Annexure-I

List of Products

Sr. No.	Products	Production Capacity, MT/Month		
		Existing	Proposed	Total after expansion
1.	Edible oil	585	00	585
2.	De-oil cake	2600	00	2600
3.	Refined edible oil	520	00	520
4.	Hydrogenated vegetable oil	650	00	650
5.	Vegetable blown oil	312	00	312
6.	Dimmer Acid	00	100	100
7.	Ricinoleic Acid (RA)	00	400	400
8.	12 Hydroxy Stearic Acid (HSA)	00	500	500
9.	Dehydrated Castor Oil Fatty Acid	00	140	140
10.	Blown Castor Oil (BCO)	00	100	100
11.	Sulphonated Castor Oil (SCO)	00	100	100
12.	Hydrogenated Castor Oil (HCO)	00	900	900
13.	Glycerine	00	133	133
14.	Sodium Sulfate	00	220	220
	Total	**4667**	**2593**	**7260**

List of Raw Materials for proposed products

Sr. No.	Name of the Products	Name of Raw Materials	Quantity MT/Month
1	Dimer Acid (100 MT/Month)	Distilled Fatty Acid	100.0
		Gallion Earth	0.80
		Phosphoric Acid	0.60
2	Ricinoleic Acid (400 MT/Month)	Refined Castor Oil	417.60
		NaOH Lye 48%	110.0
		Sulfuric Acid 30%	200.0
3	Hydroxy Stearic Acid (12 HSA) (500 MT/Month)	Hydrogenated Castor Oil	521.0
		NaOH Lye 48%	139.0
		Sulfuric Acid 30%	247.50
4	Dehydrated Castor Oil	Castor Oil	145.46

	(140 MT/Month)	H_2SO_4	0.84
5	Blown Castor Oil (100 MT/Month)	Castor Oil	95.10
6	Sulfonated Castor Oil (100 MT/Month)	Castor Oil	75.50
		Sulfuric Acid	24.00
		Caustic Soda	10.00
7	Hydrogenated Castor oil (900 MT/Month)	Castor Oil	895.50
		Nickel	0.45
		Hydrogen Gas	6.30

Annexure -II

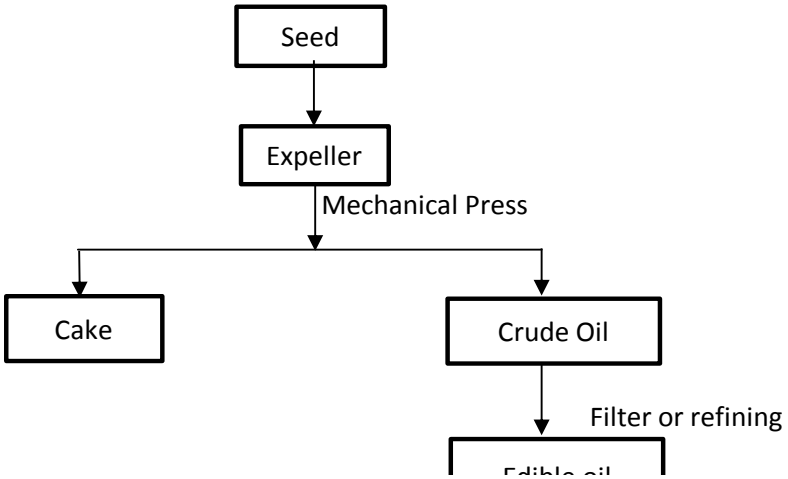
Manufacturing Process

MANUFACTURING PROCESS OF EXISTING PRODUCTS

1) Edible Oil

- ✓ First of all take various types of edible seeds as per requirement & season by weight into oil mill.
- ✓ Crush the seeds into expeller machine. So, the cake & oil will be formed.
- ✓ Oil is stored in storage tank & dispatch directly as expeller oil & cake is either sale directly to open market or sent to solvent extraction plant.

Flow diagram of Edible Oil

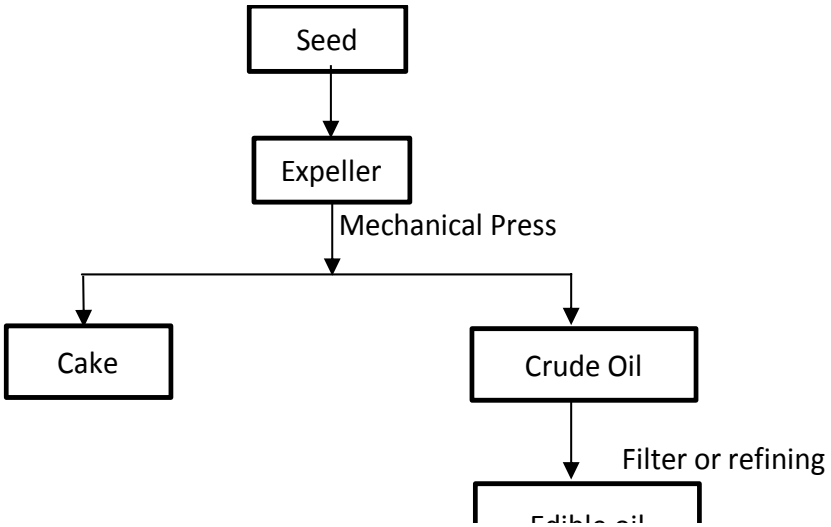


2) De-oil cake &

3) Refined Edible Oil

- ✓ In this process cake from oil mill having 6-7 % oil content is taken into solvent extraction plant where it is being treated with n-hexane (food grade) to get solvent extraction & get edible Oil.
- ✓ The Oil is further distilled out under vacuum to get raw oil & vapors are taken to condensers to recover solvent which is being reused for the nect batch process. De-oiled cake is heated with steam to remove the hexane from cake and recover solvent.

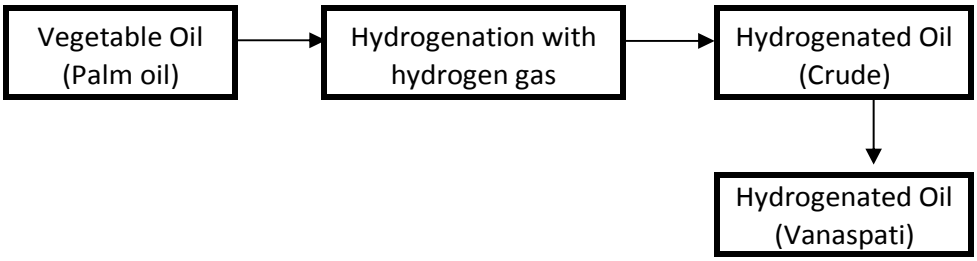
Flow diagram of De-oil cake & Refined Edible Oil



4) Hydrogenated Vegetable Oil

This is a process in which hydrogen gas is bubbled through a liquid oil such as refined oil or vegetable oil like palm oil in the presence of nickel catalyst when process is completely filter the oil.

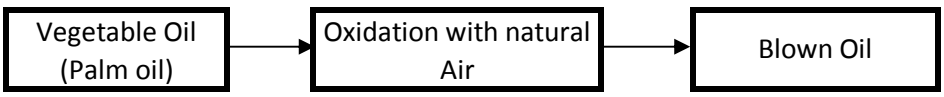
Flow diagram of Hydrogenated Vegetable Oil



5) Vegetable Blow oil (Oxidation)

This is a process in which vegetable oil is heated up to 6-8 hours after air is passed in the same and by oxidation process Blown Oil is made.

Flow diagram of Blow Oil



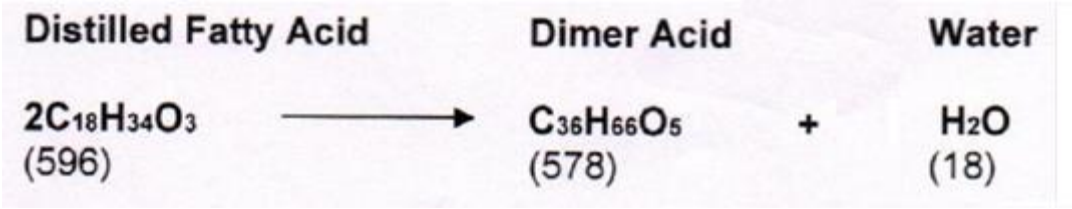
MANUFACTURING PROCESS OF PROPOSED PRODUCTS

1. Dimer Acid

Manufacturing Process:

Take distilled fatty acid in clean and dry reactor. Start stirrer and heating. Add gallion earth as catalyst. Raise temperature up to 240°C and continue it for 6 hours. Then add phosphoric acid into reactor & allow it to mix for 1 hr. Cool to 100°C and filter it. After filtration, start distillation and collect dimer acid and monomer.

Chemical Reaction:



Mass Balance:

MASS BALANCE OF DIMER ACID

INPUT	KG		OUTPUT	KG
Distilled Fatty Acid	1000	→ Reaction		
Gallion Earth	8	→ Reaction		
		Heat at 240°C		
Phosphoric Acid	6	→ Intermediate Prodcut		
		Filtration	→ Suldge	14
		Distillation	→ **Dimer Acid**	**1000**
TOTAL	**1014**			**1014**

2. Recinoleic Acid (RA)

Manufacturing Process:

Refined castor oil (RCO) is charged to the saponification-acidulation reactor followed by hot water addition. Reactor temperature is maintained at 100°C. Caustic lye is added gradually to saponify castor oil.

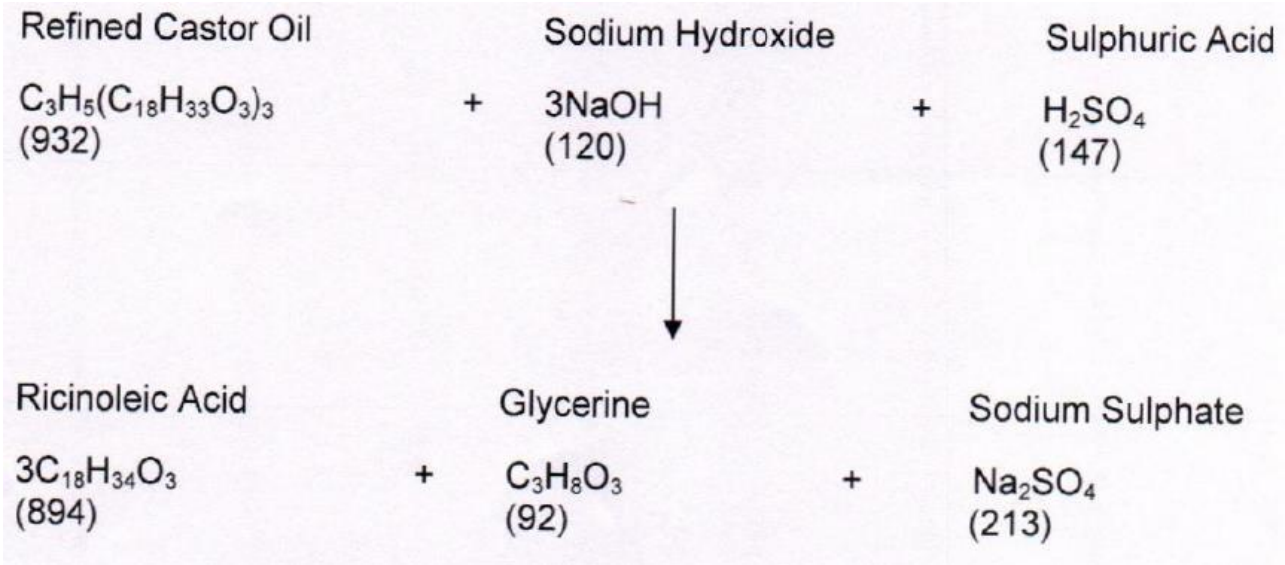
Castor oil soap sample is drawn and analyzed for acid value, on achieving acid value of 180 KOH/mg, the saponification is complete. The reaction mass is settled and heated. Then sulfuric acid is added to acidify the material.

On completion of acidification, the reaction mass is settled. The settles mass is drained and collect as sweet water and sent to evaporation plant for Glycerin and sodium sulfate.

The ricinoleic acid mass in the reactor is subjected to hot water wash of equivalent volume and allowed to settle. The settled mass is drained and sent to evaporation plant for Glycerin and Sodium sulfate recovery.

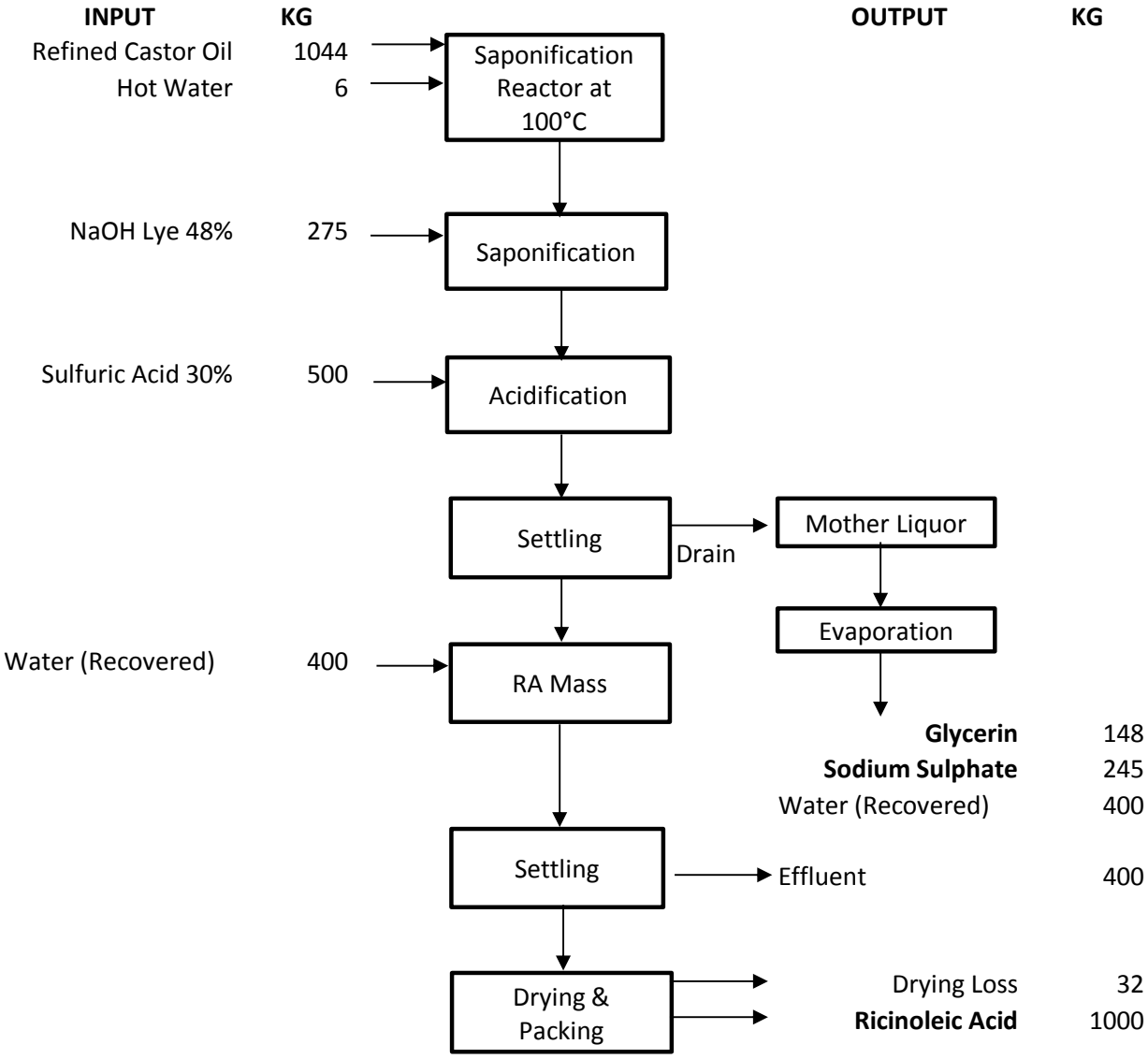
The mass in the reactor is then sent to vaccum dryer. After drying RA packed in drum or store in storage tank.

Chemical Reaction:



Mass Balance:

MASS BALANCE OF RICINOLEIC ACID



3. 12 Hydroxy Stearic Acid (12HSA)

Manufacturing Process:

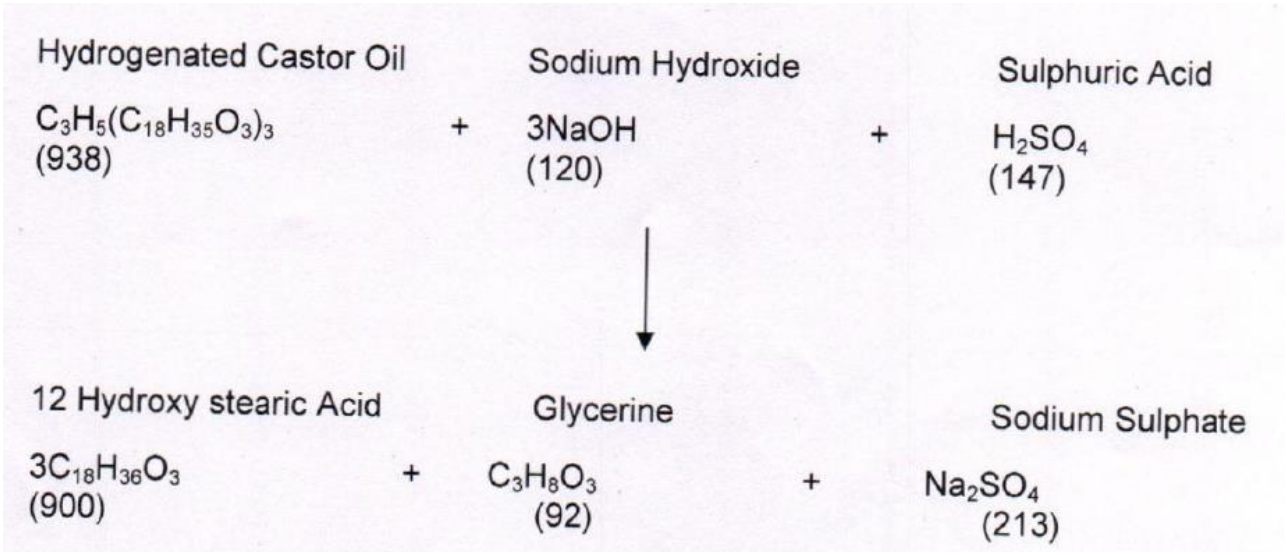
Hydrogenated castor oil (HCO) is charged to the saponification-acidulation reactor followed by hot water addition. Reactor Temperature is maintained at 100°C. Caustic lye is added gradually to saponify HCO. HCO soap sample is drawn and analyzed for acid value, on achieving acid value of 180mg KOH/mg, the saponification is complete. The reaction mass is settled and heated. Then sulfuric acid is added to acidify the material.

On completion of acidification, the reaction mass is settled. The settled mass is drained and collected as sweet water and sent to evaporation plant for Glycerin and sodium sulfate.

The 12 hydroxy stearic acid mass in the reactor is subjected to hot water wash of equivalent volume and allowed to settle. The settles mass is drained and sent to evaporation plant for Glycerin and sodium Sulfate recovery.

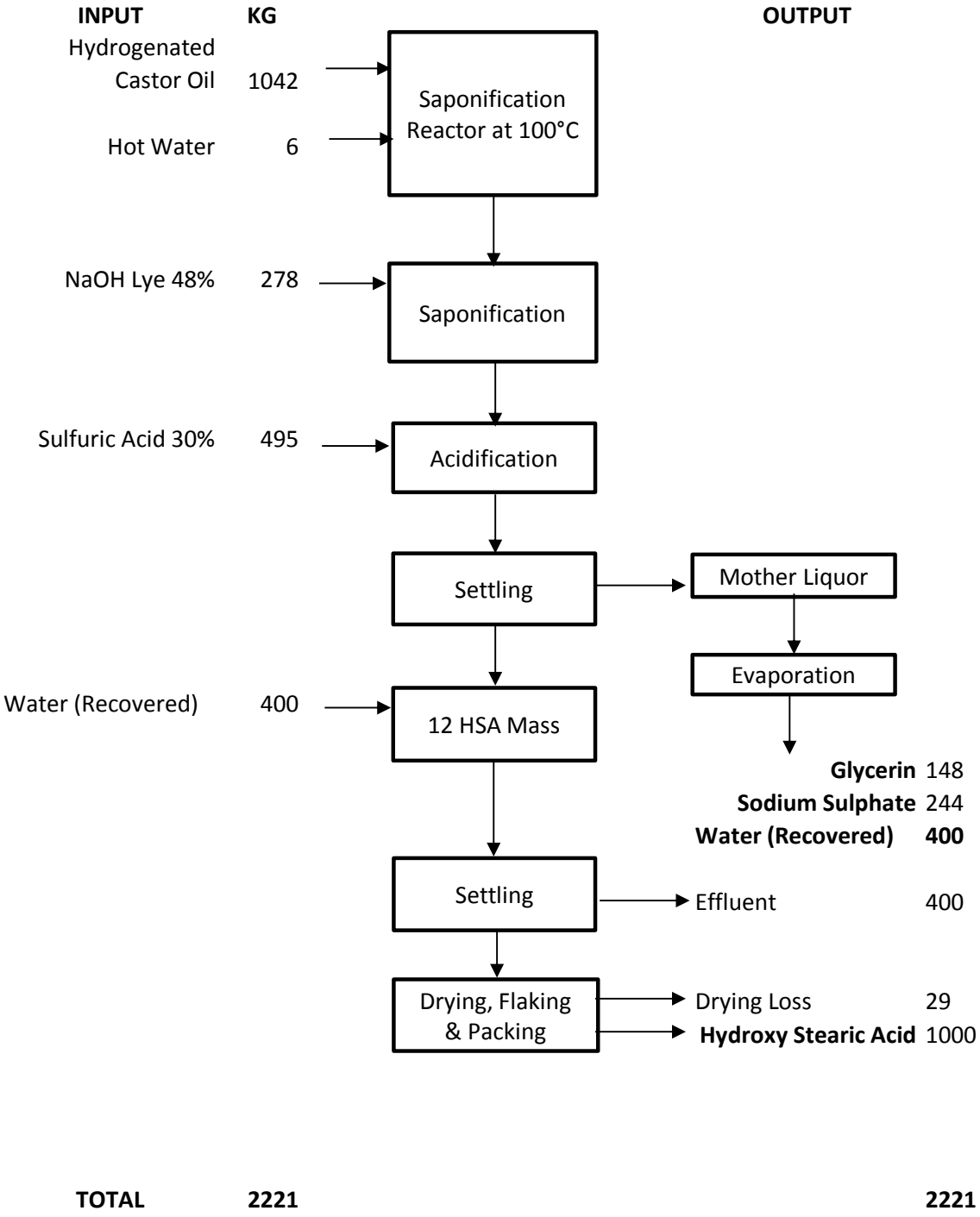
The mass in the reactor is then sent to vaccum dryer and flaker. The flaked 12 hydroxy stearic acid packed in bags and stored in godown.

Chemical Reaction:



Mass Balance:

MASS BALANCE OF HYDROXY STEARIC ACID (12 HSA)



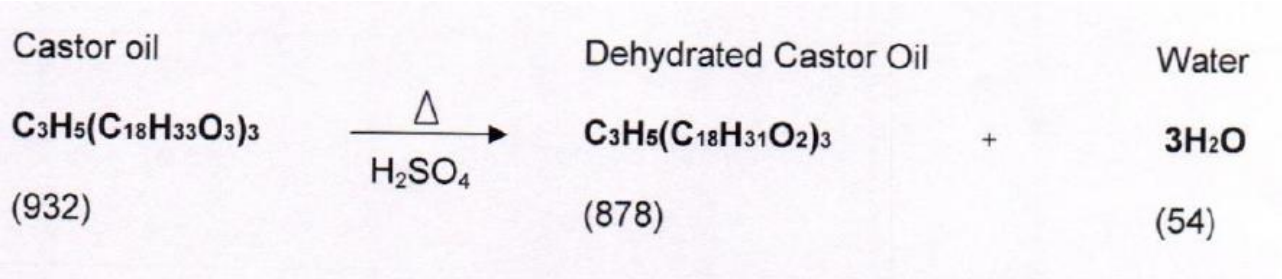
TOTAL	**2221**		**2221**

4. Dehydrated Castor oil (DCO)

Manufacturing Process:

Charged Castor oil in thermic fluid heater reactor, apply vaccum and raise temperature until it reached to required temperature. Add required quantity of catalyst (sulfuric acid) gradually. After completion of reaction, cool the material under vaccum below 70°C and transfer it to settling tank and finally to storage tank.

Chemical Reaction:



Mass Balance:

MASS BALANCE OF DEHYDRATED CASTOR OIL

INPUT	KG		OUTPUT	KG
Castor Oil	1039	→ Thermic Fluid Heater Reactor		
H_2SO_4	6	→ Thermic Fluid Heater Reactor		
		Heat at 240°C Under Vaccum		
		Cooling		
		Settling tank	→ Effluent	45
		Packing & Storage	→ Dehydrated Castor Oil	1000
TOTAL	**1045**			**1045**

5. Blown Castor oil (BCO)

Manufacturing Process:

Charge castor oil in reactor. Raise temperature gradually to required temp. 150°C. Start blowing air through sparger. Continue reaction and draw sample at regular time interval up to require viscosity. Stop heating and air blowing, cool and pack material as per requirement in barrel or other alternate.

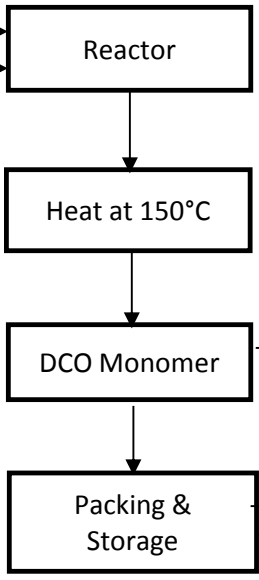
Chemical Reaction:

Castor oil		Oxygen		Blown Castor oil
$C_3H_5(C_{18}H_{33}O_3)_3$ (932)	+	$3O_2$ (48)	⟶	$[C_3H_5(C_{18}H_{33}O4)_3]_N$ (980)

Mass Balance:

MASS BALANCE OF BLOWN CASTOR OIL

INPUT	KG	OUTPUT	KG
Castor Oil	951		
Air	70		
		Non Condensable Air	21
		Loss	
		Blown Castor Oil	1000
TOTAL	**1021**		**1021**



6. Sulfonated Castor oil (SCO)

Manufacturing Process:

Charge castor oil in clean and dry reactor, start cooling and maintain temperature of oil to 70-80°C. Start addition of H_2SO_4 gradually with care as reaction is exothermic.

Maintain temperature to 70-80°C until H_2SO_4 addition is completed. Allow stirring for 2 hrs. After two hours, stop stirring and allow the mass to settle for 4-5 hrs. Finally neutralize the batch with caustic soda.

Chemical Reaction:

Castor Oil		Caustic Soda		Sulfuric Acid		Sulfonated Castor Oil		Water
$C_3H_5(C_{18}H_{33}O_3)_3$	+	3NaOH	+	$3(H_2SO_4)$	→	$C_{57}H_{101}Na_3O_{18}S_3$	+	$6H_2O$
(932)		(120)		(294)		(1238)		(108)

Mass Balance:

MASS BALANCE OF SULFONATED CASTOR OIL

INPUT	KG		OUTPUT	KG
Castor Oil	755	→ Reactor		
Sulfuric Acid	240	→ Reactor		
		Reactor → Maintain Temp. 70° - 80C		
		Maintain Temp. 70° - 80C → Neutralization		
Caustic Soda	100	→ Neutralization	Effluent	95
		Neutralization → Packing & Storage		
		Packing & Storage →	**Sulfonated Castor Oil**	1000
TOTAL	**1095**			**1095**

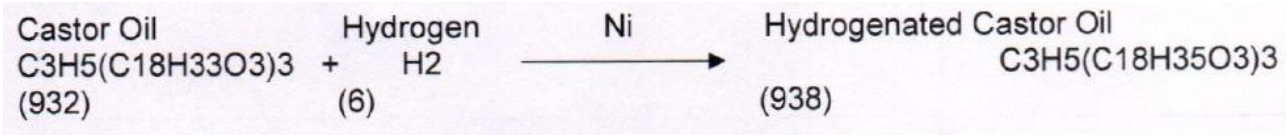
7. Hydrogenated Castor Oil (HCO)

Manufacturing Process:

Refined castor oil is charged in autoclave under vaccum and heated up to 110°C. Nickel is added into the autoclave as catalyst. The vaccum is closed and hydrogen valve is opened to charge of hydrogen gas at 10 Kg/cm2 in autoclave. The hydrogenation reaction being an exothermic reaction, the temperature in autoclave is maintained between 140-150°C. The hydrogenation process takes approximately 5 hrs. to complete.

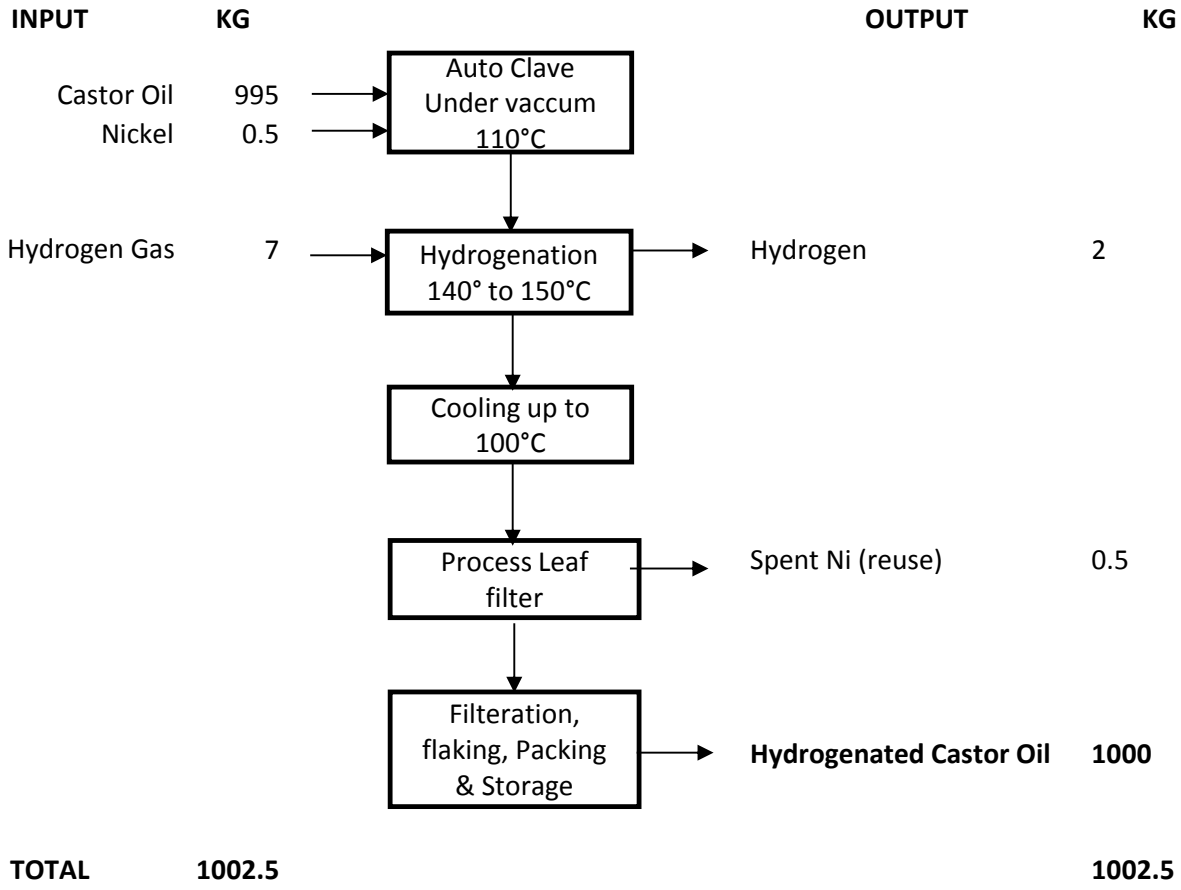
Collect sample and analyzed for iodine valve, on achieving iodine value below 3 units, the reaction mass is cooled to 100°C. The batch is filtered through pressure leaf filter to recover the nickel catalyst and transferred to storage tanks. The material from the storage tanks is transferred for manufacturing next derivatives or to flakers. The flakes material is then packed bags and stored in Godown.

Chemical Reaction:



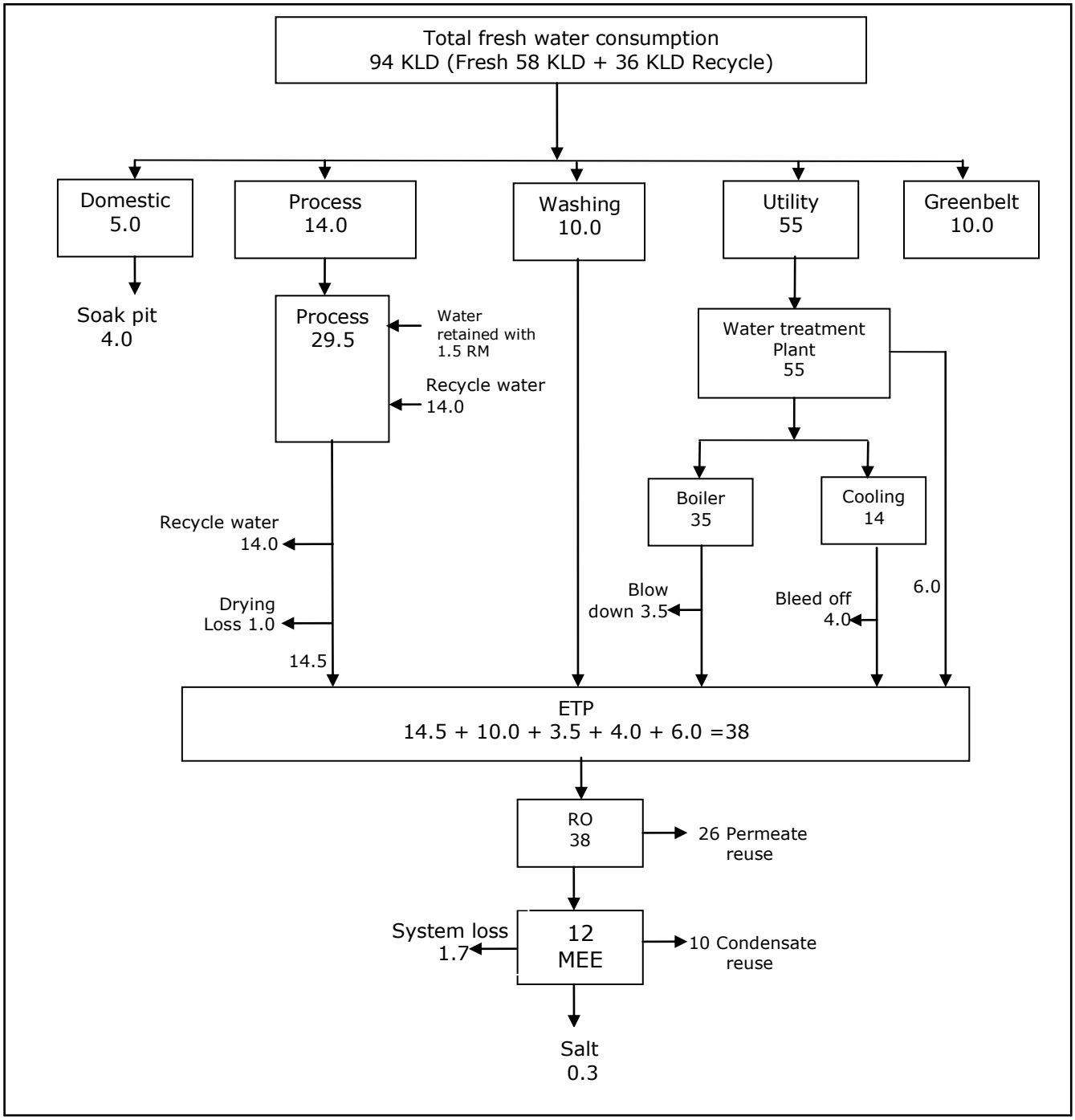
Mass Balance:

MASS BALANCE OF HYDROGENATED CASTOR OIL



Annexure-III

Water Balance Diagram



Water Consumption

Sr. No.	Source	Water Consumption Existing (KL/day)	Water Consumption After expansion (KL/day)
1.	**Domestic**	2.5	5.0
2.	**Green Belt**	5.0	10.0
3.	**Industrial**		
A	Process	2.0	14.0
B	Water treatment	3.0	6.0
C	Boiler	26.0	35.0
D	Cooling	7.0	14.0
E	Washing	6.0	10.0
	Total Industrial	**44.0**	**79.0**
	Total (1+2+3)	**51.5**	**94.0**
	Recycle water	**11.0**	**36.0**
	Fresh water requirement	**40.5**	**58.0**

Wastewater Generation

Sr. No.	Source	W/w Generation Existing (KL/day)	W/w Generation After expansion (KL/day)
1.	**Domestic**	2.0	4.0
2.	**Industrial**		
A	Process	1.0	14.5
B	Water treatment	0.0	6.0
C	Boiler	4.2	3.5
D	Cooling	1.0	4.0
E	Washing	4.8	10.0
	Total Industrial	**11.0**	**38.0**
	Total (1+2)	**13.0**	**42.0**

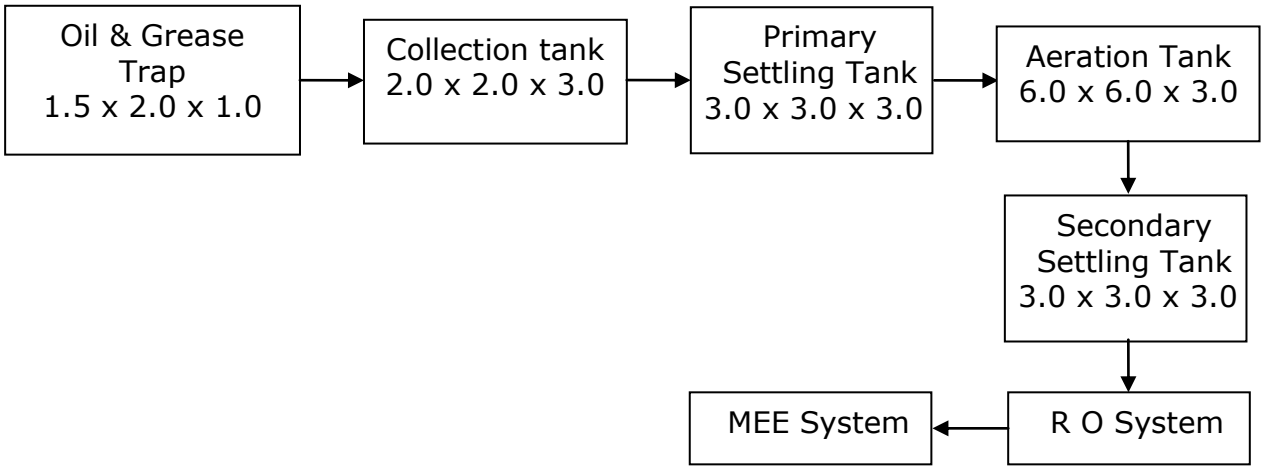
Waste water treatment:

- ✓ At present waste water generated from process, boiler and washing is treated in ETP comprising of primary and secondary treatment units. After treatment treated water is used for gardening purpose.
- ✓ Waste water generated from cooling will be directly utilized for cooling make up.
- ✓ After proposed expansion, waste water generated from process, boiler, cooling and washing will be treated ETP followed By RO. RO reject will be followed to MEE. RO permeate and MEE condensate will be reused in process and utilities. Thus, Unit is achieving ZLD. Sewage will be disposed of into soak pit though septic tank.

Annexure-III (A)

ETP Details

ETP flow diagram



Details of ETP unit

Sr. No.	Name of Unit	Size of the Unit in meter
1.	Oil & Grease Trap	1.5 x 2.0 x 1.0
2.	Collection Tank	2.0 x 2.0 x 3.0
3.	Primary settling Tank	3.0 x 3.0 x 3.0 1.5 SD
4.	Aeration Tank	6.0 X 6.0 X 3.0 2.5 WD
5.	Secondary Settling Tank	3.0 x 3.0 x 3.0 1.5 SD
6.	Sludge Drying Bed-2 Nos.	1.5 x 2.0 x 1.0
7.	RO system	2 KL/hr
8.	MEE	1 KL/hr

Annexure -IV

Details of Air Emissions

Sr. No.	Stack attached to	Fuel Type	Stack Height, Meter	Fuel Consumption	APC measures	Probable pollutants
Flue Gas Stack						
➢ **Existing**						
1.	Steam Boiler	Ground nut husk	30	15.0 MT/Day	Cyclone with settling chamber	PM<150mg/NM^3 SO_2<100 ppm NO_x<50 ppm
2.	Thermic fluid heater		30		Multi Dust Collector with settling Chamber	
3.	D. G. set (125KVA) (Stand by)	Diesel	6.0	10 Liter/Hr	Acoustic enclosure	
➢ **Proposed**						
No addition						

Annexure-V

Details of Hazardous Generation and Disposal

Sr. No.	Type of Hazardous Waste	Schedule	Quantity		Disposal method
			Existing	Total after expansion	
1	ETP Sludge MEE salt	35.1	0.2 MTPM 0.0 MTPM	1.0 MTPM 7.5 MTPM	Collection, storage, transportation and disposal at TSDF site.
2	Used oil,	5.1	11.0 liter/Year	500 liter/Year	Collection, storage, transportation and disposal by selling to registered re-processors.
3	Spent Catalyst (Nickel)	--	0.225 MT/Year	0.300 MT/Year	Collection, storage and sale to authorized recyclers.
4	Discarded containers/ liners	33.1	400 Nos./Month 0.5 MT/Month	500 Nos./Month 0.75 MT/Month	Collection, storage and sale to authorized venders/recyclers