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| Sector | Agro & Food Processing |
| Sub - sector | Food Processing |
| Project No. | AF- 16 |
| Project Title | Natural food colors – Marigold, Annatto |

Project Description

The project envisions setting up of a Natural food colors extraction unit which will cater to domestic as well as global demand. The manufacturing facilities proposed in this unit will be multipurpose and hence will be processing more than one raw material.

Product Application

Annatto and Marigold being non-toxic in nature are widely acceptable food colors for food products that include dairy products like butter, ghee, cheese, ice cream and margarine as well as some oil and bakery products. They are also used in preparation of cosmetic accessories, pharmaceuticals, crayons, textiles, floor wax, shoe polishes etc.

Yellow color is extracted from Marigold flowers, while butter yellow color is extracted from Annatto seed.

Market & Growth Drivers

Market

The natural food color industry market is growing at 10% -15% annually. The rationale for growth is increasing awareness among the developed countries like USA, UK, Germany, Europe, Japan etc. about the harmful effects and consequences of using synthetic color. Since the product is expensive, it is consumed in countries having high income strata.

The reason for accelerating demand of the natural food colors in international market is the growing awareness of environmental hazards of synthetic colors and harmful impact of chemicals used for manufacturing them. European countries have not only put total ban on manufacturing of synthetic dye based colors and the products containing such colors but also banned the imports of products from the countries using such colors.

Food industry is the major segment attracting investors. Natural color market products promise a good and vast market for dyes. Due to foreseen pollution problems and environmental erosions, synthetic dyes tend to be soon out of use at least in food preparations which will further give thrust to products like Annatto dyes.

The world market potential for food color in 2000 was 2400 MT which increased to 3000 MT by the year 2005 and is expected to increase to 8000 MT by the year 2010. Global Natural food color

market has touched to US \$ 1 billion and is continuously growing with the increasing preference for natural food colors against synthetic food colors.

Growth Drivers

- Boost in demand for natural food colors in the international market due to increasing awareness about the harmful effects of usage of synthetic colors and the chemicals used in manufacturing them.
- Ban in trading of synthetic color made products and its manufacturing in selected international markets like Japan and all European countries.
- Encouragement for using Natural food colors in novel products like infant toys and crayons, organic textile printing, hand made paper etc;.

Why Gujarat?

- Gujarat produced 17559 MT of Marigold Flowers from 2187 hectare of cultivated area in the year 2004-2005. Marigold cultivation is increasing in the state as high value floriculture activities along with other agriculture activities.
- Annatto seeds are cultivated in Gujarat presently by a private sector Biot-tech company under buy back arrangement by supplying tissue culture plants of Annatto-Bixa.
- Gujarat is the leading state manufacturing synthetic color but due to increasing stringent environment laws and control implemented by state pollution control authorities these units are suffering. They have an alternate to switch over and diversify in natural color extraction and manufacturing as it has a huge potential.
- Gujarat is having well developed dairy industry manufacturing butter, cheese, flavored milk and lassi, shrikhand, yogurt and ice cream where both these natural colors will find ready market.
- Large pool of Chemical, Pharma, cosmetics and textile units which can generate demand for Natural colors in India. The state having rich chemical expertise with experience also has good market access over other states.
- Availability of canal irrigation will lead to development of value added horticulture crops like Marigold and Annatto, and such processing unit will provide ready market for growers in Gujarat.

Technology/Process

- There are two methods for extracting natural colors. One is the conventional method that is batch type percolation which uses suitable organic solvent for extraction of the coloring material from natural materials.
- While Super Critical Extraction (SCE) is the advance technology used for extracting natural colors in the purest form. In India the technology for SCE has been developed by Chemical Engineering Department IIT- Mumbai. Imported technology can be sourced from Germany and Austria.

- It can separate components in single extraction process with use of process variables like temperature and pressure and can process multiple commodities and even improve economic viability.

Cold Percolation

This is a traditional method of extraction used by herbalists throughout the world and it's very simple. Above a flask or vessel is suspended a cone or tube. The bottom of the tube has a perforated base which holds ground herb in place. Solvent is poured into the top of the tube where it soaks through the herb leaching out the extract and then falling out the bottom end of the tube into the flask. If desired, the percolation tube can be wrapped in heating tape to help facilitate the extraction.

High Pressure- Supercritical/ Sub critical Extraction

This is the most technologically advanced extraction system in the world. Super Critical Fluid Extraction (SFE) involves taking gases, usually CO₂, and compressing them into a dense liquid. This liquid is then pumped through a cylinder containing the material to be extracted. From there, the extract laden liquid is pumped into a separation chamber where the extract is separated from the gas and the gas is recovered for re-use. CO₂'s solvent properties can be manipulated and adjusted by varying the pressure and temperature that one works at.

The advantages of SFE are the versatility it offers in pinpointing the constituents you want to extract from a given material and the fact that your end product has virtually no solvent residues left in it. (CO₂ evaporates completely) The downside is that this technology is quite expensive.

There are many other gases and liquids that are highly efficient as extraction solvents when put under pressure.

Raw materials

Natural colors manufacturing, has emerged as a new opportunity for the coming period. Recently cultivation of Annatto seed has started in several parts of Gujarat that is basically done through contract farming. The adjoining states of Rajasthan (*marigold flowers*), Madhya Pradesh (*Annatto seeds*) and Maharashtra would also help in getting the raw material in required quantum.

Gujarat's marigold production is shown an escalating trend since 2002-03 to 2005-06 growing at an average CAGR of 54% for the last 4 years. The following table summarizes Gujarat's marigold area under cultivation and production.

Marigold Flowers production in State

| Sr. No. | Particulars | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---------|-----------------|---------|---------|---------|----------|
| 1 | Area (Hectares) | 1469 | 1875 | 2187 | 2330 |
| 2 | Production (MT) | 12668 | 15044 | 17559 | 20714.99 |

Source: Directorate of Agriculture, Gujarat.

The extraction of natural food colours depends on the colouring Content in the raw material. Different processes are used to extract the colouring content from raw material that may vary from 4 to 7%.

Suggested Plant Capacity & Project Cost

Capacity – 300 TPA natural colors and flavors as by product.

The Block Capital cost of project is estimated to be INR 100 million (US \$ 2.25 million). The detail of project cost is summarized in following table:

Estimated Project Cost and Means of Finance

| Sr. No. | Cost of project | INR in million |
|---------|--|----------------|
| 1 | Land & Land develop | 3.00 |
| 2 | Building | 3.00 |
| 3 | Plant & Machinery | 75.00 |
| 4 | Miscellaneous Fixed Assets | 4.50 |
| 5 | Preliminary & Pre-operative exp. | 4.00 |
| 6 | Provision for contingencies | 4.50 |
| | Total Fixed Assets | 94.00 |
| 7 | Margin Money for working capital | 6.00 |
| | Estimated Block Capital Cost of Project | 100.00 |
| | Means of Finance | |
| 8 | Promoters contribution | 25.00 |
| 9 | Term loan | 75.00 |
| | Total Means of Finance | 100.00 |

As indicated above, the proposed project will require an approx 6000 sq. mt of land with proposed built up area of 1500 sq. mt. The unit is proposed to have an installed capacity of 300 TPA. Total fixed cost of the project is estimated at INR 94 million and INR 6 million is the working capital margin which adds upto total capital cost of INR 100 million. The unit being proposed to cater to domestic as well as to International demand and hence it is suggested to have a Debt equity ratio of 3:1. Thus, the estimated term loan amounts to INR 75 million and Equity at INR 25 million.

Plant and machinery

The proposed project would require the following as basic and necessary plant and machinery:

List of Plant and Machinery supplier

| Sr. No. | Particulars | Quantity | Suppliers |
|---------|----------------------------------|----------|------------------------------|
| 1 | Glass lined reactors | 2 | Gammon India Ltd, Mumbai |
| 2 | Stainless steel reaction vessels | 2 | Anup Engineering , Ahmedabad |

| Sr. No. | Particulars | Quantity | Suppliers |
|---------|----------------------------|----------|--|
| 3 | Pulverizer | 2 | Able Manufacturers, Andhra Pradesh |
| 4 | Crystallizer | 2 | Anup Engineering , Ahmedabad |
| 5 | Centrifuge | 3 | Alfa-Laval India Ltd, Pune , Penwalt India Ltd, Mumbai |
| 6 | Filters | 3 | Swastik Engineering, Jamnagar |
| 7 | Dryers | 3 | Vani Fab Engineers Pvt Limited, Hyderabad |
| 8 | Granulator | 2 | Chitra Engineering-Ahmedabad |
| 9 | De-mineralised water plant | 1 | Doshi Ion-exchange Pvt.Ltd, Ahmedabad |
| 10 | Percolator | 1 | Desmet Chemfoods Ltd, Mumbai |
| 11 | Chilled water plant | 1 | Voltas Ltd, Mumbai |
| 12 | Cooling Tower | 1 | Paharpur Engineering, Ahmedabad |
| 13 | Homogenisers | 2 | Sahyog Enterprise, Mumbai |
| 14 | Boiler | 1 | Walia Engineering-Ahmedabad |
| 15 | DG set for Stand by power | 1 | Kirloskar Electricals Ltd, Mumbai |

Utilities

The proposed unit would require approx. 140 KVA power, with steam requirement of 0.3 MT per hour. Apart from these utilities, the unit would require facilities for storing 10 KLPD liquid carbon dioxide at high pressure and handling of the same. Standby power generation of 100 KVA will also be required to run critical continuous process plant and & machinery.

Man Power Required

The unit would require direct employment of approx. 30 persons that will include technical, managerial and blue collar man power.

Suggested Location

The suggested locations for the proposed project can be in Vadodara, Kheda, Anand and Ahmedabad districts.

Project Time Line

The proposed project will have cumulative implementation period of 10 - 12 months of which 4 to 5 months would entail obtaining the obligatory clearances from various authorities.

Financial Indicators

The suggested Debt Equity Ratio for the proposed export oriented project is 3:1. Based on the financial projections worked out separately, the indicative financial ratios for the proposed project are summarized in following table.

Key Financial Indicators

| Sr. No. | Financial Ratios | 1 st Year | 2 nd Year | 3 rd Year |
|---------|-----------------------|----------------------|----------------------|----------------------|
| A | Break-Even Point in % | 32.23 | 27.92 | 23.76 |

| Sr. No. | Financial Ratios | 1 st Year | 2 nd Year | 3 rd Year |
|---------|-----------------------------|----------------------|----------------------|----------------------|
| B | Debt-service Coverage Ratio | 1.57 | 1.98 | 2.48 |
| C | Average DSCR | 2.01 | | |
| D | Return on Investment (ROI) | 22.79 | 28.12 | 33.49 |
| E | IRR | 46.24 % | | |

The indicative IRR for the proposed project is in approx. 46.24% for an operational period of 10 years.

Clearances Required

Filing of Industrial Entrepreneur's Memorandum (IEM) with the Secretariat of Industrial Approvals (SIA), Department of Industrial Development, Ministry of Industry, New Delhi

Registration with Ministry of Food Processing Industries (MOFPI), through state nodal agency GAIC, to avail benefits of scheme for food processing industry as the proposed unit would be manufacturing food ingredients for domestic and export market.

Agencies to be contacted

Industrial Extension Bureau

Mott MacDonald India

Gujarat Agro Industries Corporation Ltd.