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|----------------------|--------------------------------------|
| Sector | Agro & Food Processing |
| Sub - sector | Food Processing |
| Project No. | AF-06 |
| Project Title | Enzymes for food processing industry |

Project Description

The project envisages setting up of a food processing enzyme unit in the state of Gujarat.

Product Application

Food processing enzymes are used as food additives to modify food properties like digestability, texture and shelf life. Major enzymes used in the food industry are for starch liquefaction, saccharification and isomerization reaction. Food Processing enzymes are used in meat processing, dairy industry and in manufacture of pre-digested foods. Enzymes are also used for natural breaking of large sized molecules of carbohydrates, fats and proteins, in fermentation and preparing pre-digested protein food or preparing amino-acids and specialty foods.

Market & Growth Drivers

The global market for food processing enzymes in 2002 was approximately US\$ 700 million that increased to US\$ 740 million in the year 2004. Food and feed enzymes together had nearly 45% (highest) share, followed by industrial enzymes which are used in the detergent industry. In terms of value, this is contributing approx. US \$ 450 million in the world enzyme market estimated at US \$ 1000 million by the year 2005.

However, food processing enzymes find limited applications in India and hence its market also has remained un-tapped till date. Enzymes for food & feed processing industries contribute almost 17% to the Indian market.

In recent years, the trend is changing with globalization of food processing industry in India, Food processing enzyme market is fast growing in diverse applications.

Biocon Ltd and Novozymes are the two prominent players in the Indian Food Processing enzymes industry, their sales turnover for 2003-04 and 2004-05 and growth rate is summarized here below:

| Sr. No. | Name of Company | Sales INR In Millions | | Growth (%) |
|---------|-----------------------|-----------------------|---------|------------|
| | | 2003-2004 | 2004-05 | |
| 1 | Biocon Ltd, Bangalore | 5020.0 | 6464.0 | 29 |
| 2 | Novozymes | 530.0 | 690.0 | 30 |

Source: Bio-spectrum ABLE Survey

Growth drivers

- Population growth, urbanization and rising income levels have increased demand on food items with its spill-over effect seen on the growth of demand of food products and this in turn has spurred the demand of food enzymes in India.
- Technical innovation in enzymatic food processing is a major growth driver for this segment.
- The fast changing food habits, increased use of fast foods, modified foods and instant foods are other drivers for demand of Food processing enzymes.
- Health food is a sunrise industry in India and also globally, where food processing enzymes find wider application in manufacturing of these products.

Why Gujarat?

- Government of Gujarat is encouraging Bio-technology oriented projects, in which the products from the proposed project will be important inputs for food processing industry.
- Gujarat has well developed and fast growing processed food industry. Hence food processing enzyme will find ready market.
- Gujarat has favorable industrial investment climate specifically for this kind of high value addition products and industry.

Technology/Process

Fermentation

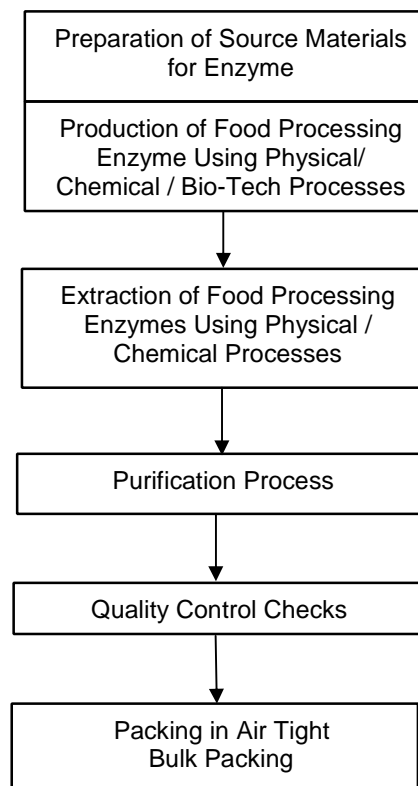
- Fermentation of a selected microorganism (bacterium or fungus) under sterile conditions
- Production of the desired enzyme by consumption of carbohydrates, proteins, salts, water and energy
- Transfer of the fermented broth to recovery

Recovery

- Filtration of the fermentation broth
- Purification of the liquid phase containing the enzyme
- Concentration of the liquid enzyme to desired enzymatic activity
- Stabilization and standardization of a liquid product or
- Standardization of a liquid concentrate for granulation

Granulation

- Formulation and standardization of the enzyme into solid granules to encapsulate the enzyme
- Providing the right property to the product (solubility, colour, etc.)



Raw Materials

Food processing enzymes are produced, mostly using all natural materials as source of raw materials (from plants and vegetables, bacteria, fungal origin). Now, these enzymes are produced in bulk using fermentation techniques-both with solid state and submerge culture in modern process of manufacturing. In the following table particulars of various food processing enzymes, their source and applications are summarized:

Food Processing Enzyme- Source and their Application

| Sr. No. | Enzyme | Source | Applications |
|---------|----------------------|-------------------------------------|----------------------------------|
| 1 | L-amylase, Bacterial | B.subtillis / B.licheniformis | Starch conversion |
| 2 | L-amylase, fungal | Aspergillus oryzae | Maltogenic Saccharofucatuib |
| 3 | Amyloglucosidedase | Aspergillus nigar var | Starch syringes, dextrose, foods |
| 4 | B-Glucanase | B.subtillis / Penicillium emersonil | Brewing and food processing |
| 5 | Neutral protease | B.subtillis | Brewing / flavouring |
| 6 | Neutral protene | Aspergillus oryzae | Baking |
| 7 | Cellulase | Trochoderma Spp | Cellulose hydrolysis |
| 8 | Invertase | Yeast SPP | Confectionary |
| 9 | Pectinase | A.niger | Fruit/wine processing |
| 10 | Papain | Papaya latex | Meat processing |
| 11 | Rennet | Mucor Spp | Dairy industry |
| 12 | Glucose isomearase | Strep.Spp | High fructose corn syrup |
| 13 | Lipasa | Mucor Spp / Aspergillus | Dairy Indus/ Fat splitting |
| 14 | Lactase | S.Lactis | Dairy industry |
| 15 | Hemicellulase | A.niger | Baking, fruits, gums |
| 16 | Glucose oxidase | A.niger | Analytical, food processing |
| 17 | Catalase | A.niger | Analytical, food processing |

Suggested Plant Capacity & Project Cost

Capacity – 360 Tons per annum.

Capital cost is estimated to be INR 50 million (US \$ 1.10 million).

Estimated Project cost & Means of finance

| Sr. No. | Cost of project | INR in million |
|---------|---------------------------|----------------|
| 1 | Land and Land development | 3.60 |
| 2 | Building & Civil works. | 6.75 |

| Sr. No. | Cost of project | INR in million |
|---------|----------------------------------|----------------|
| 3 | Plant & Machinery | 23.00 |
| 4 | Misc. Fixed Assets | 3.10 |
| 5 | Preliminary & Pre-operative | 4.00 |
| 6 | Provision for contingencies | 2.70 |
| | Total Fixed Assets | 43.55 |
| 7 | Margin Money for working capital | 6.45 |
| | Total | 50.00 |
| | Means of Finance | |
| 8 | Promoters contribution | 16.50 |
| 9 | Term loan | 33.50 |
| | Total | 50.00 |

As indicated above, the proposed project will require approx 6000 sq. mt of land with an proposed built up area of 1500 sq. mt. The unit is proposed to have an installed capacity of 360 TPA. The total fixed cost of the project is estimated at INR 43.55 and INR 6.45 million is the working capital margin which adds up to block capital cost of INR 50.00 million. The unit being proposed to cater to domestic as well as International demand is suggested to have a Debt equity ratio of 2:1. Thus, the estimated term loan amounts to INR 33.50 million and Equity at INR 16.50 million.

Plant and Machinery

The list of main plant and machinery and utility equipments is as mentioned below:

List of Main Plant and Machinery

| Sr. No | Particulars | Quantity | Supplier |
|--------|--|----------|--|
| 1. | Preparatory for Enzyme source material including Pulverizer , Sifter and particle classifier | 1 Set | Goldin India equipment Pvt. Ltd, Vadodara Riddhi Pharma Machinery Ltd, Mumbai |
| | Enzyme Production | | |
| 2. | Fermentor for Enzyme 5000 Lter | 2 | Alfa-Laval India Ltd, Pune |
| 3. | Glasslined reactors for Enzyme separation | 2 | Gammon India Ltd, Mumbai |
| 4. | Steam Distillation Column | 2 | Dipesh Engineering Works, Mumbai |
| | Enzyme Extractor | | |
| 6 | Solvent extraction equipments | 1 | Desmet Chemfoods India Pvt.Ltd, Mumbai |
| 7. | Enzyme separation column | 1 | Ion exchange India Ltd,Mumbai |
| 8. | Basket centrifuges for final product separation | 3 | Sukhras Machines Pvt. Ltd, Mumbai |

| Sr. No | Particulars | Quantity | Supplier |
|--------|---|----------|-----------------------------------|
| 9. | Hot air dryer with hot air generator for final product drying | 1 | Aerotherm India P.Ltd,Ahmedabad |
| 10. | Bag filling and sealing Machines | 3 | SPA International, Deonar, Mumbai |
| 11. | Oil fired steam generation unit | 1 | Thermax Ltd, Pune |
| 12. | HT /LT Electrification and DG set for standby power | Lot | Kirloskar Electricals Ltd, Mumbai |

Utilities

The unit will require utilities in the form of electricity and low pressure steam from non-IBR steam generating mini boiler. The unit will require approx. 220 KVA power and approx. 500 kg steam per hour for the proposed installed capacity of 360 MT/ per annum.

Man Power

The proposed project will have manpower requirement of 35 persons which is of two types, technical and non-technical. The proposed food processing enzyme unit will require 4 functional managerial persons, 1 personnel cum administrative manager, 10 technical and 15 non technical persons, 5 office staff.

Suggested Location

The preferred location for the proposed project is Central and South Gujarat areas close to urban centers, like Ahmedabad, Gandhinagar, Vadodara, Surat and Valsad districts.

Project Time Line

The proposed project will have Project time line of 5 to 6 months for obtaining various clearances and it will require 10- 12 months for implementation subject to availability of required permission, approvals and resources.

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 | 1 st Year | 2 nd Year | 3 rd Year |
|--------|--------------------------------|----------------------|----------------------|----------------------|
| A | Break-Even Point in % capacity | 42.97 | 38.84 | 35.47 |
| B | Debt-service Coverage Ratio | 1.64 | 2.26 | 3.04 |
| C | Average DSCR | 2.31 | | |
| D | Return on Investment (ROI) | 17.66 | 20.08 | 22.49 |
| E | IRR | 17% | | |

As perceived from the Project cost and Means of finance table, the suggested Debt Equity Ratio for the proposed project is 2:1. The IRR (Internal Rate of Return) for the proposed unit is approx. 17% projected for a period of 10 years.

Clearance 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.

As mentioned previously the proposed unit is for manufacturing for food processing enzymes which are critical inputs for the consuming industries. There is fast growing demand of food processing enzymes in the global market and the project envisages export to advanced countries like USA, Canada, UK, Europe and Australia. The unit will require to register their products with Food and Drugs Administration (FDA) in these countries, apart from registration with Indian and state food administration.

The most critical aspect of this product will be its shelf life for export consumers and hence it is critical to meet FDA regulations in consuming countries and Codex standards followed by them.

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

Being an exporting unit it will have to follow strict quality standards as accepted in the countries where export is to be made.

Indian FDA authorities have laid down standards for food additives including food processing enzymes which will be followed by the proposed unit. It is obligatory to meet provisions under the PFA act for all ingredients and quality aspects for marketing the product in the Indian market.

Agencies to be Contacted

Industrial Extension Bureau

Mott MacDonald India

Gujarat Agro Industries Corporation Ltd