rectified spirit by weight. In order to dissipate the heat, the fermenting mash in the fermenters is cooled with a water spray.

The liquor in the fermentor after the action is finished is called as “Wash”. The wash is distilled to obtain rectified spirit of 96% by volume or 95% by weight. The wash containing about 13% to 15% alcohol is pumped to the upper sections of an analyzer after passing several heat exchangers. As the liquid passes down the analyzer column, it gradually loses its lighter boiling constituents. The liquid passing out of the bottom of the analyzer is called as spent wash.

The analyzer overhead containing alcohol, water, and some aldehydes pass through a heat exchanger to a partial condenser or dephlegmator containing 50% of alcohol, volatiles and aldehydes. This condensate is led into the head of an aldehyde column from which the low boiling point impurities or aldehydes are separated as an overhead. The effluent liquor from part way down the aldehyde column flows into the rectifying column.

In this third column or rectifying column, the alcohol is finally brought to strength and finally purified. Rectified spirit contains 95.6% alcohol. It cannot be purified further by rectification because water forms a binary constant boiling mixture with alcohol. Rectified spirit is converted to absolute alcohol or anhydrous alcohol by azeotropic distillation with benzene at atmospheric pressure.

7. Quality specifications

- Rectified spirit shall conform to standards laid down by the Bureau of Indian Standards.

8. Pollution control measures

Pollution control measures are necessary. The spent wash originating after distillation should be collected properly and not allowed to be discharged in the surroundings. An effluent treatment plant is necessary.

9. Energy conservation measures

Common measures will do.

10. Land and construction cost for the proposed unit

Land 100 acres - Rs.1.00 lakh per acre - Rs.100.0 lakhs.
Processing area is 252000 square feet as detailed below.

SI	Description	Sq. feet
1	Raw material store	50000
2	Processing area	60000
3	Finished goods tank to store spirit	10000
4	Bagasse storage area	50000
5	Administrative area	5000
6	Laboratory space	5000
7	Security office	1000
8	Machinery spares store	10000
9	Toilet space	1000
10	Effluent treatment plant	10000
11	Generator area	20000
12	Boiler area	20000
13	Other miscellaneous area	10000
14	Total	252000

Construction cost – Rs. 800 per square foot

Total cost of construction – Rs. 2016 lakhs
Total cost of land and civil works – Rs. 2116 lakhs.

11. Costing of machinery and equipment

- **Plant Machinery (Flame Proof)**

- a) Crushers for cane juice
- b) Filters
- c) Vacuum Concentrators
- d) Mash Receiving Tanks
- e) Yeast Culture Vessels
- f) Pre-Fermentors
- g) Fermentors
- h) Analyzer Still
- i) Aldehyde Separator
- j) Rectifier Column
- k) Condenser

- l) **Total cost of Plant machinery - Rs. 900 lakhs**

- **Ancillary equipment**

- m) Generator set
- n) Effluent treatment plant
- o) Steam boiler

- p) **Total cost of ancillary equipment - Rs.400 lakhs**

- **Testing Equipment**

- q) Spectrophotometer, glassware, chemicals etc., to test the strength and purity of rectified spirit - Rs. 5.00 lakhs
- r) Brix meter, juice extractors glassware, chemicals etc., to test the quality of raw material - Rs. 1.00 lakh
- s) Laminar flow chamber, Ultra Violet inoculation chamber, TLC apparatus, general chemicals and chemicals used for microbiological assay - Rs. 6.00 lakhs.

- t) **Total cost of testing equipment - Rs.12.00 lakhs.**

12. Project cost

Sl	Description	Rs. lakhs
1	Land	100.000
2	Civil works	2016.000
3	Plant machinery	1300.000
4	Laboratory equipment	12.000
5	Transport vehicles	100.000
6	Pollution control equipment	Included
7	Energy conservation equipment	Included
8	Cost of power connection	50.000
9	Cost of electrification	25.000
10	Erection and commissioning	100.000
11	Cost of machinery spares	25.000
12	Cost of office equipment	5.000
13	Deposits if any	1.000
14	Company formation expenses	0.250
15	Gestation period expenses	100.000
16	Sales tax registration expenses	0.100
17	Initial advertisement and publicity	50.000
18	Contingencies	5.000
19	Working capital margin money	268.400
20	Total	4157.750

13. Working capital requirements per month

a. Salaries and wages

SI	Description	No of persons	Total salary / month (Rs. lakhs)
1	Chief Executive	1	1.000
2	General Manager	1	0.800
3	Production Manager	1	0.400
4	Maintenance Engineers	6	1.800
5	Production Officers	3	0.900
6	Production Supervisors	12	3.000
7	Analytical Chemists	4	1.000
8	Skilled Workers	15	1.500
9	Unskilled workers	60	3.000
10	Loadmen	6	0.360
11	Administrative staff	6	1.500
12	Security staff	20	1.200
13	Sales Manager	1	0.400
14	Sales staff	4	0.600
15	Vehicle drivers	6	0.600
16	Total	146	18.060

b. Raw material requirement per month

SI	Description	Qty (MT)	Rate / ton (Rs)	Value (Rs. lakhs)
1	Sugar Cane	25000	2000	500.00
2	Yeast, Urea Phosphates			10.00
3	Total raw material	25000		510.00

d. Utilities per month

SI	Description	Rs. lakhs
1	Power 2,05,000 kwh @ Rs. 6.00 per unit	12.3000
2	Water	0.650
3	Boiler fuel	50.000
4	Total utilities	62.950

e. Contingent expenses per month

SI	Description	Rs. lakhs
1	Rent for processing shed	0.000
2	Postage and stationery	0.050
3	Telephones, fax etc.	0.250
4	Consumable stores	1.670
5	Repairs and maintenance	4.200
6	Local transports, loading and unloading	25.000
7	Advertisement and publicity	0.000
8	Insurance	1.670
9	Sales expenses @ 1% of sales	7.875
10	Miscellaneous expenses @ 1% of sales	7.875
11	Trade incentives	0.000
12	Taxes @ 4%	31.500
13	Total contingent expenses	80.090

f. Total working capital requirement per month

SI	Description	Rs. lakhs
1	Salaries and wages	18.060
2	Raw material and packaging material	510.000
3	Utilities	62.950
4	Contingent expenses	80.090
5	Total	671.100

14. Means of finance

SI	Description	Rs. lakhs
1	Total Project Cost	4157.750
2	Equity	1372.058
3	Debt	2785.692
4	Working capital margin money	268.40

15. Financial analysis

SI	Description	Rs. lakhs
1	Total recurring cost per year	8053.200
2	Depreciation on land and building	211.600
3	Depreciation on machinery and vehicles	141.200
4	Depreciation on furnaces	3.000
5	Depreciation on moulds and fixtures	2.500
6	Depreciation on office equipment	0.500
7	Interest on long term loan @ 14%	389.997
8	Interest on short term borrowings@ 14%	56.378
9	Total cost of production	8858.375

16. Turnover per year

SI	Item	Qty	Rate/litre (Rs)	Total Rs. lakhs
1	Rectified Spirit	31.50 Million Litres	30.00	9450.00

17. Viability analysis

SI	Description	Value
1	Net profit before income tax (Rs. lakhs)	591.625
2	Net profit ratio	6.2%
3	Internal rate of return	23.6%
4	Break even percentage	61%
5	Debt service coverage ratio	1.864

Machinery suppliers for rectified spirit from sugarcane juice

Address available on further consultation as permission, excise duties and clearances are involved.