

**213. PROFILE ON PRODUCTION OF
CARBOXYMETHYLE CELLULOSE (CMC)**

TABLE OF CONTENTS

	<u>PAGE</u>
I. SUMMARY	213-3
II. PRODUCT DESCRIPTION & APPLICATION	213-3
III. MARKET STUDY AND PLANT CAPACITY	213-4
A. MARKET STUDY	213-4
B. PLANT CAPACITY & PRODUCTION PROGRAMME	213-6
IV. RAW MATERIALS AND INPUTS	213-7
A. RAW & AUXILIARY MATERIALS	213-7
B. UTILITIES	213-8
V. TECHNOLOGY & ENGINEERING	213-8
A. TECHNOLOGY	213-8
B. ENGINEERING	213-9
VI. MANPOWER & TRAINING REQUIREMENT	213-10
A. MANPOWER REQUIREMENT	213-10
B. TRAINING REQUIREMENT	213-11
VII. FINANCIAL ANALYSIS	213-11
A. TOTAL INITIAL INVESTMENT COST	213-11
B. PRODUCTION COST	213-12
C. FINANCIAL EVALUATION	213-14
D. ECONOMIC BENEFITS	213-15

I. SUMMARY

This profile envisages the establishment of a plant for the production of carboxymethyle cellulose (CMC) with a capacity of 30 tones per annum.

The present demand for the proposed product is estimated at 18.8 tones per annum. The demand is expected to reach 64.7 tones by the year 2020.

The plant will create employment opportunities for 15 persons.

The total investment requirement is estimated at about Birr 3.67 million, out of which Birr 1.91 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 19 % and a net present value (NPV) of Birr 2.03 million discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Carboxymethyle cellulose (CMC), a kind of cellulose ether, is a white powdery soluble polymer made from pulp cellulose. CMC is prepared by treating alkali cellulose with sodium chloroacetate. Its production is simpler than that of most other cellulose ethers because all reagents are solid or liquid and allow operation at atmospheric pressure. For this reason and because of its versatile properties, CMC has become the largest industrial cellulose ether and has a wide range of applications in various industries.

CMC is used in synthetic detergent formulations due to its ability to prevent redeposition of dirt on clothing, and is used as a warp size in textile manufacturing, because it has good sizing action and it is easily removed by water. CMC is also used in paper industry to size paper boxboard to permit printing, decrease wax penetration, and import

grease resistance. Other applications of CMC include its use in oil well drilling muds, in ceramics and refractories because of its

suspending and binding properties. Since CMC is physiologically inert, it is used extensively for food, pharmaceuticals and cosmetics.

CMC is applicable in a number of industries as sizing agent, anti-grease and anti-reposition of dirt on clothing and even as lubricant in mud drilling. In Ethiopia it is applied as warp sizing agent in textile industries and anti-redeposition agent in detergent industries. Since the mud drilling activities are not well developed, its consumption is insignificant and considered as nil.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Present Demand and Supply

CMC has a wide range of applications in various industries. It is used in detergent, soaps, food products(especially dietetic foods and ice cream), where it acts as water binder, thickener, suspending agent, and emulsion stabilizer, textile manufacture(sizing), coating paper and paper board to lower porosity, emulsion paints, pharmaceuticals, and cosmetics.

The country's requirement for the product is met through imports. The quantity of imports of the product during the period 2000 - 2006 is shown in Table 3.1.

Table 3.1**IMPORTS OF CMC (TONNES)**

Year	Import
2000	12.5
2001	0.02
2002	15.4
2003	20.3
2004	15.9
2005	12.7
2006	27.7

Source: Customs Authority, External Trade Statistics, 1997-2004.

During the period under reference, imports exhibited substantial fluctuations and averaged at 14.9 tones. Given, the substantially considerable fluctuations in the supply of the product, which comprises of only imports, the average annual supply during the last three years (2004 – 2006) is considered as the effective demand for the product for the year 2007. Accordingly, the present demand for the product (i.e., 2007) is thus estimated at 18.8 tones.

2. Projected Demand

The future demand for CMC is a function of growth of the end-user industries. The market oriented economic policy is expected to hasten the rate of investment in different economic sectors of the country including the manufacturing sector. Taking the expected favorable conditions in the future an annual growth rate of 10% is considered for projecting the demand for the product. The projected demand is presented in Table 3.2.

Table 3.2**PROJECTED DEMAND (IN TONNES)**

Year	Projected Demand
2008	20.6
2009	22.7
2010	25.0
2011	27.5
2012	30.2
2013	33.2
2014	36.5
2015	40.2
2016	44.2
2017	48.6
2018	53.5
2019	58.9
2020	64.7

3. Pricing and Distribution

Based on current market price of the product and assuming margins for distributors a factory gate price of Birr 7,500 per tone is recommended for the envisaged plant. The product can be directly supplied to end-users.

III. PLANT CAPACITY AND PRODUCTION PROGRAM

1. Plant Capacity

The plant is envisaged to produce 30 ton/year, in 300 working days and operating 8 hrs/day.

2. Production Programme

The production programme is shown in Table 3.4. The production programme is set by considering just 300 working days per annum.

Table 3.4
PRODUCTION PROGRAMME

Year	1	2	3	4
Capacity utilisation (%)	70	80	90	100
Production programme (tons)	21	24	27	30

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

The annual material requirement and corresponding cost of the plant is shown in Table 4.1 below.

Table 4.1**ANNUAL RAW MATERIAL REQUIREMENT AND CORRESPONDING COST**

No	Raw Material	Unit	Annual Consumption	('000 Birr)		
				FC	LC	Total
1	Pulp	ton	24	132	32.6	164.6
2	Sodium	"	18	188	46.4	234.4
3	monochloroacetate	"	30	187	47	234
4	Caustic soda	"	18	115	28	143
5	Methanol	"	1.5	8.6	2.2	10.8
	Hydrochloric acid					
	Total			630.6	156.2	786.8

In addition to the above raw materials the annual requirement of packaging materials will be 600 bags of 50kg holding capacity the total annual cost of which is estimated at Birr 1,035.

B. UTILITIES

Utilities such as oil, water and electricity are required by the plant. The annual consumption is shown in Table 4.2 below.

Table 4.2
ANNUAL CONSUMPTION OF UTILITIES

No	Utility	Unit	Annual Consumption	('000 Birr)		
				F.C	L.C	Total
1	Furnace Oil	m ³	30	-	162.3	162.3
2	Water	m ³	1500	-	8.3	8.25
3	Electricity	KWH	40,000	-	19.5	19.5
	Total			-	190.1	190.1

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

CMC is prepared by treating alkali cellulose with sodium chloroacetate. After the alkali cellulose is prepared from pulp and caustic soda, the sodium chloroacetate is added as a solid or an aqueous solution into the reactor. The exothermic reaction requires little or even no initial heating, but sometimes cooling is needed to maintain the temperature between 25-70°C. The reaction product is obtained as slurry and it is neutralized by hydrochloric acid. Before drying, it must be freed from by-product salts (mainly NaCl) by washing with 70-80% methanol. Finally, it is pulverised to fixed particle size for packing.

2. Source of Technology

The technical data and information are compiled from a document of CP Kelco Oy, Aaenkoski, Finland.

B. ENGINEERING

1. Machinery and Equipment

The list of machinery and equipment required by the plant is given in Table 5.1. The total cost of these machinery and equipment is estimated at about Birr 1,913.68 thousands out of which Birr 1,594.73 thousands will be required in foreign currency.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT

No	Item
1	Mixer
2	Reactor
3	Washing tank
4	Filter press
5	Dryer
6	Pulverisor
7	Conveyors
8	Refrigerator

2. Building and Civil Works

The total land requirement is close to 1000 m². The built up area is estimated at 400 m² while the remaining part is for open space and for future expansion. The lease cost for 99 years lease holding will be Birr 79,200. Building and civil works cost about Birr 1,000,000.

3. Proposed Location

The proposed location for the plant is Wolkite town in Meskan woreda, Guraghe Zone.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The manpower requirement of the plant and the monthly and annual salary expenditure are shown in Table 7.1.

Table 7.1
REQUIRED MANPOWER

No	Manpower	Quantity	Monthly Salary	Annual Cost
1	General Manager	1	3,000	36,000
2	Technical "	1	2,500	30,000
3	Administrative Manager	1	1,200	14,400
4	Production Head	1	1,500	18,000
5	Supervisor	1	1,200	14,400
6	Chemist	1	1,000	12,000
7	Skilled operators	2	1,200	14,400
8	Semiskilled Operators	2	800	9,600
9	Maintenance crew	2	1,200	14,400
10	Unskilled (Labourers)	3	600	7,200
	Total	15	14,200	170,400

B. TRAINING REQUIREMENT

The technical personnel of the plant should be trained by qualified engineers of the machinery supplier. The cost of training shall be Birr 50,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the CMC 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	30days
Work in progress	5 days
Finished products	30 days
Cash in hand	5 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 3.67 million, of which 17 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	79.2
2	Building and Civil Work	1,000.00
3	Plant Machinery and Equipment	1,913.68
4	Office Furniture and Equipment	100
5	Vehicle	250
6	Pre-production Expenditure*	150
7	Working Capital	186.55
	Total Investment cost	3,679.4
	Foreign Share	17

* *N.B Pre-production expenditure includes interest during construction (Birr 208.25 thousand) training (Birr 50 thousand) and Birr 100 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 1.83 million (see Table 7.2). The material and utility cost accounts for 53.2 per cent, while repair and maintenance take 6.26 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	786.80	42.85
Utilities	190.1	10.35
Maintenance and repair	115	6.26
Labour direct	102.24	5.57
Factory overheads	42.6	2.32
Administration Costs	68.16	3.71
Total Operating Costs	1,304.90	71.07
Depreciation	335.33	18.26
Cost of Finance	195.89	10.67
Total Production Cost	1,836.12	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.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 40 \%$$

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 5 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 19 % and the net present value at 8.5% discount rate is Birr 2.03 million.

D. ECONOMIC BENEFITS

The project can create employment for 15 persons. In addition to supply of the domestic needs, the project will generate Birr 1.10 million in terms of tax revenue.