159. PROFILE ON PRODUCTION OF CLOVE OIL

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I. SUMMARY

This profile envisages the establishment of a plant for the production of clove oil with a capacity of 155 tonnes per annum.

The present demand for the proposed product is estimated at 5,000 tonnes per annum. The demand is expected to reach at 10,395 tonnes by the year 2022.

The plant will create employment opportunities for 14 persons.

The total investment requirement is estimated at Birr 3.30 million, out of which Birr 1.60 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 28% and a net present value (NPV) of Birr 2.77 million, discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Clove oil is a colourless or pale-yellow with characteristic odour and taste of cloves. The oil darkerns with the age or on exposure and becomes reddish brown.

Clove oil is one of the most important essential oils used for flavouring of all kinds of food products, such as mealy sausage, baked goods, confectioneries , etc. It is also used for flavouring oral preparation like denitrifies, gargles and chewing gums. Because of its antiseptic and bactericidal properties, numerous pharmaceutical preparation contains oilof clove. The use of clove oil in perfumes, toilet waters, and soaps of oriental and spicy odour is well known.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Clove trees Sysygium Aromaticum (syn. *Eugenia caryophyllus*) belong to the Myrtaceae family. Evergreen, they grow in warm humid tropical regions with a minimum annual rainfall of 150 - 250 cm, up to an altitude of 800 - 900 m. They start bearing cloves (Eugenia caryophyllata), which grow in thick clusters, twice a year after the seventh year.

Cloves contain 11% to 17% essential oil, which is mostly eugenol, an effective local anaesthetic. The percentage of oil depends on the freshness of the cloves: the fresher, the higher.

Clove bud essential oil is used in perfumery and, though less frequently, in pharmaceutical industries. The essential oil is also used by the food industry in meat products, sauces and pickles, confectionery and bakery products. The oil is a colourless or yellow liquid obtained in a yield of 11% to 17% on distillation of the spice. The quality is the best when the yield is included in a range of 15% - 17%.

Less expensive clove stem oil, pale yellow, obtained after distillation in a yield of about 6% is used in the mass-market products. It is also increasingly used in meat seasonings. Clove leaf oil**,** a dark brown liquid obtained after distillation of the dry leaves in a yield of 2% to 3%, is the major traded clove oil. When rectified, the oil is pale yellow. Less expensive than the bud or stem oil, it is used as a main source for the production of eugenol, which is used as an analgesic and as a raw material for other chemical products such as vanillin.

Clove oleoresin is extracted from the stems or the buds. Its flavour and odour is similar to the spice, to which it is sometimes substituted. It is traded as an essential oil and is mainly used as seasoning in the meat industry, baked goods or desserts.

Currently the local market for clove oil is not well developed, therefore the envisaged product is mainly for export.

According to the FAO, Indonesia produced around 70% of world clove oil in 2005, followed by Madagascar with around 12%. Tanzania and the Comoros followed with a share of 10% and 2.4%, respectively.

The annual world trade of clove oil averaged 50 thousands tones with an average value of USD 150 million during the period 2000-2005. Singapore and India were the leading importers in 2005. Singapore's share was around 39% (USD 53.6 million and 21,416 tonnes). India's was around 20% in value and 13% in quantity (USD 27.4 million and 6,945 tonnes). During the same year the European Union's share was 6.6% in value and 5.1% in volume (USD 9.3 million and 2,739 tonnes).

Accordingly, the average global import of the period 2000 – 2005 i.e. 50 thousand tonnes is assumed to approximate the present (2007) global demand for clove oil and in order to be conservative the market share that could be capture by locally produced clove oil is assumed to be 10% which is 5,000 tonnes.

2. Projected Demand

The global market for clove oil is expanding one therefore based on past trend it can be assumed that the market grows at an annual growth rate of 5%. Accordingly by taking the estimated present demand as a base and applying a 5% growth rate the projected demand for the product and estimated share of local product is shown in Table 3.1.

Table 3.1

PROJECTED DEMAND FOR CLOVE OIL (TONNES)

Year	Projected Global Demand	Local Product Market Share
2008	52,500	5,250
2009	55,125	5,513
2010	57,881	5,788
2011	60,775	6,078
2012	63,814	6,381
2013	67,005	6,700
2014	70,355	7,036
2015	73,873	7,387
2016	77,566	7,757
2017	81,445	8,144
2018	85,517	8,552
2019	89,793	8,979
2020	94,282	9,428
2021	98,997	9,900
2022	103,946	10,395

3. Pricing and Distribution

According to FAO clove oil prices went up in the last six years from USD 2,500 to USD 3,800 per tonne.

Accordingly, a factory- get price of Birr 27,500/ tonne is recommended.

Distribution of the product should be arranged through contacts with agents having deep and extensive experience of the market.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The annual production capacity of the envisaged plant is 155 tonnes of clove oil, based on 300 working days and single shift per day.

2. Production Programme

The production program of the project is indicated in Table 3.2. At the initial stage of production, the project requires some years to penetrate into the market. Therefore, in the first and second year of production, the capacity utilization rate will be 70% and 90%, respectively. In the third year and thenafter, full capacity production shall be attained.

Table 3.2
PRODUCTION PROGRAMME

Sr. No.	Product	Production Year		
		1	2	3-10
1	Clove oil (ton)	108.5	139.5	155
2	Capacity utilization (%)	70	90	100

IV. MATERIAL AND INPUTS

A. RAW AND AUXILIARY MATERIALS

The essential oil content of clove buds, stem and leaves is on average 17%, 6% and 2.5%, respectively. In this profile only the clove buds have been considered as input for the envisaged project. In addition, essential oils from clove stems and leaves are low-priced oils. The annual requirement and cost of raw and auxiliary materials are indicated in Table 4.1.

Table 4.1

ANNUAL RAW AND AUXILIARY MATERIALS REQUIREMENT AND COST (AT FULL CAPACITY)

Sr. No.	Description	Qty	Cost ('000 Birr)
1	Clove buds (ton)	912	1965.36
2	Tin-plated drums (200 lt capacity)	775	93
	Total		**2,058.36**

B. UTILITIES

Utilities required by the project comprise of electricity, fuel oil and water. Table 4.2 below gives the annual utility requirement along with its cost.

Table 4.2

UTILITIES REQUIREMENT & COST

Sr. No.	Utility	Unit	Qty	Cost ('000 Birr)
1	Electricity	kWh	150,000	71.1
2	Furnace oil	Lt	135,000	730.35
3	Water	m^3	2000m^3	20
	Total			**821.45**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Water or steam distillation still are popular for the production of clove oil. The first method yields essential oil for perfumery and flavour purposes, and the oil contains 85 to 89% of eugenol. The second method, on the other hand, yields, strong oil, rich in eugenol (91-95% by volume).

Before distillation the clove buds are milled and must be distilled immediately, to prevent loss of oil by evaporation.

The steam produced in a boiler is introduced into a vessel which contains the buds and water. The buds are located on a grid placed at a certain distance above the level of the water which fills the bottom of the vessel. The water is vaporized indirectly, by steam flowing in a pipe coil submerged by the water. The water vapor plus the distilled oil coming from the evaporator vessel is recovered in a separate water cooled condenser. This mixture flowing out of the condenser is separated by decantation in a Florentine flask, in which two fractions, one lighter, the other heavier, than water are separated. The two fractions must be remixed after water is decanted.

The distillate water should be redistilled to recover all the dissolved oil extracted from the clove by distillation. This process is called cohabation.

Finally, the clove oil is packed and dispatched for sales.

2. Source of Technology

The technology of clove oil processing can be acquires from different suppliers of steam distillation plant. The following company could be one of them.

Servotex Engineers
Ghodbunder Road, Opp.NT Strips, Mumbay, India
Phone: +91-22- 28454982
Fax: +91-11-28455615

B. ENGINEERING

1. Machinery and Equipment

The list of machinery and equipment required for the production of clove oul is indicated in Table 5.1. The cost of machinery and equipment including engineering and know-how is estimated at Birr 1,607,400 of which Birr 1,339,500 is in foreign currency.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT

Sr. No.	Description	No.
1	Evaporator vessels	2
2	Condenser (water cooled)	1
3	Florentine flask (ss)	1
4	Pumps	2
5	Cooling tower	1 set
6	Submersible pump	1
7	Boiler system	1 set
8	Grinding unit	1 set

2. Land, Building And civil Work

The total land requirement of the project is estimated at 1000 m^2, of which the built-up area is 300 m^2. Therefore, the cost of building is Birr 450,000. The lease value of land is about Birr 80,000 at a rate of 1 Birr per m^2 per annum for 80 years.

3. Proposed Location

Ada town of Tello woreda Kaffa zone is selected as the best location of the proposed project because of its proximity to major raw material sources.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The envisaged project requires 14 work force Table 6.1 shows the list of manpower and annual labour cost. The total annual cost of labour is estimated at Birr 184,500.

Table 6.1

MANPOWER REQUIREMENT AND LABOUR COST

Sr. No.	Manpower	Req. No.	Monthly Salary (Birr)	Annual Salary (Birr)
1	General manager	1	3000	36,000
2	Production & technic manager	1	2500	30,000
3	Accountant	1	2000	24,000
4	Secretary	1	800	9,600
5	Operators	2	1400	16,800
6	Ass. Operators	2	800	9,600
7	Daily labourers	4	1200	14,400
8	Guards	2	600	7,200
	Sub-Total	**14**	**12300**	**147,600**
	Benefits (25% of BS)		3075	36,900
	Grand-Total		**15,375**	**184,500**

B. TRAINING REQUIREMENT

On-the-job training shall be carried out by the experts of machinery supplier, and its cost is estimated at Birr 20,000.

VII. FINANCIAL ANALYSIS

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

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	5 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30 days
Work in progress	2 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 3.30 million, of which 46 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 Cost ('000 Birr)
1	Land lease value	80.0
2	Building and Civil Work	450.0
3	Plant Machinery and Equipment	1,607.4
4	Office Furniture and Equipment	100.0
5	Vehicle	200.0
6	Pre-production Expenditure*	290.4
7	Working Capital	581.0
	Total Investment cost	**3,308.7**
	Foreign Share	46

** N.B Pre-production expenditure includes interest during construction (Birr 140.37 thousand) training (Birr 20 thousand) and Birr 130 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc*.

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 3.50 million (see Table 7.2). The material and utility cost accounts for 82.11 per cent, while repair and maintenance take per cent of the production cost.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)

Items	Cost	%
Raw Material and Inputs	2,058.36	58.69
Utilities	821.45	23.42
Maintenance and repair	75	2.14
Labour direct	88.56	2.53
Factory overheads	29.52	0.84
Administration Costs	59.04	1.68
Total Operating Costs	3,131.93	89.30
Depreciation	263.24	7.51
Cost of Finance	111.98	3.19
Total Production Cost	**3,507.15**	**100**

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 life-time 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 operate at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 58\ \%$$

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 4 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 28 % and the net present value at 8.5% discount rate is Birr 2.77 million.

D. ECONOMIC BENEFITS

The project can create employment for 14 persons. In addition to supply of the domestic needs, the project will generate Birr 1.8 million in terms of tax revenue.