69. RESINS FROM NATURAL GUM

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I. SUMMARY

This profile envisages the establishment of a plant for the production of Resins with a capacity of 157 tonnes per annum.

The present demand for the proposed product is estimated at 96.5 tonnes per annum. The demand is expected to reach at 144.8 tonnes by the year 2010.

The plant will create employment opportunities for 24 persons.

The total investment requirement is estimated at Birr 3.4 million, out of which Birr 2.0 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 37 % and a net present value (NPV) of Birr 5.4 million, discounted at 8.5 %.

II. PRODUCT DESCRIPTION AND APPLICATION

Gum or oleoresins obtained from various coniferous trees consists of 75 to 90% resin and 10 to 25% oil of turpentine. Upon distillation it yields resin and oil of turpentine. Rosin obtained as the residue in the distillation of exuded or gum turpentine is one of the most important resins commercially and is used extensively in making varnishes, paints, and soaps, in the manufacture of linoleum, in sizing paper, as a drier in oils, as a flux for solder and as an adulterant of more costly resins. It is also used to treat violin bows and dancing slippers.

Oil of turpentine is also the principal product of gum and it is widely used as a solvent and thinner for various oil paints and varnishes, to which it gives consistency and drying properties. Medically oil of turpentine acts as a powerful stimulant and is often used as an antipasmodic and a stringent. It is also capable of destroying various intestinal parasites and exhibits powerful diuretic properties.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Resins from natural gum used in varnishes, paints, soaps, paper sizing, and as a adulterant of more costly resins. It is also used to treat violin bows and dancing papers. Due to the wide applications, resins have high demand both in the local and international market.

Ethiopia exports natural gums to the international market while it imports gum resins from the world market. The average quantity of export in the past six years was more than 1,947 tonnes per annum. Import of gum resins and other vegetable saps and extracts is given in Table 3.1.

Table 3.1

IMPORT OF LAC, GUMS, RESINS & OTHER VEGETABLE EXTRACTS

Year	Import (Tonnes)
1996	107.1
1997	206.5
1998	174.1
1999	77.4
2000	42.3
2001	154.8
2002	138.0
Total	**900.2**
Average	**128.6**

The import data shown in Table 3.1, reveals that on the average the country has been importing 128.6 tonnes of gum resins and other vegetable extracts.

According to knowledgeable persons, of the total imported quantity about 75% is the share of gum resins. Taking this assumption, the present local demand for resins is estimated at 96.5 tonnes. In addition to the local demand, the product has a wide export market.

According to the resource potential study, the BGRS has a production potential of about 906 tonnes of natural gum. Hence, the extraction of resins from the natural gum will have a significant value added.

2. Projected Demand

The demand for resins depends mainly on the development of the end-users such as paint and varnish factories, soaps, paper and other chemical industries. Assuming that the project is envisaged to produce for the local market, an annual average growth rate of 7% is applied taking the current demand as a base. The projected demand based on the above assumption is given in Table 3.2.

Table 3.2

PROJECTED LOCAL DEMAND FOR RESINS

Year	Local Demand (Tonnes)
2004	96.5
2005	103.3
2006	110.5
2007	118.2
2008	126.5
2009	135.3
2010	144.8
2011	155.0
2012	165.8
2013	177.4
2014	189.8
2015	203.1

3. Pricing and Distribution

For financial analysis purpose an ex-factory gate price of Birr 20,000 per tonne for resins and Birr 3,010 per tonne for turpentine oil is adopted.

The project can supply its product directly to the end-users.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The plant capacity is determined by the availability of crude resin (gum), throughout which can be sustained, and the size of the market for the products. The limiting factor here is market. The plant is proposed to process 157 tonnes of gum to produce 110 tonnes of resin and 22 tonnes of turpentine oil.

2. Production Programme

The plant is expected to start at 70% of its installed capacity reaching full capacity in the fourth year and thenafter with 10% progressive growth in capacity each year taking the problem in market penetration and skill development into consideration. The plant will have 250 working days per year. It will operate in a single shift of 8 hours each, a day.

IV. RAW MATERIALS AND INPUTS

A. RAW MATERIALS

The raw materials required for the envisaged plant are gum and diatomaceous earth as a filter aid. Both raw materials are locally available. The raw materials requirement and cost details are shown on Table 4.1.

Table 4.1

RAW MATERIALS REQUIREMENT AND COST

Sr. No.	Description	Qty.	Cost (Birr)		
			LC	FC	TC
1	Gum	157 tonnes	1,099,000	-	1,099,000
2	Diatomaceous earth	94.2 kg	141.3	-	141.3
3	Packing material	6000 pcs	-	18,000	18,000
	Grand Total Cost		**1,099,141.3**	**18,000**	**1,117,141.3**

B. UTILITIES

The utilities required by the envisaged project are electricity, water and fuel oil. 500m^3 of water, 50,000 lt of fuel oil and 50,000 kWh of electricity are required for the smooth operation of the plant. The total cost of utilities is approximately Birr 158,000.

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Process

Gum arriving at the plant is immediately weighed and up turned over an iron grill covering a large concrete or mild steel damp vat. In order to facilitate the flow from one unit to another, the resin has to be diluted with turpentine and heated. As well as making the resin more fluid, dilution lowers its specific gravity, so that in the latter washing stage it will form a two phase system water more readily. The resin is transferred first from the damp vat to a blowcase, and then from the blow case to a melter, by the use of steam pressure. Filter aid diatomaceous earth 0.5-0.6 kg / tonnes of resin is added at either of the two units. The temperature inside the melter is raised to 85-100^oC by steam, the exact temperature again being dependent on the quality of the resin. Steam pressure is then used to force the hot resin first through a metal screen at the bottom of the melter to remove the larger sized solid matter and then through a filter to remove all remaining solids. Filtration is assisted by the filter aid added, previously. The resin passes directly from the filter to the bottom of a wash tank containing hot water. After washing, the mixture is allowed to settle for at least 4 hours and preferably overnight. The bottom aqueous layer is then run off to waste, an intermediate layer of unbroken emulsion is run off to be returned to the low grade damp vat for reprocessing and the top layer, which consists of washed resin, is drained and pumped to a charge tank in preparation for distillation.

The still is filled with resin from the charge tank. The temperature is then raised by means of steam coils to about 110^{o}C at which point live steam is gradually introduced through sparger valves. As the temperature continues to rise, distillation proceeds and the sparger steam inflow is increased until, at the end of the distillation, the temperature has reached 160-170^{o}C.

The turpentine and water vapours pass through an enterainment trap to remove any entrained resin and then condense in a water cooled condenser. Completion of distillation is indicated by a minimal level of turpentine in distillate (which by experience, is found to correspond to a particular temperature).

The water turpentine distillate is led immediately to a separating tank; the upper turpentine layer overflows and passes first down to the base of the dehydrator and then upwards through a bed of rock salt to remove all traces of water. The dry turpentine is then fed to holding tanks for subsequent storage in bulk or in galvanized steel drums. The hot resin from the body of the still is discharged from the bottom into suitable containers which are set aside for the resin to cool and solidity. The process doesn't have any adverse impact on the environment.

2. Source of Technology

The information and technology for gum resin production can be obtained from the following companies.

1) Forest history society
Library and Archives
701 William Vickers Avenue
Durham, North California
27701 - 3162 USA
Phone: (919) 6820 - 9319
Fax: (919) 682 - 2349
E-mail: Coakes@duke. edu

2) Van cover suite 357
185-9040 Bliendell road
Richmond BC V 6Y 1k3
Canada
Fax: +1(604) 270-8285.

B. ENGINEERING

1. Machinery and Equipment

The machinery and equipment required for the production of resin from gum are listed in Table 5.1. The total cost of machinery and equipment is estimated at Birr 2,017,215, out of which Birr 1,613,772 is required in foreign currency.

The plant needs two pick-up vehicles for transportation of raw materials & finished product as well as for office work. The total cost of vehicles is estimated to be Birr 300,000.

Table 5.1

LIST OF MACHINERY AND EQUIPMENT

Sr. No.	Description	Qty.
1	Tank	4
2	Melter (steam coiled)	1
3	Plate filter	1
4	Pump	4
5	Distillation still	1
6	Entrainment separator	1
7	Condenser	1
8	Boiler	1

2. Land, Building and Civil Works

The total land requirement for the envisaged plant is estimated to be 1000 m^2, out of which 500 m^2 is a built-up area. The total construction cost is estimated to be Birr 600,000 by assuming a rate of Birr 1200 per m^2. The total land lease value, at a rate of Birr 1.5 per m^2 for 70 years holding period, is estimated to be Birr 105,000. The total cost of land, building and civil works assuming that the total land lease cost will be paid in advance is estimated to be Birr 705,000.

3. Proposed Location

BGRS has a potential for natural gum. The western low lands of the region such as Guba, Kurmuk, Gzen and Oda - Godere woredas are highly endowed with gum tree species. The nature of resin from gum plant is a resource oriented one. Hence, Assosa zone is proposed as an appropriate location for the resin plant in a site where there is basic infrastructure for setting up industry.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

A total of 24 employees are required for the smooth running of the envisaged plant. The detailed list of manpower with their monthly salary including employees' benefits is depicted in Table 6.1. The total cost of manpower is estimated at Birr 206,250.

B. TRAINING REQUIREMENT

The process involves cleaning and distillation, which is simple that it doesn't need any special training arrangement. However, supervisors, operators and technicians need to be trained on the operation and maintenance of machinery for two weeks by the expert of the machinery supplier during commissioning and erection. The total cost of training is estimated at Birr 30,000.

Table 6.1

MANPOWER REQUIREMENT AND LABOUR COST (BIRR)

Sr. No.	Description	Req. No.	Monthly Salary	Annual Salary
1	G/manager	1	2,000	24,000
2	Secretary	1	700	8,400
3	Accountant	1	800	9,600
4	Sales man	1	800	9,600
5	Supervisor	1	850	10,200
6	Chemist	1	850	10,200
7	Operators	4	600	28,800
8	Laborers	4	300	14,400
9	Technician	2	600	14,400
10	Time keeper	1	450	5,400
11	Store keeper	1	500	6,000
12	Guard	4	300	14,400
13	Driver	2	400	9,600
	Sub-total	**24**		**165,000**
	Employees benefit (25% of sub-total)			41,250
	Grand Total			**206,250**

VII. FINANCIAL ANALYSIS

The financial analysis of the Resin project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 years
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	7.5 %
Discounted cashflow	8.5 %
Repair and maintenance	3 % of the total plant and machinery
Accounts receivable	30 days
Raw material, local	30 days
Raw materials, import	90 days
Work in progress	days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total initial investment cost of the project including working capital is estimated at 3.4 million, of which 47.6 per cent will be required in foreign currency.

The major breakdown of the total initial investment cost is shown in Table 7.1

Table 7.1

INITIAL INVESTMENT COST

Sr. No.	Cost Items	Total ('000 BIRR)
1	Land lease value	105
2.	Building and Civil Work	600
3.	Plant Machinery and Equipment	2,017.2
4.	Office Furniture and Equipment	60
5.	Vehicle	300
6.	Pre-production Expenditure*	35
7	Working Capital	105.6
	Total Investment cost	**3,403**
	Foreign share	**47.6%**

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 1.86 million (see Table 7.2). The material and utility cost accounts for 61.7 per cent while depreciation and financial costs take 25.8 per cent of the production cost.

* *N.B Pre-production expenditure includes interest during construction (Birr180.5 thousand), training (Birr 30 thousand), and (Birr 5 thousand) costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

Table 7.2
ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)

Items	Cost	%
Raw Material and Inputs	1,005.7	54
Utilities	142.2	7.6
Maintenance and repair	27.8	1.5
Labour direct	148.5	8.0
Factory overheads *	37.1	2.0
Administration Cost **	20	1.1
Total Operating Costs	**1,381.3**	**74.2**
Depreciation	310	16.6
Cost of Finance	170.6	9.2
Total Production Cost	**1,861.8**	**100.0**

C. FINANCIAL EVALUATION

1. Profitability

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the lifetime of the project.

The income statement and the other indicators of profitability show that the project is viable.

2. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operates at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 33\ \%$$

**Factory overhead cost includes salaries and wages of supervisors, insurance of factory workers, social costs on salaries of direct labour, etc.*
*** Administrative cost includes salaries and wages, insurance, social costs, materials and services used by administrative staff etc.*

3. Pay-Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 3 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 37 % and the net present value at 8.5% discount rate is Birr 5.4 million.

D. ECONOMIC BENEFITS

The project can create employment for 24 persons. In addition to supply of the domestic needs, the project will generate Birr 0.4 million per annum in terms of tax revenue when it starts to operate at full capacity. Moreover, the Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.