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APPENDIX

APPENDIX A

Table A . 1 Price of decolorizing agents.

Decolorizing agent	Price (Baht / Kg.)
Activated carbon	70
Fullers earth	450
Clay	20

Remark : Price at Bangkok in January 1993

Table A . 2 Price of paraffin waxes

Type of Wax	Price (Baht / Kg.)
German Wax (refined wax)	150
Chinese Wax (semirefined wax)	50
Fang Slack Wax	6

Remark : Price of German and Chinese Wax was at Bangkok in January 1993.

Price of Fang Slack Wax was at Chaing Mai in January 1993.

APPENDIX B

Feasibility study (72)

A feasibility study must provide a base - technological, economic, commercial - for an investment decision on an industrial project. It should define and analyse the critical elements that relate to the production of a given product together with alternative approaches to such production. Such a study should provide a project of a defined production capacity at a selected location, using a particular technology or technologies in relation to defined materials and inputs at identified investment and production costs, and sale revenues yielding a defined return on investment.

Feasibility study of paraffin wax

A. Market study

In 1991 Thailand imported paraffin waxes (oil content less than 0.75 %) 4,805,359 Kg. that CIF value was 65,755,050 Baht. (Data from Department of Customs)

B. Raw material study

Raw material for refined wax manufacture was slack wax that separated from light distillate and heavy distillate. In 1991, Fang oil refinery produced about 446,610 Kg. of slack wax after dewaxing by sweating process and about 8,558,363 litres of heavy distillate from Fang oil refinery was sold as low cost fuel oil (3.66 Baht / litre). Fang heavy distillate had 55% wax content so it gave 4,707,099 litre of slack wax after dewaxing process.

C. Technical aspect (73,74)

1. Deoiling process

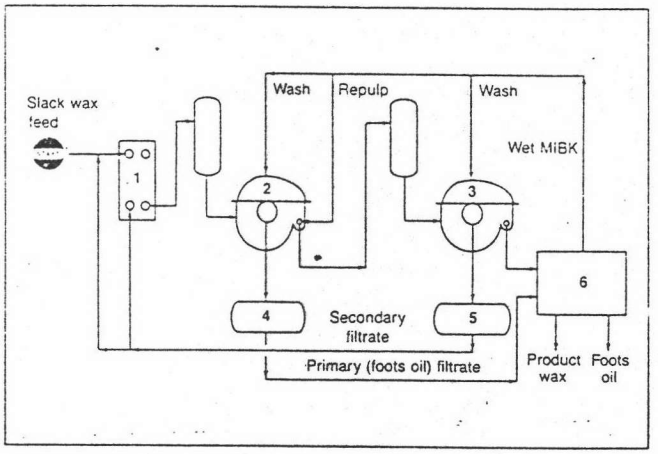


Figure B.1 Flowchart of MIBK Wax Deoiling Process.

Application : Produce paraffin waxes (< 0.2 % oil) and microcrystalline waxes (< 1 % oil) with high melting points and another properties desirable in high quality product waxes using the MIBK Wax Deoiling Process.

Description : Solvent treatment at refrigerated temperatures. Water - saturated methyl isobutyl ketone (wet MIBK) is used with conventional solvent deoiling equipment. No solvent-drying equipment is needed. Melted slack wax feed is cooled in scraped-surface double-pipe chillers [1] and wet MIBK is added for optimum crystallization. The mixture is filtered through a rotary vacuum filter [2], and wax cake is washed with cold solvent. Wax cake is slurried, with additional cold solvent, and again filtered and solvent washed [3]. Solvent in product wax cake and in foots oil filtrate [4] is removed in recovery system [6]. Secondary filtrate [5] is recycle.

Operating conditions : Fresh solvent ratios of 1 to 2 volume on feed are typical for paraffin slack waxes. Recirculated filtrate is used as a substitute for fresh solvent at several points in the plant. Oil miscibility and wax antisolvency properties of wet MIBK permit maximum use of incremental dilution and filtrate recirculation. Filtration temperatures (40-85 ° F) can be used to obtain a given yield and qulity of product wax. Filter rates are generally 10 to 30 lb dry wax per h sq ft of filter surface. Rate depends mainly on feed characteristics.

Economics :

Investment (basis : 300 - 1500 bpd capacity)	
$ per bpd	2,600 - 4,300
Utilities, typical per bbl feed :	
Fuel, 10^3 Btu	300
Electricity, kWh	9
Steam, lb	60
Water, cooling, (10 ° F rise), 10^3 gal	2.5
MIBK solvent, makeup, lb	0.02

Installation : Two in service ; two more under construction.

Licensor : Unocal Corp.

2. Decolorizing process

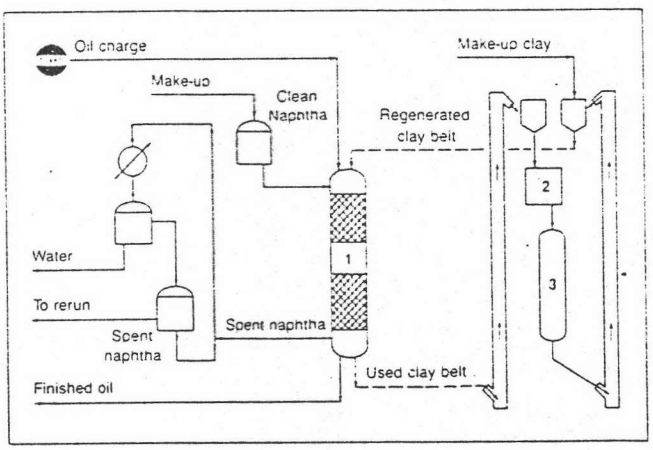


Figure B.2 Flowchart of Percolation Filtration Process.

Application : Finish refining and purification of lube oils, (monomers, solvents, etc.) waxes and other organic materials using the Percolation Filtration Process.

Products : Finished oils, waxes and organic products characterized by excellent color, odor and taste, and by their stability in demulsifying properties. Trace contaminants are also removed.

Description : The process consists of filtering the oil or other charge through a vessel [1] commomly containing 10 to 50 tons of adsorbent media, either Attapulgus sorbent or activated Porocel sorbent, depending on comparative costs and product quality considerations. Generally heavy decolorization requirements will favor Attapulgite while lighter color loads (less color reduction) will favor Porocel.

After a preliminary period during which the bed is thoroughly soaked with charge oil, the feedstock is pass through the adsorbent for as long as targeted product specifications are met. The first oil out is lightest in color. The color of the effluent oil darken gradually as more and more oil flows through the unit. After the oil stream has stopped, naphtha is sent through the material to reclaim the remaining oil. Steaming follows to recover the naphtha. The material is then optionally conveyed to kiln [2] for regeneration by burning off the carbonaceous deposits of oil and impurities and returned via a cooler [3] to the filter bed for another cycle. The 20 / 60 and 30 / 60 mesh adsorbent grades have been found to be the best adapted to most operations.

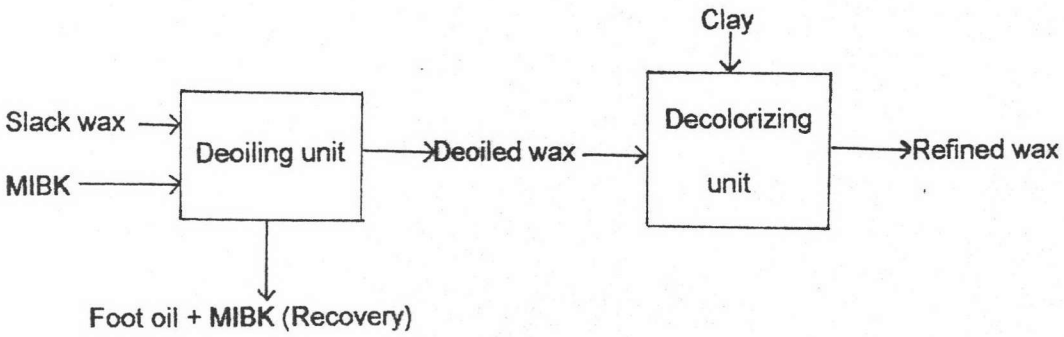
Yields : Relative yields will vary with different oils; the principal factors influencing them being crude oil source and the amount of refining pretreatment lubricating oil fractions recieved prior to finishing. For other products, the yield will also depend on the type and quantity of contaminant to be removed.

Installation : More than 50 installations.

Licensor : Engelhard Corp.

We assumed that investment cost and utility cost of decolorizing process was equal to deoiling process because there was not economic data in decolorizing process.

D. Material balance



Feedstock : barrel		Utility consumption	
- Slack wax	100	Fuel, 10^3 Btu	600
- MIBK	200	Electricity, kWh	18
total	300	Steam, lb	120
		Water, cooling (10 °F), 10^3 gal	5
		MIBK solvent, makeup, lb	0.02

Product and by-product : barrels	
- Refined wax	95
- Foot oil + MIBK + impurities	204.99
- MIBK loss	0.00713
total	300

There was not data about percent yield of process. So we assumed that percent yield of purification process was 95.

E. Required capital

1. Assumption of source of financing

Share capital	100 %
Long term loan	
- Local loan	0
- Foriegn loan	0
Working capital loan	0

2. Assumption

a) Project cost

-Plant cost (ISBL)	0.81
-Pre - operating expenses	16 % of ISBL
-License fee	8 % of ISBL
-Contingency	10 % of ISBL and pre -operating expenses

b) Production cost

-Labor cost	0.036
-Factory overhead cost	100 % of labor cost
-Maintenance cost	2.5 % of ISBL and contingency of ISBL
-Property tax & Insurance	1.0 % of ISBL and contingency of ISBL

c) Selling cost

-Selling expenses	2.6 % of sale revenue
-General & Administration expenses	1 % of sale revenue
-Business tax	3.3 % of sale revenue
-Others	1 % of sale revenue

d) Coorporate income tax 35 % of net income before tax

e)	Depreciation	
	-Plant cost (ISBL)	20 years
f)	Amortization	
	-Pre - operating expenses	10 years
	-License fee	10 years
	-Other (contingency)	10 years
g)	Account receivable	30 days
h)	Account payable	30 days
i)	Land lease fee	0
j)	Dividend	90 %

TABLE B.1 PROJECT COSTS
UNIT:MILLION US$

	YEAR	1993	1994	1995	1996	1997	1998	1999
ALLOCATION		100 %	10 %	40 %	50 %			
Project Costs:								
-Plant Cost (ISBL)		0.8100	0.0810	0.3240	0.4050			
-Pre-operating Expense		0.1296	0.0130	0.0518	0.0648			
-License Fee		0.0648	0.0065	0.0259	0.0324			
-Contingency		0.0940	0.0094	0.0376	0.0470			
-Land Lease Fee		0.0000	0.0000	0.0000	0.0000			
Total Project Costs		1.0984	0.1098	0.4393	0.5492			

TABLE B.1 PROJECT COSTS
UNIT:MILLION US$

	YEAR	2000	2001	2002	2003	2004	2005	2006
ALLOCATION								
Project Costs:								
-Plant Cost (ISBL)								
-Pre-operating Expense								
-License Fee								
-Contingency								
-Land Lease Fee								
Total Project Costs								

3. Pricing assumption

a) Feedstocks :	Unit	Unit Price (US $)
- Slack wax	barrel	34.76
- MIBK	lb	0.45
b) Products :		
- Refined wax	barrel	95.10
(domestic price)		
c) Utilities :		
- Fuel	million Btu	3.00
- Electricity	kWh	0.28
- Steam	1000 lb	1.10
- Water, cooling	1000 gal	0.40

TABLE B.2 REVENUE
UNIT:MILLION US$

YEAR	1993	1994	1995	1996	1997	1998	1999
REVENUE:							
Plant Capacity (barrels/year)	0.0000	0.0000	0.0000	21000	24000	27000	30000
% Utilization				70	80	90	100
Product (barrels)							
-refined wax				21000	24000	27000	30000
Product Price (US$/barrel)				95.10	95.10	95.10	95.10
Sale Volume (barrels)				21000	24000	27000	30000
Total Sale Revenue				1.9971	2.2824	2.5677	2.8530

TABLE B.2 REVENUE
UNIT:MILLION US$

YEAR	2000	2001	2002	2003	2004	2005	2006
REVENUE:							
Plant Capacity (barrels/year)	30000	30000	30000	30000	30000	30000	30000
% Utilization	100	100	100	100	100	100	100
Product (barrels)							
-refined wax	30000	30000	30000	30000	30000	30000	30000
Product Price (US$/barrel)	95.10	95.10	95.10	95.10	95.10	95.10	95.10
Sale Volume (barrels)	30000	30000	30000	30000	30000	30000	30000
Total Sale Revenue	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530

TABLE B.3 PRODUCTION COST & OPERATING EXPENSES

UNIT:MILLION US$

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refined Wax Production (bbl)	0.0000	0.0000	0.0000	21000	24000	27000	30000	30000	30000	30000	30000	30000	30000	30000
Feedstock Required (bbl)														
-slack wax				22104	25262	28420	31578	31578	31578	31578	31578	31578	31578	31578
Feedstock Prices (US$/barrel)														
-slack wax				34.7600	34.7600	34.7600	34.7600	34.7600	34.7600	34.7600	34.7600	34.7600	34.7600	34.7600
Total Feedstock Costs				0.7683	0.8781	0.9794	1.0977	1.0977	1.0977	1.0977	1.0977	1.0977	1.0977	1.0977
Utility Consumption (per bbl feed)														
-Fuel, million BTU 3.00				0.0398	0.0455	0.0512	0.0568	0.0568	0.0568	0.0568	0.0568	0.0568	0.0568	0.0568
-Electricity, kWh 0.28				0.1114	0.1273	0.1432	0.1592	0.1592	0.1592	0.1592	0.1592	0.1592	0.1592	0.1592
-Steam, 1000 lb 1.10				0.0029	0.0033	0.0038	0.0042	0.0042	0.0042	0.0042	0.0042	0.0042	0.0042	0.0042
-Water cooling, 1000 gal 0.4				0.0442	0.0505	0.0568	0.0632	0.0632	0.0632	0.0632	0.0632	0.0632	0.0632	0.0632
-MIBK, lb 0.45				0.0004	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Total Utility Costs				0.1987	0.2271	0.2555	0.2839	0.2839	0.2839	0.2839	0.2839	0.2839	0.2839	0.2839
Total Feedstock & Utility Costs				0.9671	1.1052	1.2348	1.3815	1.3815	1.3815	1.3815	1.3815	1.3815	1.3815	1.3815
Fix Production Costs:														
-labor costs				0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360
-factory overhead costs				0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360	0.0360
-maintenance costs				0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226	0.0226
-property tax & insurance				0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090	0.0090
-amortization				0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288
-depreciation				0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405
Total Fix Production Costs				0.1730	0.1730	0.1730	0.1730	0.1730	0.1730	0.1730	0.1730	0.1730	0.1730	0.1730
Total Costs of Goods Sold				1.1400	1.2782	1.4078	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545

TABLE B.4 PROFIT & LOSS STATEMENT
UNIT:MILLION US$

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
SALE REVENUE														
-refined wax				1.9971	2.2824	2.5677	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530
Total Sale Revenue	0.0000	0.0000	0.0000	1.9971	2.2824	2.5677	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530	2.8530
COST OF GOODS SOLD														
-refined wax				1.1400	1.2782	1.4078	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545
Total Cost of Goods Sold	0.0000	0.0000	0.0000	1.1400	1.2782	1.4078	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545	1.5545
Production Margin	0.0000	0.0000	0.0000	0.8571	1.0042	1.1599	1.2985	1.2985	1.2985	1.2985	1.2985	1.2985	1.2985	1.2985
Selling & Admin. Costs														
-Selling Expenses				0.0519	0.0593	0.0668	0.0742	0.0742	0.0742	0.0742	0.0742	0.0742	0.0742	0.0742
-General & Administration				0.0200	0.0228	0.0257	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285
-Business Tax				0.0659	0.0753	0.0847	0.0941	0.0941	0.0941	0.0941	0.0941	0.0941	0.0941	0.0941
-Others				0.0200	0.0228	0.0257	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285
-Land Lease Fee				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Operating Costs	0.0000	0.0000	0.0000	0.1578	0.1803	0.2028	0.2254	0.2254	0.2254	0.2254	0.2254	0.2254	0.2254	0.2254
Operating Profit before Interest & Tax				0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Add:Interest Earned				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Exchange Gain (Loss)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gross Income before Interest & Tax	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Interest Expenses														
-Short Term Loan Interest	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Working Capital Loan Interest	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Long Term Loan Interest														
-Local Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Foreign Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Interest Expenses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gross Income before Tax	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Amortized Loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Taxable Income	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Corperate Income Tax	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Net Income	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731

TABLE B.5 CASHFLOW STATEMENT
UNIT:MILLION US$

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Gross Profit before Interest & Tax	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Add : Depreciation				0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405
Amortization				0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288	0.0288
Operating Cash Inflow				0.7686	0.8932	1.0264	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
Add : Interest Earned				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Exchange Gain (Loss)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Less : Change in Working Capital				0.0714	0.0123	0.0130	0.0116	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Gross Operating Cash Inflow				0.6972	0.8810	1.0134	1.1309	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
Non-operating Cash Inflow	0.1098	0.4393	0.5492	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Share Capital	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Long Term Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Local Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Foriegn Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Working Capital Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Non-operating Cash Inflow	0.1098	0.4393	0.5492	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Cash Inflow	0.1098	0.4393	0.5492	0.6972	0.8810	1.0134	1.1309	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
CASH OUTFLOW :														
-Project Costs														
-Plant Cost (ISBL)	0.0810	0.3240	0.4050											
-Pre-operating Expenses	0.0130	0.0518	0.0648											
-License Fee	0.0065	0.0259	0.0324											
-Contingency	0.0094	0.0376	0.0470											
-Land Lease Fee	0.0000	0.0000	0.0000											
Total Project Costs	0.1098	0.4393	0.5492											
-Interest during Construction	0.0000	0.0000	0.0000											
Total Investment Costs	0.1098	0.4393	0.5492	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Coperate Income Tax	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cashflow before Financial Charges	0.0000	0.0000	0.0000	0.6972	0.8810	1.0134	1.1309	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
Total Interest Expenses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Long Term Repayment														
-Local Loan				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Foreign Loan				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Long Term Repayment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Net Cashflow before Reserve Account	0.0000	0.0000	0.0000	0.6972	0.8810	1.0134	1.1309	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
Transfer to Reserve Account	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Net Cashflow	0.0000	0.0000	0.0000	0.6972	0.8810	1.0134	1.1309	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424
Cash Begining Balance	0.0000	0.0000	0.0000	0.0000	0.0697	0.0951	0.1108	0.1242	0.1267	0.1269	0.1269	0.1269	0.1269	0.1269
Net Cashflow in the year	0.0000	0.0000	0.0000	0.6972	0.9507	1.1085	1.2417	1.2666	1.2691	1.2693	1.2694	1.2694	1.2694	1.2694
Short Term Loan Required	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Working Capital Loan Repayment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Short Term Loan Repayment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cash Available for Dividend	0.0000	0.0000	0.0000	0.6972	0.9507	1.1085	1.2417	1.2666	1.2691	1.2693	1.2694	1.2694	1.2694	1.2694
Dividend Payment	0.0000	0.0000	0.0000	0.6275	0.8556	0.9975	1.1176	1.1399	1.1422	1.1424	1.1424	1.1424	1.1424	1.1424
Cash Ending Balance	0.0000	0.0000	0.0000	0.0697	0.0951	0.1108	0.1242	0.1267	0.1269	0.1269	0.1269	0.1269	0.1269	0.1269

TABLE B.6 BALANCE SHEET
UNIT:MILLION US$

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	200
ASSET :														
Current Assets														
-Cash	0.0000	0.0000	0.0000	0.0697	0.0951	0.1108	0.1242	0.1267	0.1269	0.1269	0.1269	0.1269	0.1269	0.1269
-Reserve Account	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Account Receivable	0.0000	0.0000	0.0000	0.1664	0.1902	0.2140	0.2378	0.2378	0.2378	0.2378	0.2378	0.2378	0.2378	0.2378
-Inventory	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Current Assets	0.0000	0.0000	0.0000	0.2361	0.2853	0.3248	0.3619	0.3644	0.3647	0.3647	0.3647	0.3647	0.3647	0.3647
Fixed Assets														
-Plant Cost (ISBL)	0.0810	0.3240	0.4050	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100	0.8100
Less : Cum.Depreciation	0.0000	0.0000	0.0000	0.0405	0.0810	0.1215	0.1620	0.2025	0.2430	0.2835	0.3240	0.3645	0.4050	0.4455
Net Fixed Assets	0.0810	0.3240	0.4050	0.7695	0.7290	0.6885	0.6480	0.6075	0.5670	0.5265	0.4860	0.4455	0.4050	0.3645
Other Assets														
-Pre-operating Expenses	0.0130	0.0518	0.0648	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296	0.1296
-License Fee	0.0065	0.0259	0.0324	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648	0.0648
-Contingency	0.0094	0.0376	0.0470	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940	0.0940
-Land Lease Fee	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Interest during Construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Less : Cum.Amortization	0.0000	0.0000	0.0000	0.0288	0.0577	0.0865	0.1153	0.1442	0.1730	0.2019	0.2307	0.2595	0.2884	0.3172
Net Other Assets	0.0288	0.1153	0.1442	0.2595	0.2307	0.2019	0.1730	0.1442	0.1153	0.0865	0.0577	0.0288	0.0000	-0.0288
Total Assets	0.1098	0.4393	0.5492	1.2652	1.2450	1.2152	1.1829	1.1161	1.0470	0.9777	0.9084	0.8390	0.7697	0.7004
LIABILITIES & SHAREHOLDER'S EQUITY														
Current Liabilities														
-Account Payable	0.0000	0.0000	0.0000	0.0950	0.1065	0.1173	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295
-Tax Payable	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Dividend Payable	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Short Term Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Working Capital Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Current Liabilities	0.0000	0.0000	0.0000	0.0950	0.1065	0.1173	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295
Long Term Liabilities														
-Local Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-Foreign Loan	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Long Term Liabilities	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Liabilities	0.0000	0.0000	0.0000	0.0950	0.1065	0.1173	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295	0.1295
Share Capital	0.1098	0.4393	0.5492	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984	1.0984
Retain Earning (Begining)	0.0000	0.0000	0.0000	0.0000	0.0718	0.0401	-0.0005	-0.0450	-0.1118	-0.1809	-0.2502	-0.3195	-0.3889	-0.4582
Add : Net Income	0.0000	0.0000	0.0000	0.6993	0.8239	0.9570	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731	1.0731
Less : Dividend	0.0000	0.0000	0.0000	0.6275	0.8556	0.9976	1.1176	1.1399	1.1422	1.1424	1.1424	1.1424	1.1424	1.1424
Retain Earning (Ending)	0.0000	0.0000	0.0000	0.0718	0.0401	-0.0005	-0.0450	-0.1118	-0.1809	-0.2502	-0.3195	-0.3889	-0.4582	-0.5275
Total Shareholder's Equity	0.1098	0.4393	0.5492	1.1702	1.1384	1.0979	1.0534	0.9865	0.9175	0.8481	0.7788	0.7095	0.6401	0.5708
Total Liabilities & Shareholder's Equity	0.1098	0.4393	0.5492	1.2652	1.2450	1.2152	1.1829	1.1161	1.0470	0.9777	0.9084	0.8390	0.7697	0.7004

TABLE B.7 NET CASHFLOW OF THE PROJECT

UNIT:MILLION US$

YEAR	1	2	3	4	5	6	7
	1993	1994	1995	1996	1997	1998	1999
Net Cashflow	-0.1098	-0.4393	-0.5492	0.6972	0.8810	1.0134	1.1309

YEAR	8	9	10	11	12	13	14
	2000	2001	2002	2003	2004	2005	2006
Net Cashflow	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424	1.1424

IRR = 58.50 %

IRR of this project was 58.50%. It indicated that it was possible to invest in this project because of high IRR.

APPENDIX C

Power factor applied to plant - capacity ratio [75]

This method for study or order-of-magnitude estimates relates the fixed-capital investment of a new process plant to fixed-capital investment of similar previously constructed plants by an exponential power ratio. That is, for certain similar process plant configurations, the fixed-capital investment of the new facility is equal to the fixed-capital investment of the constructed facility C multiplied by the ratio R, defined as the capacity of the new facility divided by the capacity of the old, raised to a power x. This power has been to average between 0.6 and 0.7 for many process facilities.

$$C_n = C(R)^x \quad \text{.....(1)}$$

Cost index [76]

Most cost data which are available for intermediate use in a preliminary or predesign estimate are based on conditions at some time in the past. Because prices may change considerably with time due to changes in economic conditions, some method must be used to updating cost data applicable at a past date to costs that are representative of conditions at a later time. this can be done by the use of cost index.

Table C.1 Cost indexes as annual averages

Year	Chemical engineering plant cost index
1987	323.8
1988	342.5
1989	355.4
1990	357.6
1991	361.3
1992	358.2
1993 (Feb.)	357.7

Refined wax plant

In 1990, plant cost (ISBL) was 1.56 Million US$ at capacity 300 bpd (Licensor : Unocal).

A capacity for this project was 100 bpd.

If Eq. (1) was used with a 0.6 power factor and Chemical engineering plant cost index (Table C.1) the fixed-capital investment is

$$C_n = C f_E (R)^x$$

$$= 1.56 \, (357.6 / 357.7) \, (100 / 300)^{0.6}$$

$$= 0.81 \text{ Million US\$}$$

Labor cost

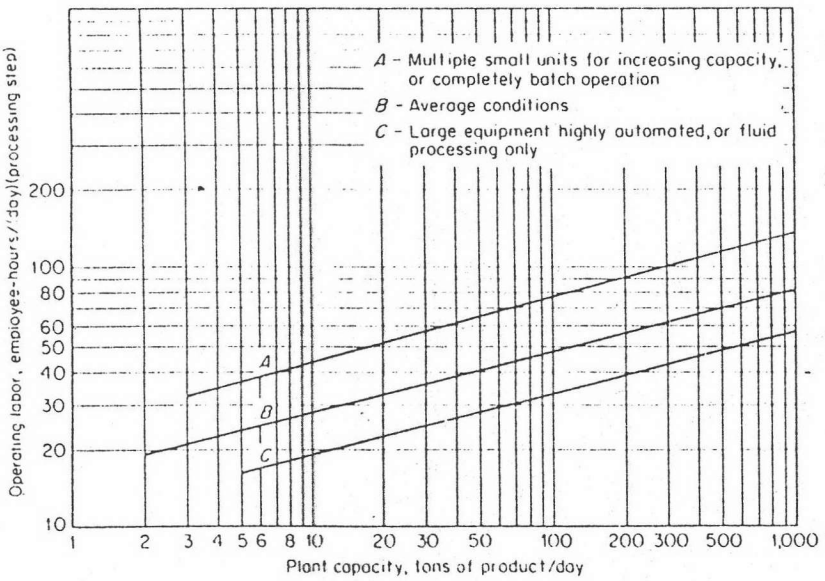


Figure C.1 Operating labor requirements for chemical process industries.

Refined wax plant

A capacity 100 bpd was equal to 14 ton / d.

There is 6 steps for this process.

1. Solution
2. Filtration
3. Washing
4. MIBK recovery
5. Percolation
6. Clay regeneration

The process plant was considered to require six process steps. From Fig. C.1, for a capacity of 14 tons product / day , the fluid process plant required 20 employee - hours / day / processing step. Thus, for 300 days annual operation, operation labor required = (6) (20)(300) = 36,000 employee - hours / year.

If wage rate was 1 US$ / h.

Labor cost = 36,000 employee - hours / year x 1 US$ / h

= 36,000 US$ / y

= 0.036 Million US$ / y

Product

Domestic cost = CIF + 20 % tax

Utilities cost

Table C.2 Cost tabulation for selected utilities and labor

1989 costs based on U.S. Gulf Coast location

	Cost
Steam costs	
Exhaust, $/1000 lb	1.10
Pressure of 100 psig, $/1000 lb	2.40
Pressure of 500 psig, $/1000 lb	3.60
Fuel costs	
Gas at well head including gathering-system costs:	
Existing contracts, $/million Btu	2.40
New contracts, $/million Btu	3.00
Fuel oil in $/million Btu with 6.25 million Btu/bbl	3.00
Gas transmission costs in ¢/100 miles	7.30
Plant fuel gas in $/million Btu	3.20
Purchased power for midcontinent USA in ¢/kWh	7.00
Water costs	
Process water (treated) in ¢/1000 gal	80
Cooling water in ¢/1000 gal (tower or river)	10
Labor rates	
Supervisor, $/h	28.00
Operators, $/h	21.00
Helpers, $/h	17.40
Chemists, $/h	20.00
Labor burden as % of direct labor§	25
Plant general overhead as % of total labor + burden	40

VITA

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