Sector Agro and Food Processing

Sub - sector Agro Processing

Project No. AF-05

Project Title Castor Oil Derivatives – Perfumery Raw materials

Project Description

The proposed project envisages setting up of a Castor oil derivatives unit to manufacture perfumery raw materials viz Undecylenic acid and Heptaldehyde by Pyrolytic decomposition of Castor oil.

Product Applications

The basic derivatives, Heptaldehyde and Undecylenic acid are used to manufacture various perfumery compounds, which in turn are used to manufacture perfumes and synthetic flavors.

Sr. No.	Perfumery Chemical	Perfumery Compounds prepared	End – use of Perfumery compound
1	Heptaldehyde	Alpha-amyl Cinnamic aldehydes	In soap perfumery
		Nonylenic acid esters to make 8-n-amyl-butyrolactone	Coconut aldehyde for flavor of coconut milk
		Heptanoic acid	Verts de Violette
		Methyl-n-heptyl ketone and ester of 3-noninic acid	Oil of Rue used in violet perfume
		Heptaldehyde	Jasmine Flavor
2	Undecylenic acid	Gamma Undecalactone also known as Aldehyde- C-14	Peach odor
		Nonylic acid , Nonylic alcohol and nonylic aldehydes	Rose and Orange oil constituents
		Undecylenic alcohol	Floral odor with fatty note
		n-decylaldehyde	Spicy Orange like odor
		Allyl esters of Undecylenic acid	Odor of quinches and as modifier

Market and Growth Drivers

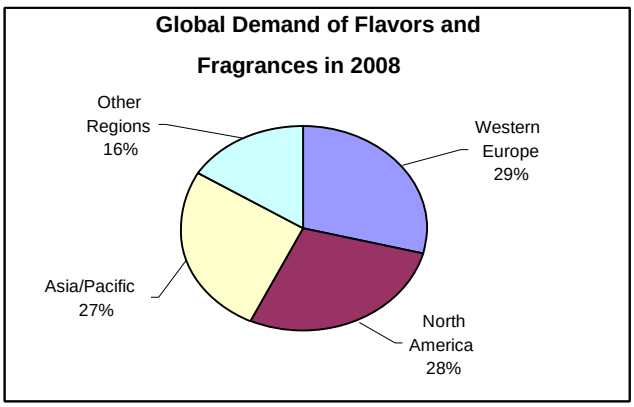
Market

India is one of the leading manufacturers of Flavors and fragrances in the world. These all are natural products, but in developing synthetic flavors and fragrances from castor oil derivatives, India is lagging behind. India, being a world leader in Castor seeds and Castor oil production and processing has edge over other countries like Japan, France and Germany who are importing castor oil and manufacturing these perfumery chemicals for further processing into perfumes and Synthetic flavors.

Internationally, Germany, France, Switzerland and Japan are the leading producers of synthetic flavors and fragrances from many natural ingredients, including castor oil derivatives like Undecylenic

acid and Heptaldehyde. Though, there is large international market for perfumery chemicals, estimated market in India is approx. 5000 MT.

The Global Demand of Flavors and Fragrances is set to increase. The following figure gives the region wise Demand Break up of Flavors and Fragrance market, estimated for the year 2008.



Source: FAO statistics

Growth Drivers

- The Global Demand of flavors and fragrance is estimated to increase at a growth rate of around 4% per annum.
- Moreover, the demand for flavors and fragrances in the Asia/Pacific region is estimated to be growing at a rate of about 7% per annum through 2008. Growth in the world's most developed markets will continue to be moderate, restrained by market maturity, consolidation in flavors and fragrances using industries and strong downward pressure on prices.
- Flavor and fragrance is looking for products from natural sources and prefer to use raw-materials which are harmless and bio-degradable. In the light of this fact, there is good scope for castor oil derivatives in the global market.
- Demand for fragrance blends and essential oils will benefit from increased interest in natural and exotic aromas, which are more expensive than their synthetic counterparts.

Trade statistics

Sr. No	Product	Years	Export Quantity (MT)	Import Quantity (MT)
1	**Heptaldehyde**			
		2002-03	112	N.A
		2003-04	130.01	0.68
		2004-05	210.57	10.44
		2005-06	183.74	N.A
2	**Undecylenic acid**			
		2002-03	372.66	768.18
		2003-04	385.02	1042.98
		2004-05	257.96	695.72
		2005-06	365.91	N.A

Source: Department of Commerce, GOI

Why Gujarat?

- Gujarat is the largest producer of Castor seed and estimated production is 5.71 Lac tons in the year 2005-06.
- These Castor seeds are processed in Gujarat itself to produce approx 2.57 Lac MT of castor oil of various grades. Thus, Gujarat is also largest processor and exporter of Castor oil from India.
- Gujarat has a well developed chemical industry base, which can offer ready availability of technical and commercial manpower.

Technology / Process

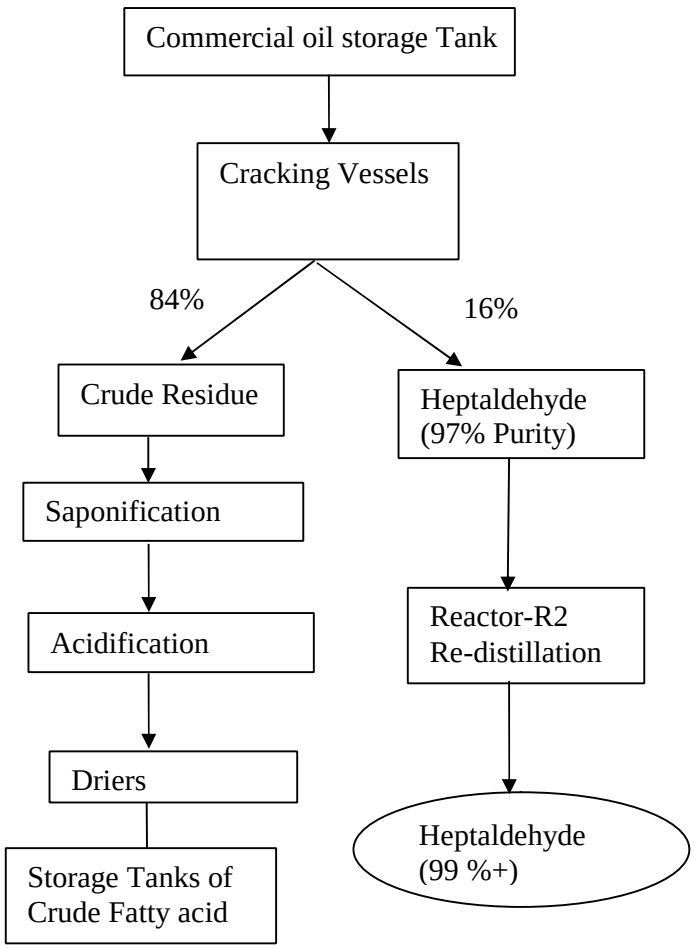
Castor oil, when subjected to pyrolysis or destructive distillation at temperature of over 450° C under vacuum, under goes decomposition to yield mainly Undecylenic acid and Heptaldehyde, in roughly equal quantities (28% approx). The presence of water vapor has been found to enhance the yields of both acid and aldehyde. The spongy mass left behind, consisting principally of polymerized Undecylenic acid, which can be used in recovering of some quantity of Undecylenic acid. Esters of Undecylenic acid are used as input for perfumery chemicals.

Heptaldehyde is having characteristic Jasmine flavor in it and typically it is also known as Jasmine aldehyde, and it can be converted to Heptanoic acid and Heptanol which are used in manufacture of many perfumery compounds.

Specifications for Proposed Perfumery Chemicals

Sr.No.	Specification Details	Heptaldehyde	Undecylenic Acid
1	Appearance Description	Pungent smelling Oily liquid	Oily liquid
2	Color	Colorless to pale yellow	Water white to pale yellow
3	Acid content Max %	5	90-95 % minimum
4	Aldehyde content. Min %	90-95	3 to 5 % maximum
5	Refractive index at 25° C	1.415	1.4880
6	Freezing point, ^{o}C	N.A.	21-24
7	Acid value	N.A.	295-304
8	Specific gravity	0.815	0.92
9	Boiling point, ^{o}C	152-154	N.A

Heptaldehyde and Undecylenic acid – Process flow sheet



Technology sources:

1. Indian Institute of Chemical Technology- Hyderabad
2. Jepro Engineering- Mumbai

Raw material requirement

Castor oil – 5000 MT/annum (first special grade).

Gujarat has assured and continuous supply of castor seeds. The production trend for the same is as follows:

Area, Production and Yield – Castor seeds in Gujarat

Sr.	Year	Area ('00 Hectares)	Production ('00 MT)	Yield, Kg. / Hectare
1	2000-01	4586	6388	1393
2	2001-02	3047	4651	1527
3	2002-03	2422	2831	1168
4	2003-04	2903	5411	1864
5	2004-05	3305	5648	1709

Source: Department of Agriculture Statistics, Gandhinagar, Government of Gujarat

Suggested Plant Capacity and Project Cost

Looking to the market size and financial out go, a medium size project with 1500 MT per annum finished product capacity is suggested to start with. Once the process and quality parameters are set, the capacity can be expanded further looking to the demand of end use segments.

The estimated project cost of the proposed project is INR 30 million (US $ 0.67 million)

Cost of Project and Means of Finance

Sr. No.	Particulars	INR in million
1	Land and Land development	3.50
2	Building & Civil works	6.00
3	Plant & Machinery 10 MT/day	10.00
4	Misc./ Other Fixed Assets	2.00
5	Preliminary & Pre-operative	1.50
6	Provision for contingencies	1.50
	Total Fixed Assets	**24.50**
7	Margin Money for working capital	10.50
	Estimated Block Capital Cost of Project	**35.00**
	Means of Finance	
8	Promoters contribution	11.57
9	Term loan	23.43
	Total Means of Finance	**35.00**

As indicated above, the proposed project will require an approx 5000 sq. mt of land with an proposed built up area of 2000 sq. mt. Considering 150 working days in a year the unit is proposed to have an installed capacity of 1500 TPA. The total fixed cost of the project is estimated at INR 24.50 million and INR 10.50 million is the working capital margin which adds up to a capital cost of INR 35 million. The unit is being proposed to cater to domestic as well as International demand and is suggested to have a Debt equity ratio of 2:1. Thus, the estimated term loan amounts to INR 23.43 million and Equity at INR 11.57 million.

Plant and machinery

The list of main plant and machineries required for Castor oil derivatives proposed in this project is summarized in following table:

List of Plant and Machinery

Sr. No	Particular	Quantity	Supplier
1	Cracking unit – with column (MS), condenser (MS), receiver (MS) with electrical heating	2	Troika Process Pvt Ltd. Mumbai / Jepro Engineering Pvt. Ltd, Mumbai

Sr. No	Particular	Quantity	Supplier
2	Castor oil (raw material) tanks	4	Sterling Equipments Pvt. Ltd.- Pune
3	Acidification tank (SS)	2	Sterling Equipments Pvt. Ltd.- Pune
4	Saponification tank (SS)	2	Mag-Tech Engineers - Ghaziabad
5	Caustic tank (MS)	1	Mag-Tech Engineers - Ghaziabad
6	H_2SO_4 tank (SS)	1	Sterling Equipments Pvt. Ltd.- Pune
7	Dryer (PVC)	1	Proton Engineering Works- Mumbai
8	Storage tanks of crude fatty acid (PVC)	1	Elixir Engineering Private Limited – Mumbai

Utilities required

The proposed unit will necessitate 90 KVA – LT power. A man power of 10 will be required for the proposed project.

Suggested Location

Suggested location for the proposed project is Kutchh, and districts of North and Central Gujarat.

Project Time Line

The proposed project will have project timeline of 6 to 8 months in obtaining necessary clearances from concerned authorities and a project implementation period of 10 to 12 months.

Financial Indicators

Based on the profitability projections worked out for the proposed project, key financial indicators are as summarized below:

Key Financial Indicators

Sr. No.	Financial Ratios	1st year	2nd year	3rd year
A	Break-Even Point in % capacity	33.56	31.75	30.00
B	Debt-service Coverage Ratio	1.71	2.14	2.66
C	**Average DSCR**	**2.17**		
D	Return on Investment (ROI)	21.76	26.66	31.58
E	**IRR**	**40%**		

The proposed project will have an indicative IRR of approx 40% considering initial 10 years operation. Proposed Debt equity ratio is 2:1.

Clearances Required

The proposed unit will have to register itself with Secretariat of Industrial Approvals (SIA), Ministry of Industries and Government of India, by filing Industrial Entrepreneur's Memorandum (IEM), as it will have plant and machinery investment of more than INR 10 million.

The major perfumery chemical market is in advanced countries like USA, Canada, Europe, Japan and CIS countries. The unit will be required to get its product registered with Food and Drugs Administration (FDA) in these countries, apart from registration with Indian and state Drugs control authorities as cosmetics ingredient.

The unit will get EOU registration from RBI, DGFT and with CHEMEXCIL as registered manufacturer exporter to avail export incentives.

Agencies to be contacted

Industrial Extension Bureau

Gujarat Agro Industries Corporation

Mott MacDonald India