Annexure-I

Production Capacity

Sr. No.	Name of product	Quantity (MT/month)		
		Existing	Proposed	Total
1.	2,4-D Sodium Salt	173	00	173
2.	2,4-D Acid Technical	141	00	141
3.	2,4-D Amine Salt	150	00	150
4.	2,4-D Ethyl Ester Technical	50	00	50
5.	Clodinfaop- Propargyl Chloride Technical	1.7	00	1.7
6.	Lambda Cyhalothrin Technical	1.7	00	1.7
Herbicides				
7.	Glyphosate	00	50	50
8.	Pretilachlor	00	20	20
9.	Atrazine	00	10	10
10.	Imizathypr	00	10	10
11.	Sulphosulpron	00	2.5	2.5
12.	Metsulphron	00	2.5	2.5
13.	Metribuzin	00	10	10
14.	Quizalafop - p- ethyl	00	10	10
15.	Oxyflurofen	00	10	10
16.	Pendimathalien	00	20	20
17.	Bispyribac Sodium	00	10	10
Insecticides				
18.	Diafenthuron	00	20	20
19.	Imidacloroprid	00	10	10
20.	Acetamiprid	00	10	10
21.	Thiamethoxam	00	10	10
22.	Cypermethrin	00	20	20
23.	Permethrin	00	10	10
24.	Delta cypermethrin	00	10	10
25.	Buprofezin	00	10	10
26.	Fipronil	00	10	10

27.	Thiophenate methyl	00	10	10
28.	Emamectin benzoate	00	10	10
29.	Bifenthrin	00	10	10
30.	DDVP	00	10	10
31.	Chlorpyriphos	00	20	20
32.	Indoxacarb	00	05	05
33.	Novaluron	00	10	10
34.	Fenpyroximate	00	10	10
Fungicides				
35.	Azoxystrobin	00	15	15
36.	Tricyclozole	00	10	10
37.	Hexacanazole	00	10	10
38.	Mancozeb	00	150	150
39.	Metalexyl	00	10	10
40.	Diafenaconzole	00	10	10
41.	Propiconazole	00	10	10
42.	Tebuconazole	00	10	10
Intermediates				
43.	MPBD	00	25	25
	Total	**517.4**	**600.0**	**1117.4**
By-Products				
1	HCl (28 to 30%)	100	50	150
2	Recovered Di Chloro Phenol (30%)	60	00	60
	Total	**160**	**160**	**210**

Pesticides Formulation		**Existing MT/Annum**	**Propose MT/Annum**	**Total MT/Annum**
Pesticide (Fungicides, Herbicides & Insecticides)				
1	Liquid	**12300**	**0**	**12300**
2	Powder	**5500**	**0**	**5500**
3	Granule	**2200**	**0**	**2200**

List of Raw Materials

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
2,4-D Sodium Salt – 173 MT/month				
1	Phenol	77	00	**77**
2	Chlorine	117.3	00	**117.3**
3	Mono Chloro Acetic Acid	74.4	00	**74.4**
4	Caustic Lye	149	00	**149**
2,4-D Acid -141 MT/Month				
1	HCl	80.37	00	**80.37**
2	2,4- D Sodium salt	169.2	00	**169.2**
2,4-D Amine -150 MT/Month				
1	2,4-D Acid	89.2	00	**89.2**
2	Dimethyl Amine (40%)	58.5	00	**58.5**
3	Oxalic Acid	2.25	00	**2.25**
2,4-D Ethyl Ester-50 MT/Month				
1	2,4-D Acid	45	00	**45**
2	Ethyl Alcohol	9.8	00	**9.8**
3	Sulphuric Acid	25	00	**25**
Clodinafop Propargyl Chloride-1.7 MT/Month				
1	R-2-4 Hydroxy Phenoxy Propionic Acid	0.89	00	**0.89**
2	DMF	0.51	00	**0.51**
3	Potassium Carbonate	1.46	00	**1.46**
4	Pyridine	0.75	00	**0.75**
Lambda Cyhalothrin Technical-1.7 MT/Month				
1	MPBAD	0.8	00	**0.8**
2	TP Acid Chloride	1.1	00	**1.1**
3	NaCN	0.22	00	**0.22**
4	n-Hexane	4.25	00	**4.25**
5	Soda ash soln for 5%	1.7	00	**1.7**
6	Cyhalothrin Oil	1.8	00	**1.8**
7	IPA-Solvent	1.8	00	**1.8**
8	Sodium Hypochlorite	2.55	00	**2.55**
Glyphosate-50 MT/month				
1	PMIDA	00	42.5	**42.5**
2	Carbon catalyst	00	0.3	**0.3**
3	Hydrogen Peroxide	00	21.3	**21.3**
4	SMBS	00	0.3	**0.3**
Pretilachlor-20 MT/month				
1	DEPA	00	13.6	**13.6**
2	Chloro Acetyl chloride	00	9.3	**9.3**

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
3	Hexane	00	22.2	**22.2**
4	Ammonia gas	00	1.0	**1.0**
Atrazine-10 MT/month				
1	Toluene	00	0.5	**0.5**
2	Cynuric chloride	00	9.0	**9.0**
3	Isopropyl amine	00	4.4	**4.4**
4	Mono ethyl amine	00	3.2	**3.2**
5	Caustic Soda	00	4.1	**4.1**
Imizathypr-10 MT/month				
1	Diethyl 5 Ehtylpyridine dicarboxylate	00	8.2	**8.2**
2	2-Amini 2,3 dimethyl Butane amide	00	5.2	**5.2**
3	Sodium ethoxide	00	4.9	**4.9**
4	Toluene	00	1.2	**1.2**
5	HCl 30%	00	9.3	**9.3**
6	Ethanol	00	2.0	**2.0**
Sulphosulphron-2.5 MT/month				
1	Dichloromethane	00	0.5	**0.5**
2	ESPO	00	1.8	**1.8**
3	ADCP	00	1.6	**1.6**
4	TEA	00	1.0	**1.0**
5	HCl 30%	00	1.1	**1.1**
Metsulphron-2.5 MT/month				
1	O-sulfo isocyante Methyl Benzoate	00	1.6	**1.6**
2	2-Amino 4-methoxy 6-methyl 1,3,5 Triazine	00	0.9	**0.9**
3	Toluene	00	0.3	**0.3**
Metribuzin-10 MT/month				
1	Sulphuric acid	00	12.5	**12.5**
2	Triazinone	00	4.1	**4.1**
3	Dimethyl sulphate	00	6.8	**6.8**
4	Soda ash	00	18.7	**18.7**
Quizalafop - p- ethyl- 10 MT/month				
1	Hydroquinone	00	3.5	**3.5**
2	Toluene	00	0.8	**0.8**
3	potessium hydroxide	00	4.1	**4.1**
4	N,N-Dimethylformamide	00	0.7	**0.7**
5	Ethyl-a-chloropropionate	00	4.4	**4.4**
6	2,6-dichloro quinoxaline	00	5.8	**5.8**
Oxyflurofen- 10 MT/month				

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
1	Potassium hydroxide	00	3.3	**3.3**
2	Ethanol	00	2.7	**2.7**
3	1,3- bis(2-chloro-α,α,α-trifluoro-p-tolyloxy)-4-nitrobenzene	00	16.7	**16.7**
4	Dioxane	00	2.7	**2.7**
5	Hexane	00	10.0	**10.0**
6	Isopropanol	00	3.3	**3.3**
Pendimathalien-20 MT/month				
1	Di Ethyl Ketone	00	5.0	**5.0**
2	4 NOX	00	10.4	**10.4**
3	Hydrogen	00	0.8	**0.8**
4	caustic lye	00	9.0	**9.0**
5	EDC	00	1.0	**1.0**
6	Hexane	00	0.8	**0.8**
7	Nitric acid	00	15.5	**15.5**
8	Sulphuric acid	00	7.5	**7.5**
9	HCl	00	1.2	**1.2**
10	Soda Ash	00	1.6	**1.6**
Bispyribac Sodium-10 MT/month				
1	2-MSDMP	00	11.7	**11.7**
2	2,6-DHBA	00	30.0	**30.0**
3	TBAB	00	0.3	**0.3**
4	Caustic Soda	00	3.3	**3.3**
5	Toluene	00	6.7	**6.7**
Diafenthiuron-20 MT/month				
1	Xylene	00	1.1	**1.1**
2	DIPBA	00	14.3	**14.3**
3	NaSCN	00	5.4	**5.4**
4	HCl 30%	00	7.7	**7.7**
5	Tert-butylamine	00	4.3	**4.3**
Imidacloroprid-10 MT/month				
1	CCMP	00	9.3	**9.3**
2	N-NII	00	7.4	**7.4**
3	DMF	00	1.1	**1.1**
4	Catalyst	00	0.1	**0.1**
5	Na2CO3	00	9.9	**9.9**
6	Methanol	00	0.2	**0.2**
7	caustic lye	00	1.0	**1.0**
Acetamiprid-10 MT/month				
1	NCMA	00	5.2	**5.2**

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
2	CMAMP	00	7.0	**7.0**
3	Methanol	00	0.5	**0.5**
Thiamethoxam-10 MT/month				
1	CCMT	00	7.7	**7.7**
2	MNIO	00	7.3	**7.3**
3	DMF	00	7.0	**7.0**
4	K2CO3	00	8.5	**8.5**
5	80% methanol	00	3.7	**3.7**
Cypermethrin-20 MT/month				
1	CMAC	00	12.0	**12.0**
2	MPB	00	9.4	**9.4**
3	NaCN	00	3.0	**3.0**
4	PTC	00	0.2	**0.2**
5	Hexane	00	1.0	**1.0**
Permethrin-10 MT/month				
1	MPBAL	00	5.8	**5.8**
2	CMAC	00	6.5	**6.5**
3	n-Hexane	00	1.5	**1.5**
4	Soda Ash	00	1.0	**1.0**
5	caustic lye	00	0.5	**0.5**
Delta cypermethrin-10 MT/month				
1	Ester of Bicisthemic Acid	00	5.2	**5.2**
2	caustic soda	00	2.6	**2.6**
3	Thionyl chloride	00	1.5	**1.5**
4	M-phenoxy benzaldehyde	00	4.8	**4.8**
5	Sodium cynide	00	1.5	**1.5**
6	DMF	00	0.2	**0.2**
7	Hypo solution	00	3.4	**3.4**
8	IPA	00	0.3	**0.3**
Buprofezin-10 MT/month				
1	1-isopropyl 3-t-butyl thiourea	00	4.8	**4.8**
2	N-chloromethyl N-phenyl carbamoyl chloride	00	6.5	**6.5**
3	MCB	00	1.1	**1.1**
4	ammonium bicarbomate	00	23.5	**23.5**
5	Methanol	00	0.8	**0.8**
Fipronil-10 MT/month				
1	CF3COOH	00	1.0	**1.0**
2	Monochloro benzene	00	0.3	**0.3**
3	H_2O_2	00	10.4	**10.4**
4	Thiopyrazole derivative	00	25.0	**25.0**

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
Thiophenate methyl-10 MT/month				
1	EDC	00	1.0	**1.0**
2	Sodium thiocynate	00	5.0	**5.0**
3	Methyl chloro formate	00	3.5	**3.5**
4	OPDA	00	3.8	**3.8**
Emamectin benzoate-10 MT/month				
1	streptomycess avermitis	00	5.2	**5.2**
2	anthelminic	00	11.4	**11.4**
3	acaricidal	00	8.1	**8.1**
4	Methyl amine	00	1.4	**1.4**
5	Methyl benzoate	00	2.9	**2.9**
6	Methanol	00	1.9	**1.9**
Bifenthrin-10 MT/month				
1	MTH acid	00	6.1	**6.1**
2	BPC	00	5.6	**5.6**
3	DMF	00	0.6	**0.6**
4	K_2CO_3	00	1.9	**1.9**
5	Hexane	00	0.5	**0.5**
6	10% $NaHCO_3$	00	0.8	**0.8**
7	Methanol	00	0.5	**0.5**
DDVP-10 MT/month				
1	Chloral	00	7.4	**7.4**
2	TMP	00	5.6	**5.6**
Chlorpyriphos-20 MT/month				
1	Sodium Salt of trichloroPyridinol	00	15.6	**15.6**
2	Diethyl ThioPhosphoryl Chloride	00	10.8	**10.8**
3	EDC	00	1.6	**1.6**
4	caustic lye 48%	00	1.1	**1.1**
Indoxacarb-05 MT/month				
1	Methyl 7-Chloro-2,5-dihydroindeno [1,2-e][1,3,4] oxadiazine-4a(3H)-carboxylate	00	3.0	**3.0**
2	Methyl (Chlorocarbonyl) [4-(trifluoromethoxy) phenyl] carbamate	00	1.5	**1.5**
3	caustic lye	00	0.4	**0.4**
Novaluron -10 MT/month				
1	2,6-difluoro benzoyl isocyanate	00	3.4	**3.4**
2	2-chloro-4-amino phenoxy	00	8.2	**8.2**

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
	ether			
3	Monochloro benzene	00	5.5	**5.5**
4	toluene	00	0.2	**0.2**
Fenpyroximate-10 MT/month				
1	H- pyrazole-4-carboxaldehyde, 1, 3-dimethyl-5-phenoxy-oxime	00	8.8	**8.8**
2	tertiary butyl-4-(chloro methyl benzoate	00	3.0	**3.0**
3	Potassium Hydroxide	00	2.3	**2.3**
4	DMF	00	1.8	**1.8**
Azoxystrobin-15 MT/month				
1	2,6 Dichloro pyrimidine	00	6.0	**6.0**
2	DMF	00	0.8	**0.8**
3	MHPMP	00	8.3	**8.3**
4	potassium carbonate	00	13.5	**13.5**
5	Cyano phenol	00	4.8	**4.8**
6	Cuprus chloride	00	0.2	**0.2**
7	Caustic soda	00	0.4	**0.4**
8	Hexane	00	0.8	**0.8**
9	Dichloromethane	00	1.2	**1.2**
Tricyclozole-10 MT/month				
1	HMBT	00	9.8	**9.8**
2	Formic acid	00	2.9	**2.9**
3	Caustic lye	00	0.5	**0.5**
Hexacanazole-10 MT/month				
1	Dimethyl sulphate	00	5.0	**5.0**
2	sodium sulphide	00	0.3	**0.3**
3	DCVP	00	7.4	**7.4**
4	potassium hydroxide	00	3.0	**3.0**
5	DMF	00	0.5	**0.5**
6	1,2,4 Triazole	00	2.6	**2.6**
7	Potesium Carbonate	00	0.50	**0.50**
Mancozeb-150 MT/month				
1	EDA	00	29.7	**29.7**
2	NaOH	00	85.5	**85.5**
3	CS_2	00	77.3	**77.3**
4	$MnSO_4$	00	85.2	**85.2**
5	$ZnSO_4$	00	6.6	**6.6**
Metalexyl-10 MT/month				
1	Methoxy acetyl chloride	00	3.3	**3.3**

Sr. No.	Name of Raw Materials	Quantity (MT/month)		
		Existing	Proposed	Total
2	MDMPA	00	7.8	**7.8**
3	Hexane	00	0.3	**0.3**
4	caustic soda	00	0.3	**0.3**
Diafenaconzole-10 MT/month				
1	2-chloro-4-(4-chlorophenoxy) benzyl chloride	00	8.4	**8.4**
2	4-methyl-1, 3-dioxolane	00	2.9	**2.9**
3	Potassium Hydroxide	00	4.8	**4.8**
4	DMF	00	0.9	**0.9**
5	1,2,4-Triazole	00	2.1	**2.1**
6	K_2CO_3	00	0.5	**0.5**
Propiconazole-10 MT/month				
1	2,4-dichloro Benzyl Chloride	00	7.6	**7.6**
2	4-propyl-1, 3-dioxolane	00	3.9	**3.9**
3	Dimethyl Sulphide	00	11.1	**11.1**
4	Potassium Hydroxide	00	6.5	**6.5**
5	DMF	00	0.9	**0.9**
6	1,2,4-Triazole	00	2.4	**2.4**
7	K_2CO_3	00	0.5	**0.5**
8	Iso propanol	00	2.0	**2.0**
Tebuconazole-10 MT/month				
1	Dimethyl sulphate	00	5.0	**5.0**
2	sodium sulphide	00	0.3	**0.3**
3	1-(4-Chlorophenyl)-4, 4'-dimethyl-pent-3- one	00	7.4	**7.4**
4	Potassium Hydroxide	00	3.3	**3.3**
5	DMF	00	0.4	**0.4**
6	1,2,4-Triazole	00	2.5	**2.5**
7	K2CO3	00	0.4	**0.4**
MPBD-25 MT/month				
1	Benzaldehyde	00	18.8	**18.8**
2	AlCl3	00	30.3	**30.3**
3	EDC	00	1.3	**1.3**
4	Br	00	13.1	**13.1**
5	Cl2	00	6.8	**6.8**
6	formic acid	00	0.5	**0.5**
7	MEG	00	0.4	**0.4**
8	toluene	00	1.3	**1.3**
9	potassium hydroxide	00	8.8	**8.8**
10	phenol	00	13.8	**13.8**
11	Sulphuric acid	00	20.0	**20.0**

Sr. No.	Name of Raw Materials	Quantity (MT/Annum)		
		Existing	Proposed	Total
Pesticide Formulation-20000 MT/Annum				
Liquid pesticide – 12300 MT/Annum				
1	Technical Material	2740	0	2740
2	Fillers	3940	0	3940
3	Emulsifiers	1480	0	1480
4	Solvents	2960	0	2960
5	Wetting & Dispersing Agent	660	0	660
6	Stabilizer	260	0	260
7	Distilled Water	260	0	260
Powder – 5500 MT/Annum				
1	Technical	1910	0	1910
2	Intermediate	290	0	290
3	Filler	1430	0	1430
4	Wet & D. Ag.	1870	0	1870
Granules – 2200 MT/Annum				
1	Technical	660	0	660
2	Intermediate	440	0	440
3	Sand/B.Gr.	1100	0	1100

Annexure - II

Manufacturing Process

Existing products:

1. 2,4-D Sodium Salt Technical:

Manufacturing Process

2,4-D Sodium Salt technical is generally manufactured to contain 80% of 2,4-Dichlorophenoxy acetic acid (2,4-D).

2,4-D Sodium Salt technical is manufactures in two stages. In the first stage, 2-4-dichloro phenol is produced by reaction between phenol and chlorine. In the second stage, 2,4-D sodium is produced by reaction between Dichloro phenol, monochloro acetic acid and sodium hydroxide.

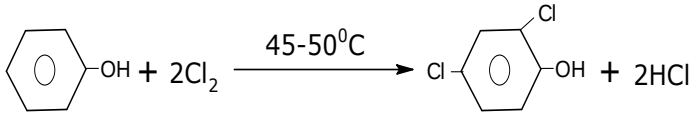
(I) In the first phase reaction, phenol is charged in a lead lined reactor and chlorine is passed through it. Chlorine reacts chemically with phenol and forms dichloro phenol. The gas stream coming out from the reactor, containing hydrochloric acid fumes and excess chlorine, is scrubbed with counter-current flow of water/dil. acid in a glass scrubber, to form bi-product hydrochloric acid (HCl).

(II) In second phase reaction, 2, 4-dichloro phenol is charged in an SS reactor. Now, MCA (Monochloro Acidic Acid) and NaOH (Caustic) are added slowly (6 hrs.) to the reactor with consist stirring. MCA and caustic react with Dichloro phenol and forms light pink coloured 2, 4-D sodium salt.

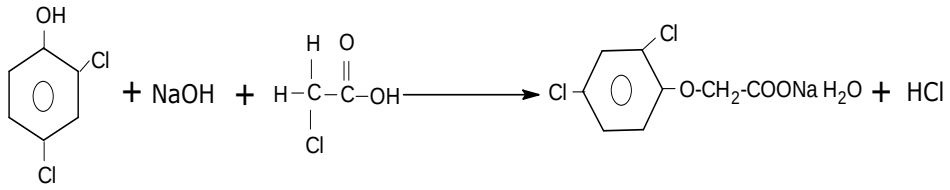
The reaction temperature is around 100^0C and pH 10 to 10.5. The product is allowed to cool down to about 65^0C, with the help of circulating cooling water, followed by transfer to cemented pits. After allowing 40 to 48 hours of stabilizing and setting, the product is separated from the mother liquor in a centrifuge and dried in a dryer. The dry product is ground in a pulverizer and packed in HDPE bags.

The mother liquor obtained from settling and centrifuge contains wastewater and different derivatives of phenol and raw materials. It is neutralized with HCl to separate the organic components, which settle down. The aqueous liquor is separated from the organic layer and sent to the ETP for treatment. The organic fraction is packed quantitatively in drums and disposed through sale to sister concern.

Chemical Reaction:



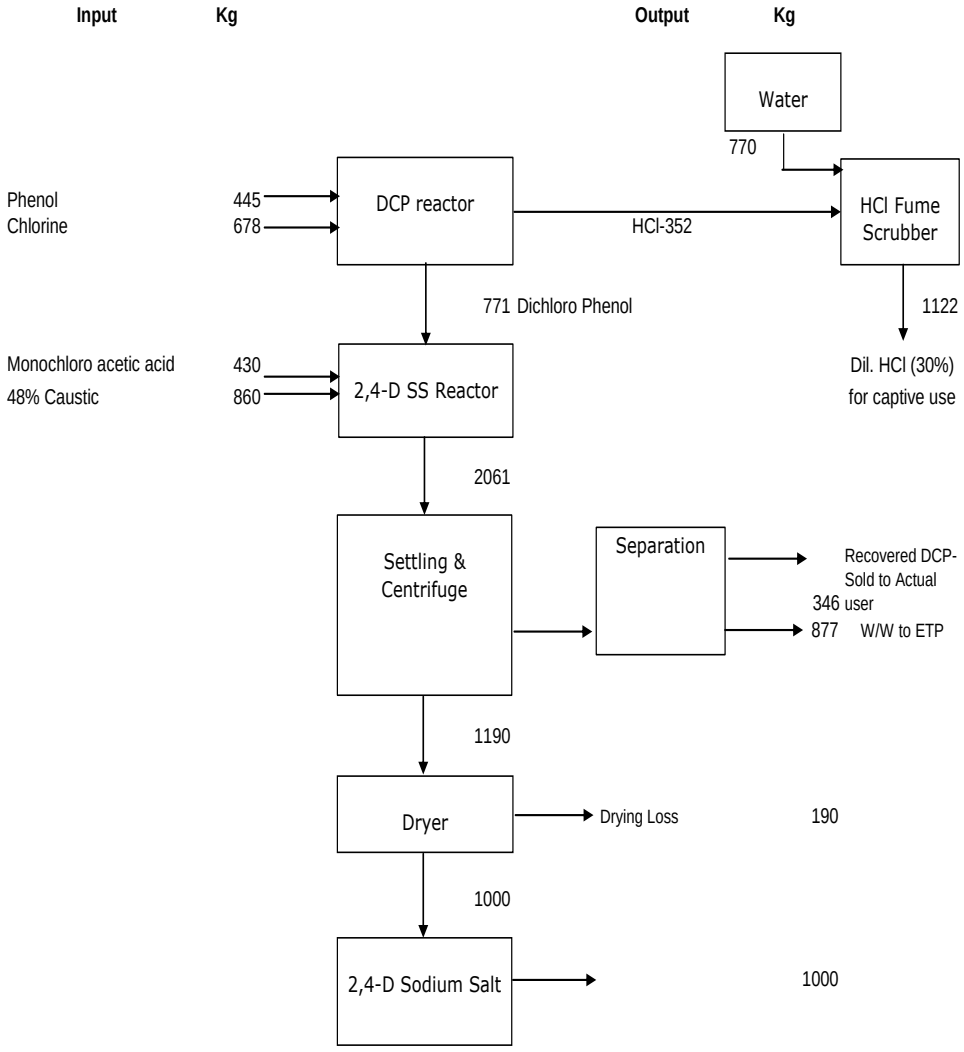
Phenol Chlorine 2,4-Dichloro Phenol Hydrochloric Acid



2,4-Dichloro Phenol Caustic MCA 2,4-D Sodium Salt Hydrochloric Acid

Mass balance and Process Flow Diagram:

2,4-D Sodium Salt



Total	2413		2413

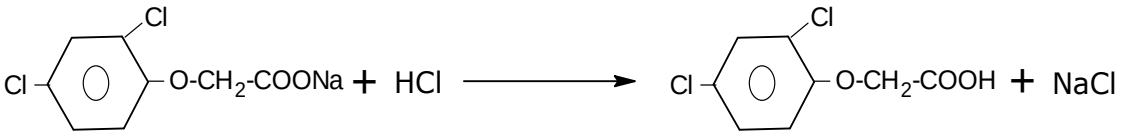
2. 2, 4-D Acid (Technical):

Manufacturing Process:

In the manufacturing process, 2,4-D Sodium Salt and water are charged in a rubber lined reactor. Now Hydrochloric acid (HCl) is added slowly with constant stirring for proper reaction. The addition of HCl is continued till the pH of the materials reaches to 2. In the reactor, HCl reacts with 2,4-D Sodium salt to form 2,4-D Acid (Tech.). Neither excess temperature nor catalyst is necessary in this reaction. The product is separated from the mother liquor in a rubber lined centrifuge and subsequently dried in a dryer. The dried product is ground with a Pulverizer and packed in HDPE bags.

Although the mother liquor (wastewater) is rich in HCl, its recycle to the reactor is prohibited by high concentration of NaCl. The mother liquor is, therefore, sent to the ETP for treatment and disposal.

Chemical Reaction:

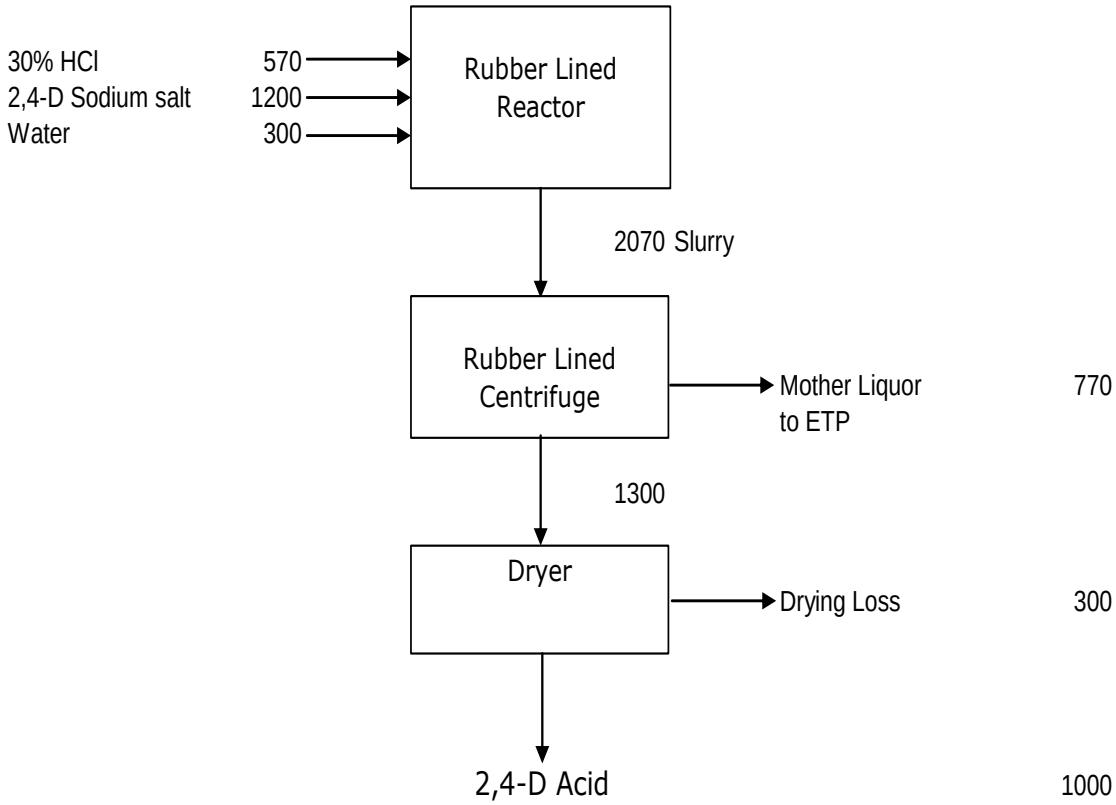


2,4-D Sodoum Salt	Hydrochloric Acid	2,4-D Acid	Sodium Chloride

Mass balance and Process Flow Diagram:

2,4-D Acid

Input	Kg	Output	Kg
30% HCl	570		
2,4-D Sodium salt	1200		
Water	300		
		Mother Liquor to ETP	770
		Drying Loss	300
		2,4-D Acid	1000
Total	**2070**		**2070**

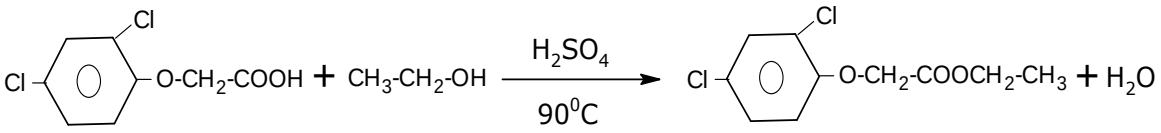


3. 2,4-D Ethyl Ester (Technical):

Manufacturing Process:

In the manufacturing process, ethyl alcohol is charged in a glass-lined reactor. Powdered 2,4-D acid and Sulphuric acid are added to the reactor with constant stirring, so as to dissolve the powder in the mixture. When all the materials have been added and thoroughly mixed, the manhole of the reactor is closed and so as to render air tight. After this, the reactor is heated by passing steam. The heating is continued till the temperature raises up to 90^0C. Under the reactor conditions, ethyl alcohol reacts with 2,4-D acid to form 2,4-D ethyl ester. The product is heated vigorously under reflux for 4 hrs for completion of the reaction. After this, the material in the reactor is allowed to cool down to 30^0C. One or two water washings and TEA washing are employed to reduce the pH of the materials 2 to 5. After 2-3 hrs of settling, the material is transferred to SS of HDPE storage tank. After further settling for 40-45 hrs, the material is filtered and stored in dry HDPE drums.

Chemical Reaction:

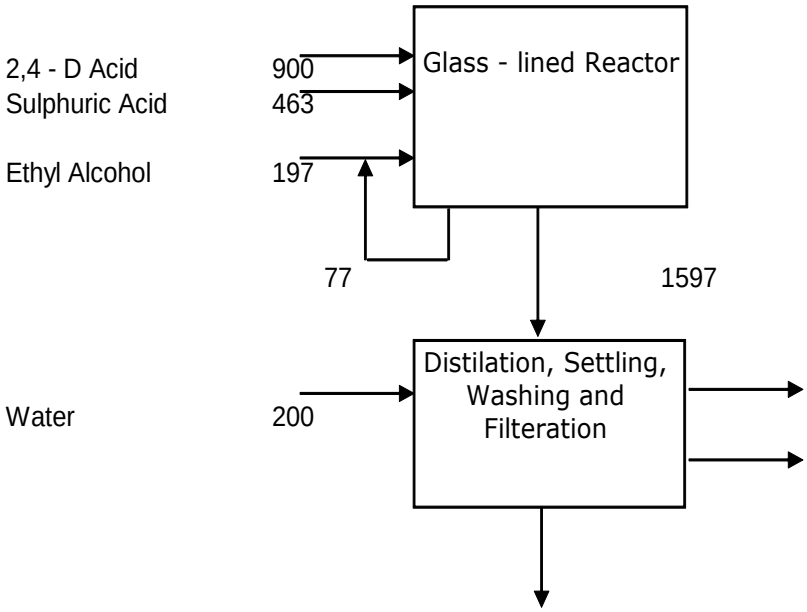


2,4-D Acid Ethyl Alcohol 2,4-D Ethyl Ester

Mass balance and process flow diagram:

2,4-D Ethyl Ester

Input	Kg	Output	Kg
2,4 - D Acid	900		
Sulphuric Acid	463		
Ethyl Alcohol	197		
	77		1597
Water	200	Mother Liquor to ETP	700
		Ethyl Alcohol	60
		2,4-D Ethyl Ester	1000
Total	**1760**		**1760**



4. 2,4-D Amine:

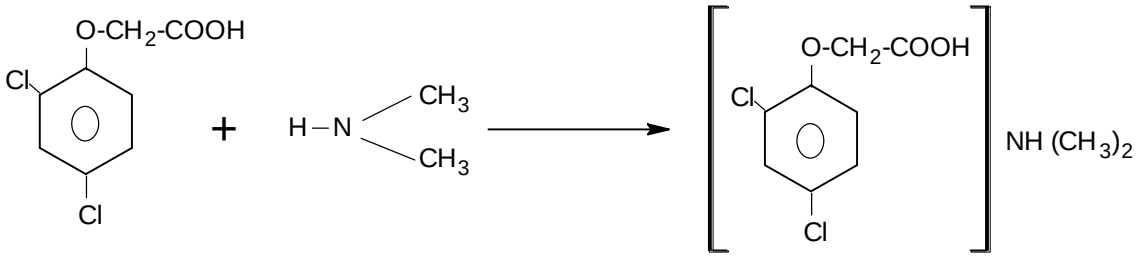
Manufacturing Process:

In the manufacturing process, dimethyl amine (40%) is charged in a SS Reactor. 2,4-D acid is added slowly to the reactor, with constant stirring, so as to dissolve it in the mixture. The stirring is continued for half an hour for proper reactions. In the reactor, dilute amine react with 2,4-D acid to form the amber coloured 2,4-D Dimethyl Amine.

The reaction is exothermic and raises the temperature. The temperature comes down after completion of reaction, i.e. within 2 hours. When temperature begins to fall, oxalic acid is added to minimize the excess amine and maintain the pH between 7-9.

The material in the reactor is allowed to cool down to room temperature with constant stirring. After two hours of settling, the material is transferred to SS or HDPE storage tanks and allowed to settle for 35 to 40 hours. After settling the material, the product is filtered through vacuums filter and stored in HDPE drums. No waste material is produced in this process.

Chemical Reaction:

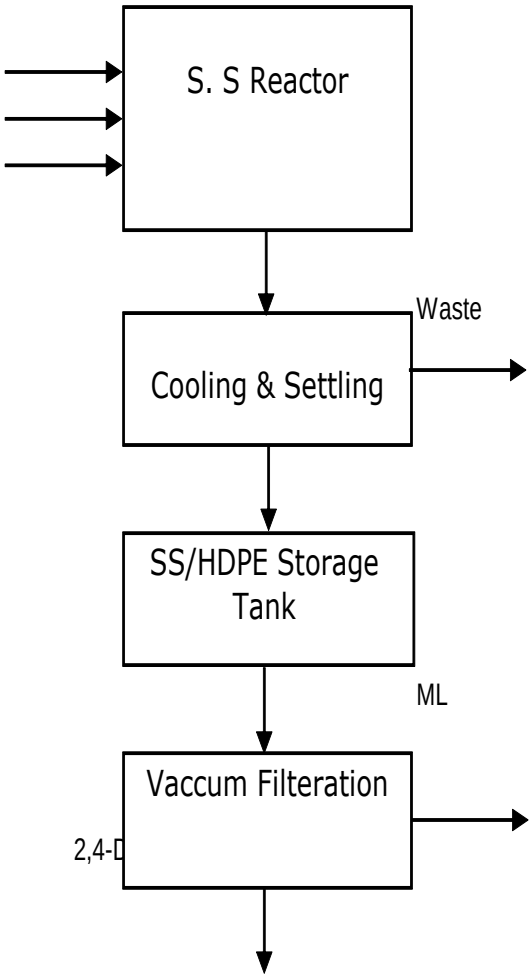


2,4-D Acid | Dimethyl Amine | 2,4-Dimethyl Amine

Mass balance and process flow diagram:

2,4 - Dimethyl Amine

Input	Kg
2,4-D Acid	595
Dimethyl Amine, 40%	975
Oxalic Acid	15
Total	**1585**



Output	Kg
Waste	45
ML	540
	1000
	1585

5. Clodinafop- Propargyl Chloride Technical:

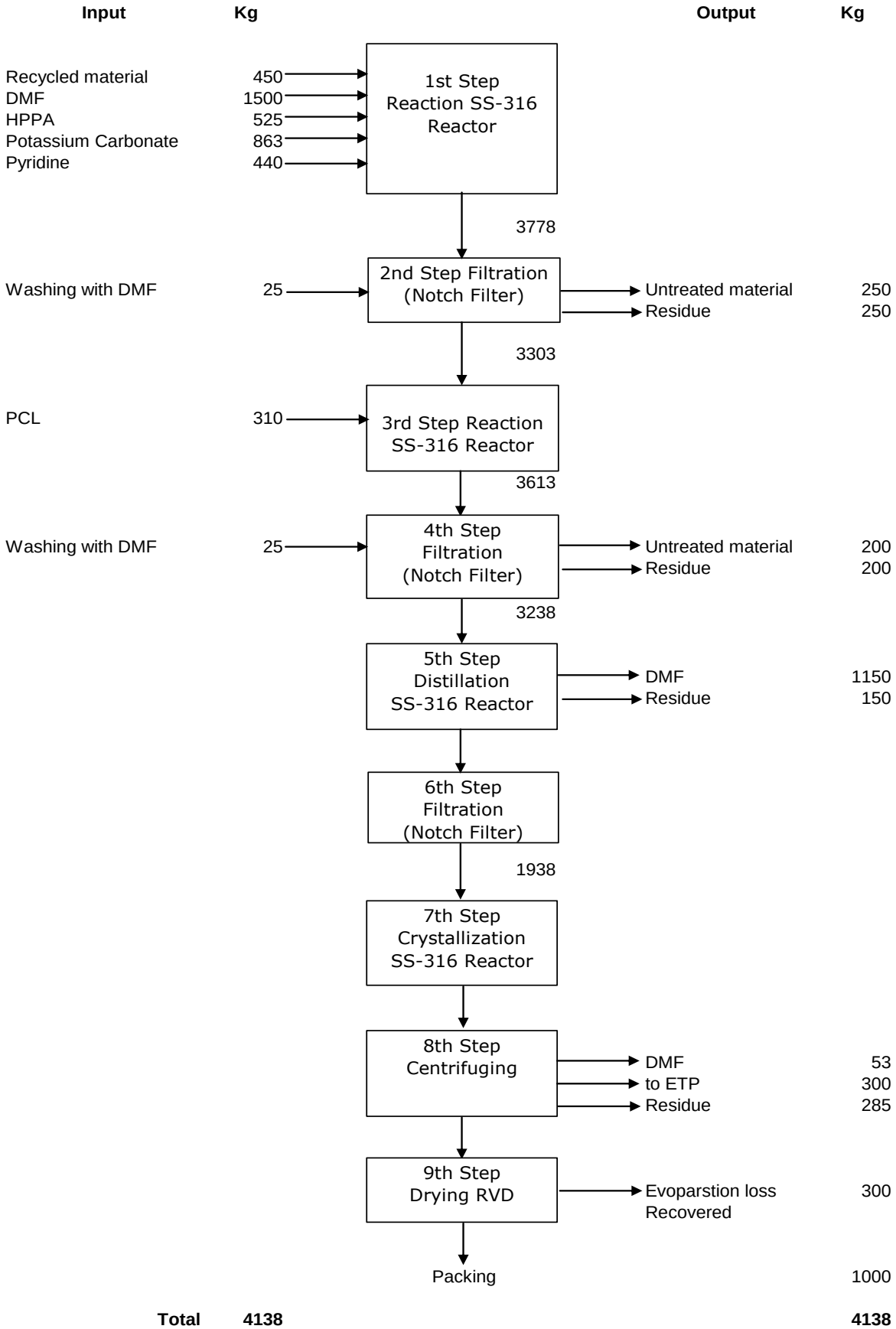
Manufacturing Process:

In the manufacturing process, DMF, Pyridine, HPPA, Potassium Carbonate is charged in a reactor. Then it is pass for filtration. Washing is done by DMF. Unreacted material is generated, which will recycle in next batch. Reaction mass is then reacted with PCL in reactor. Again it is passed through filtration step, washing with DMF. DMF will recycle and reacted mass is passed for crystallization.

The product is separated by passing through centrifuge and dried in a dryer. The dry product is ground in a Pulverizer and packed in HDPE bags.

Mass balance and process flow diagram:

Claodinafop Propargyl Chloride



6. Lambda Cyhalothrin Technical:

Manufacturing Process:

Meta Phenoxy Benzaldehyde is reacted with Sodium Cyanide to form Meta Phenoxy Benzaldehyde Cyanhydrin as an intermediate. This on reaction with Fluoro Propenyl Acid Chloride (TFP Acid Chloride) forms the Product Cyhalothrin. In this process n - Hexane is used as solvent along with phase transfer catalyst. The reaction mass of Cyhalothrin is washed by Soda Ash solution as well as water.

Solvent n-Hexane is stripped off to get pure Cyhalothrin oil. Finally Cyhalothrin oil is epimerised to give Lambda Cyhalothrin of 85%.

An aqueous layer which contains traces of Sodium Cyanide is detoxified by the treatment of Sodium Hypochlorite Solution (8-10%) up to < 0.2 ppm level. Then it is mixed up with main ETP stream for further treatment & finally drained to gutter.

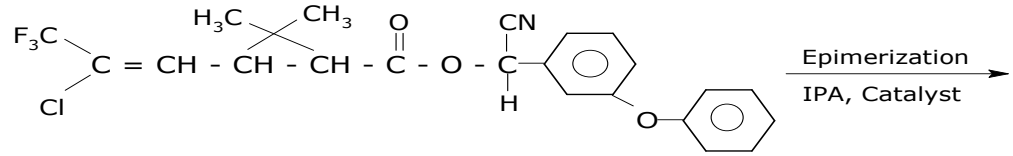
Chemical Reaction:

Lambda Cyhalothrin

Cyhalothrin
(MW- 449.9)

Sodium Cyanide
(MW- 49.1)

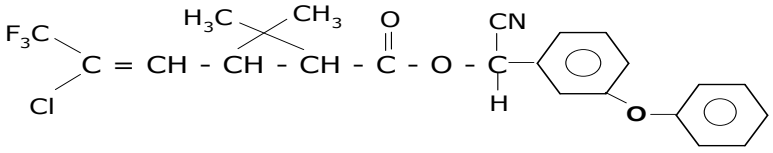
Meta Phenoxy Benzaldehyde
(MW- 198)



Cyhalothrin
(MW- 449.9)

+ NaCl

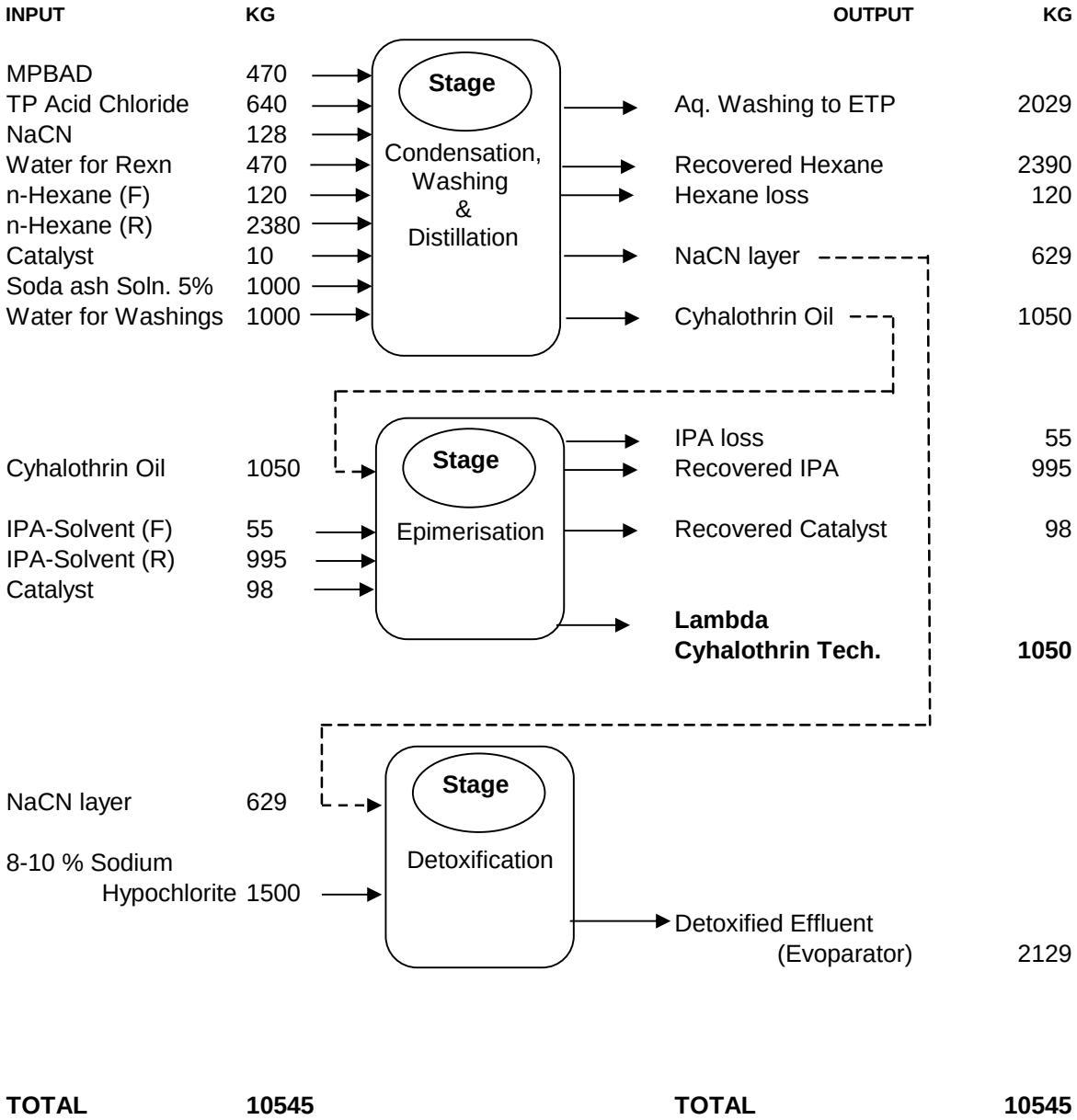
Sodium Chloride
(MW- 58.5)



Lambda Cyhaloyhrin
(MW- 449.9)

Mass balance and process flow diagram:

Lambda Cyhalothrin



Proposed products:

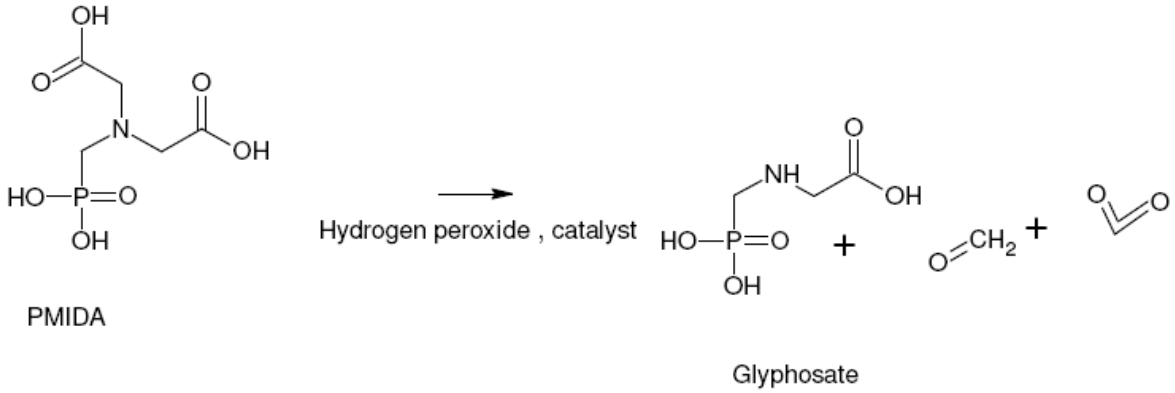
A. Herbicides

1. Glyphosate

Process description:

Phosphono Methyl IminoDiacetic Acid (PMIDA) is charged in water, catalyst sodium Tungstate is charged and temperature is raised. Hydrogen peroxide is added. Clear solution is formed. After addition of catalyst oxidation is carried out to form Glyphosate. Product is cooled and filtered out. Centrifuged and dried.

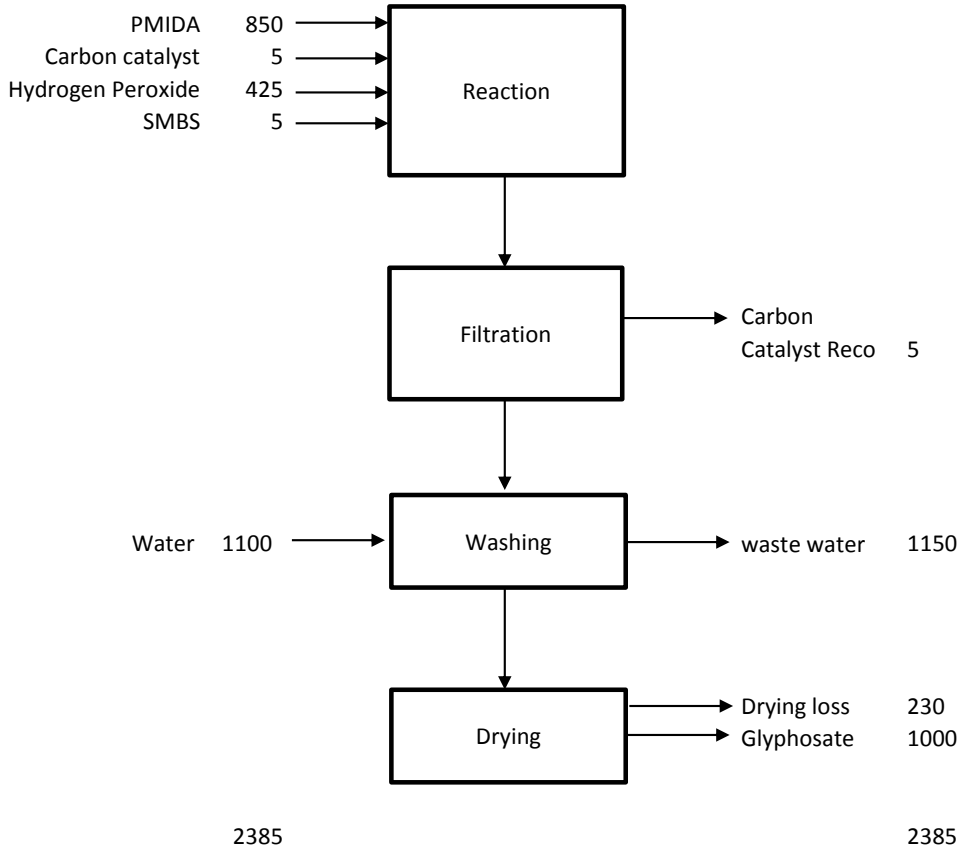
Chemical Reaction



PMIDA

Glyphosate

Mass Balance

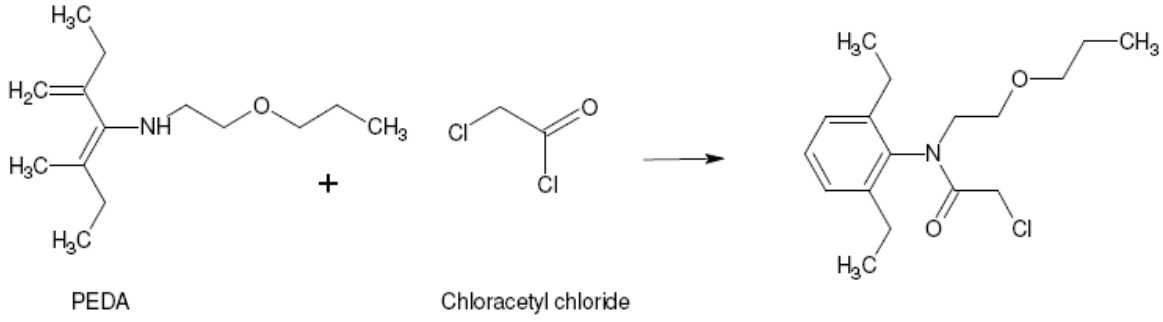


2. Pretilachlor

Process Description

Charge DEPA and Hexane into the reactor with agitation at 30^0C temperature and charge chloroacetyle chloride slowly in the reaction mass at 30^0C. When the reaction is over, cool the material and neutralize with ammonia gas till pH-8. Wash the material with water. After washing organic layer, take it to distillation vessel for hexane recovery under vacuum up to 80^0C. Cool it to 20^0C. Filter the Pretilachlor for packing.

Chemical Reaction



Mass Balance

Mass balance of Pretilachlor

IN PUT	Kg		OUT PUT	Kg
DEPA	870	Stage 1 Pretilachlor formation	Effluent HCl gas	180
Chloro acetyle chloride	595			
Hexane	1420			
Ammonia gas	65	Stage 2 Neutralization		
Water for washing	1850	Stage 3 Washing	Aqueous effluent	1920
		Stage 4 Hexane Recovery	Pretilachlor	1280
			Hexane Recovery	1350
			Residue	70
Total	**4800**			**4800**

3. Atrazine

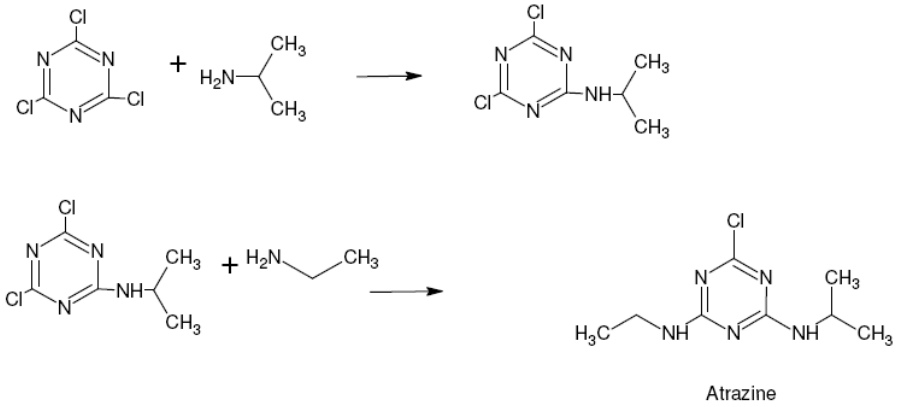
Process Description

Required quantity of Toluene is taken in to reactor; Cyanuric chloride is charged and stirred so that Cynuric chloride dissolved in the solvent completely. Isopropyl amine is charged slowly. Sodium hydroxide is charged to neutralize Hydrochloric acid which is generated in reaction.

Ethyl amine is charged slowly. Sodium hydroxide is charged to neutralize Hydrochloric acid which is generated in reaction.

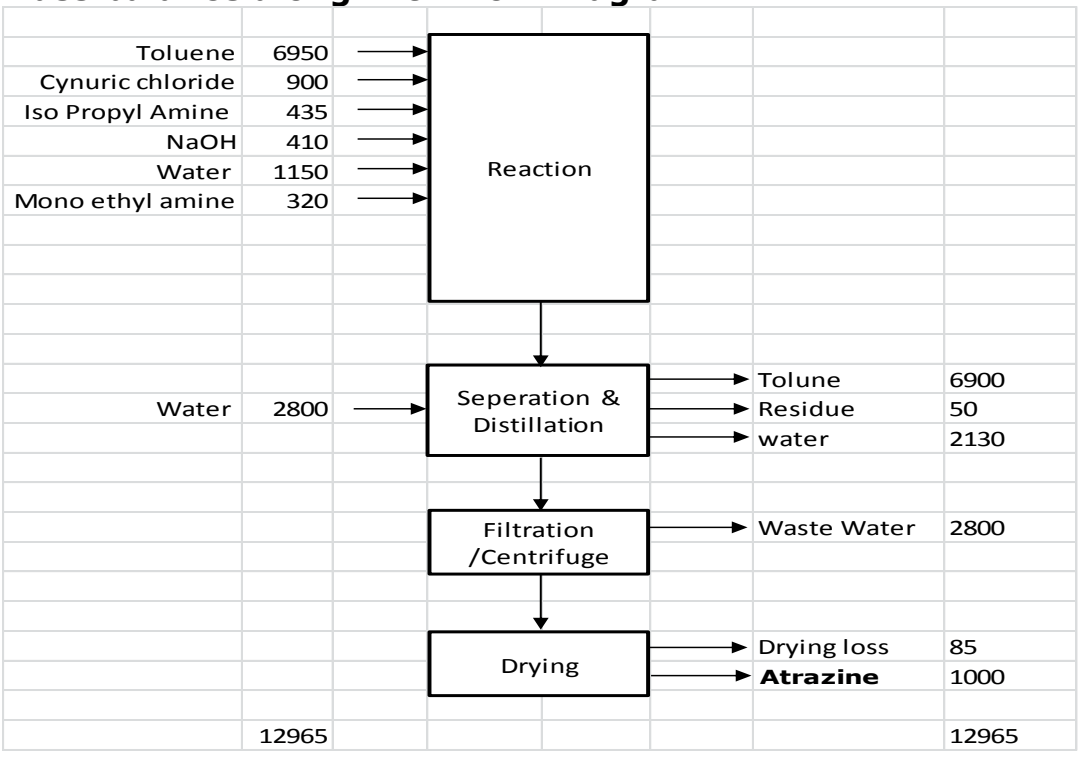
Aqueous phase is separated out, fresh water is charged and Toluene is distilled out azotropically in presence of live steam. Product is filtered off. Centrifuged, dried and pulverized and pack as per requirement.

Chemical Reaction



Atrazine

Mass balance along with Flow Diagram

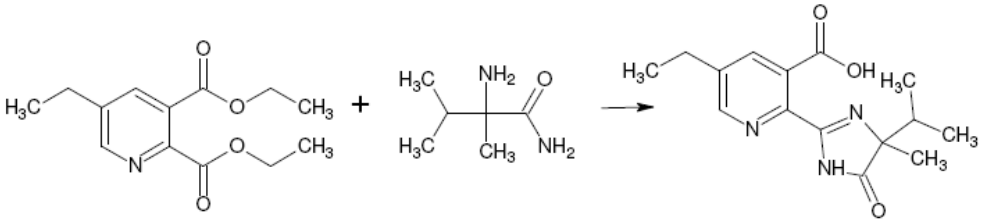


4. Imizathypr

Process Description

Charge 2 Amino 2,3 Di methyl Butane amide, Ethyl 5 Ethyl Pyridine Dicarboxylate and sodium Ethoxide in Toluene. Heat the reaction mass to 50 c. Distill ethanol from reaction mixture. Raise temperature to 110 c after removal of Ethanol from reaction mixture. Maintain temperature 110 c for few hours. On completion of reaction, charge water to reaction mass. Adjust pH 3.5 with Hydrochloric acid. Cool the reaction mass to 30^0 C. Filter the crude Imazethapyr and crystallize in ethanol.

Chemical Reaction



diethyl 5-ethylpyridine-2,3-dicarboxylate 2-amino-2,3-dimethylbutanamide Imazethapyr

Mass balance along with Flow Diagram

DI Ethyl 5 Ethylpyridine Dicarboxylate	410		
2 Amino 2,3 dimethyl Butane amide	260		
Sodium Ethoxide	245		
Toluene	1200		
HCL 30 %	465		
water	1400	Effluent	2280
		Tolune	1140
		Residue	60
		Ethanol recovery	1800
Ethanol	1900	Residue	100
		Imazethapyr	500
	5880		5880

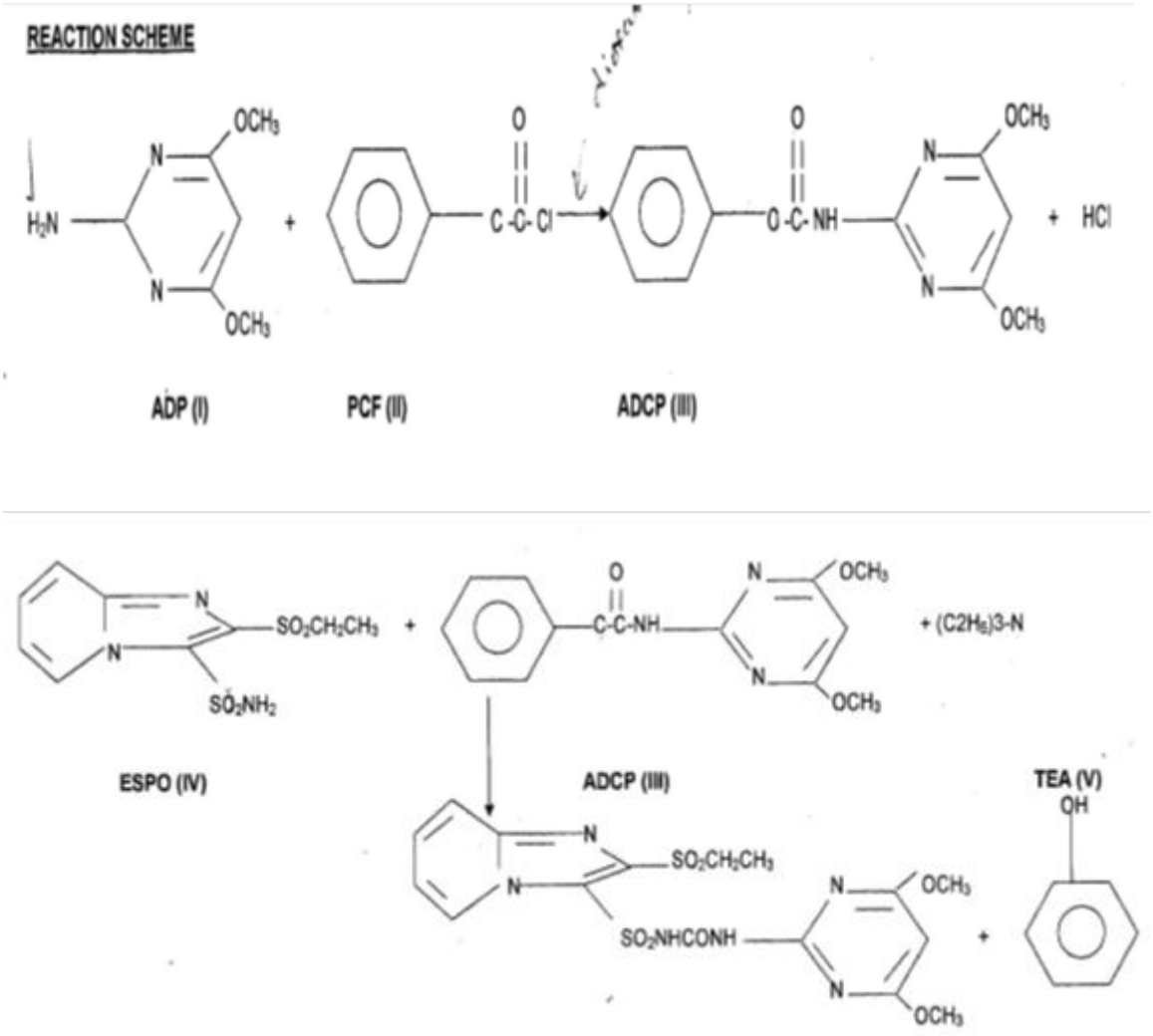
5. Sulphosulpron

Manufacturing Process

Phenyl N-(4,6-dimethorxy pyrimidine-2-yl) carbamate suspension reacts with the intermediate 2-ethyl sulfonylimidazo(1,2a) pyridine-3-sulfonamide in presence of triethyl amine.

The reaction mass is agitated for few hours. Then it is poured into acidified water to get the precipitated mass of Sulfosulfuron. Since this reaction is addition reaction, no Bi-Product of Effluent is generated. On cooling crystal forms which is filtered out followed by washing with water until free from salt and impurities. Finally the product is dried and the product is tested for purity by HPLC.

Chemical Reaction



Flow Diagram along with mass balance

MASS BALANCE OF SULFOSULFURON						
INPUT	**KGS**				**OUTPUT**	**KGS**
Dichloromethane	3600	→	**Reaction 1**			
ESPO	700	→				
ADCP	650	→				
			↓			
TEA	390	→	**Reaction 2**			
HCl	430	→				
			↓			
Water	3100	→	**Filtration Washing**			
				→	Aqueous - 1	4070
			↓			
			Distillation	→	Dichloromethane (recovery)	3420
				→	Residue	180
			↓			
			Drying	→	Sulfosulfuron technical	1000
				→	Eva loss	200
TOTAL	**8870**					**8870**

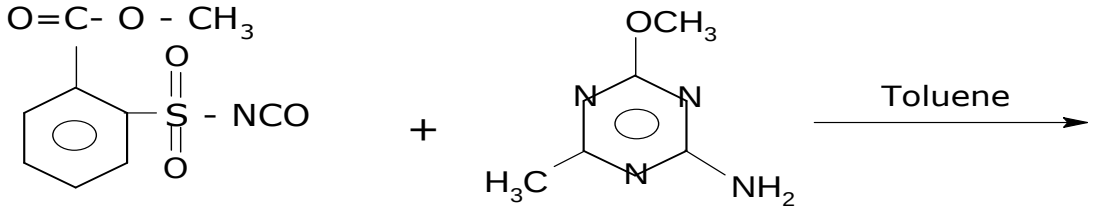
6. Metsulphron

Manufacturing Process:

O-sulfoisocyante Methyl Benzoate reacts with 2-Amino 4-Methoxy 6-Methyl 1,3,5 Triazine in presence of Solvent-Toluene. Since this reaction is addition reaction, no Bi-Product of Effluent is generated. On coling crystal form which is filtered out and solvent distilled out and recycled.

Chemical Reaction:

Metsulfuron Methyl (Tech.)

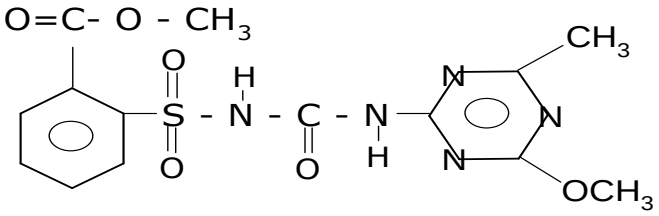


O- sulfo Iso Cyanate Methyl Benzoate

(MW- 241.4)

2- Amino 4- Methoxy 6-Methyl 1,3,5 Triazine

(MW- 139.97)

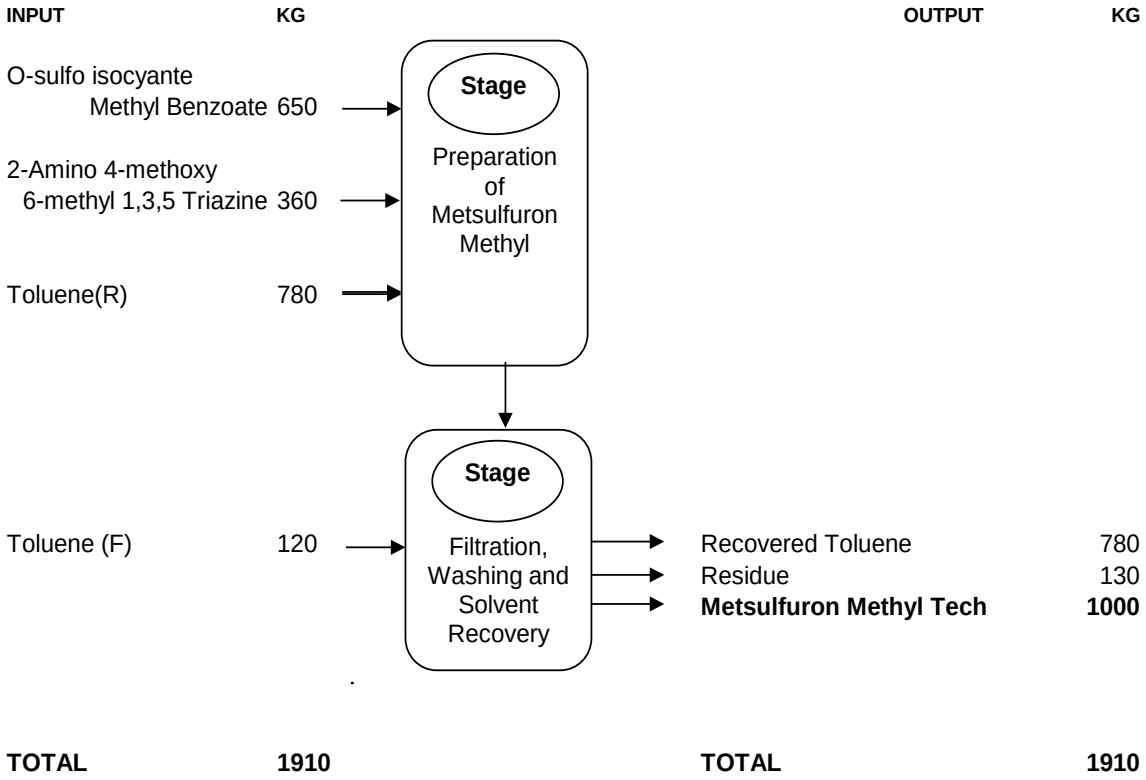


Metasulfuron Methyl

(MW- 381.37)

Flow diagram & Mass Balance:

Met sulfuron methyl

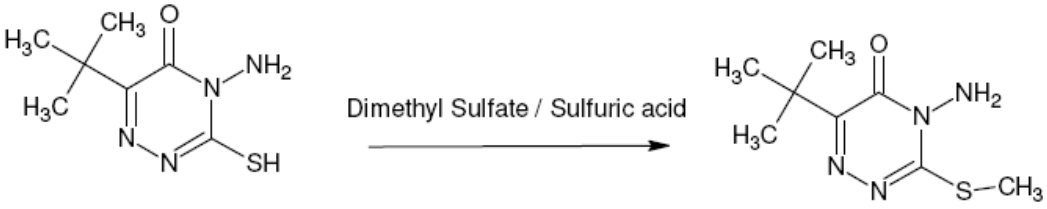


7. Metribuzin

Process Description

Triazinone is charged slowly in Sulfuric acid in 4 hours. Temperature is raised to 45^0C and Di Methyl sulfate is charged. Maintain temperature for 10 hours time. When reaction shows completion of methylation, quench in 20% Soda ash solution. Finally adjust pH 10 with NaOH lye. Filter, centrifuged and dry the wet cake. Pulverise and pack suitably.

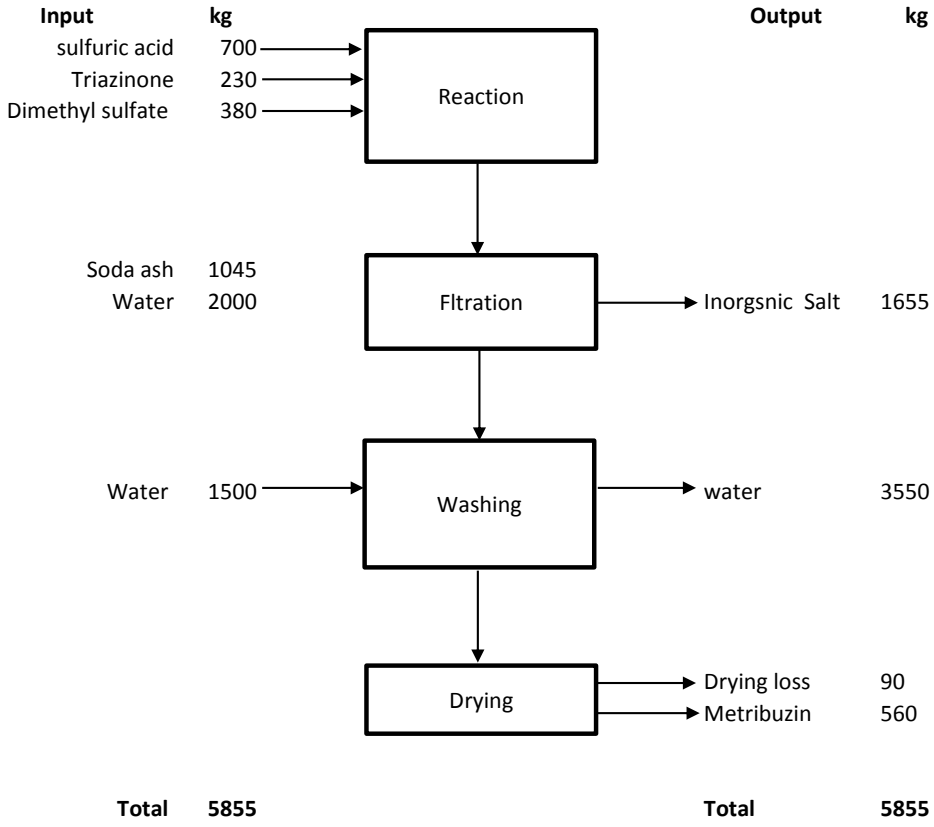
Chemical Reaction



Triazinone

Metribuzin

Flow Diagram & Mass balance



8. Quizalafop - p- ethyl

Manufacturing Process

Step 1: Hydroquinone is reacted with potassium hydroxide in solvent toluene in 3-4 hours. Then the mixture is reacted with ethyl-a-chloropropionate in solvent dimethyl formamide. After the reaction is completed the solvent toluene is distilled out and recovered.

Step 2: The organic mass is reacted with 2,6-dichloro quinoxaline for 6 hours at 70-80^{0}C. Dimethyl formamide is distilled and recovered.

Step 3: Wash organic layer with water and crystallized with toluene for purification. Recover toluene under vacuum partially. Cool the concentrate mass slowly and filter the crystals. Dry the wet product at 50-55^{0}C.

Flow diagram with Mass Balance

MASS BALANCE OF QUIZALOFOP-P-ETHYL

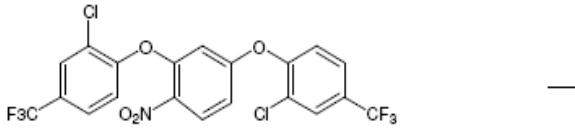
INPUT	KGS				OUTPUT	KGS
Hydroquinone	350	→	**Reaction 1**			
Toluene	730	→		→	Water	145
Potassium hydroxide	410	→				
			↓			
N,N-dimethylformamide	1450	→	**Distillation Reaction 2**	→	Toluene (recovery)	690
Ethyl-a-chloropropionate	440	→		→	Residue	40
			↓			
2,6-dichloro quinoxaline	580	→	**Reaction 3 Distillation**	→	DMF (recovery)	1380
				→	Residue	70
			↓			
Toluene	1510	→	**Washing**	→	Effluent	2110
Water	1475	→				
			↓			
			Crystallization Distillation	→	Quizalofop-p-ethyl	1000
				→	Toluene (recovery)	1470
				→	Residue	40
TOTAL	**6945**					**6945**

9. Oxyflurofen

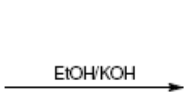
Process Description

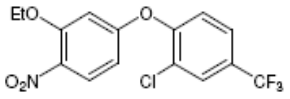
Charge a 10% solution of potassium hydroxide in ethanol is added to a solution of 1,3- bis(2-chloro-α,α,α-trifluoro-p-tolyloxy)-4-nitrobenzene in dioxane. After 40 minute at room temperature, the solution is heated to 45 C, then cooled, diluted with Hexane and washed with water, dried and the solvent removed. The residue is re-crystallized from isopropanol to give 2-chloro-α,α,α-trifluoro-p-tolyl-3-ethoxy-4-nitrophenyl ether (oxyfluorofen).

Chemical Reaction



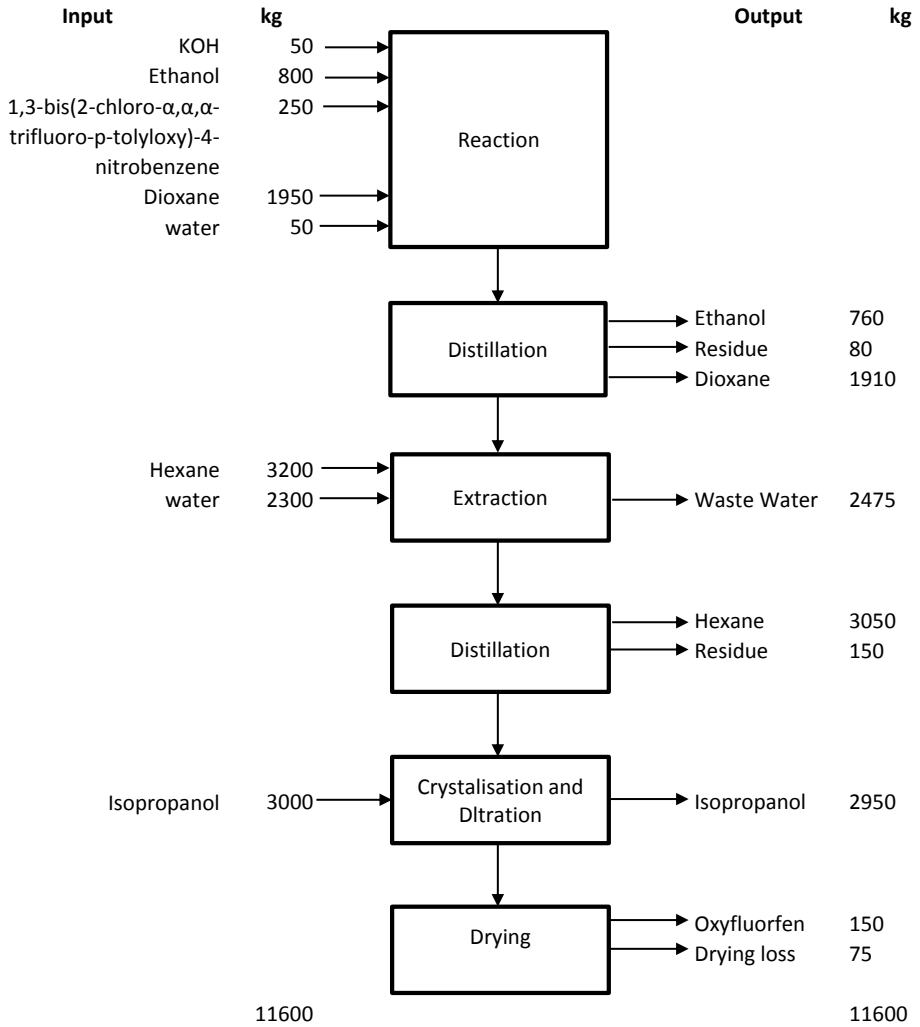
1,1'-[(4-nitrobenzene-1,3-diyl)bis(oxy)]bis[2-chloro-4-(trifluoromethyl)benzene]
Formula Weight = 512.1861792





Oxyfluorfen
2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
Formula Weight = 361.7003496

Mass Balance



10. Pendimathalien

Process Description

Mixture of 4 NOX (4 Nitro Ortho Xylene), Di Ethyl Ketone and Platinum on carbon as catalyst is charged in autoclave. Hydrogen Gas is purged. Hydrogenation will be completed in 8-10 hours of time.

Reaction mass is filtered to recover the platinum on carbon catalyst, which is used in next batches. Excess Di ethyl Ketone is recovered by distillation.

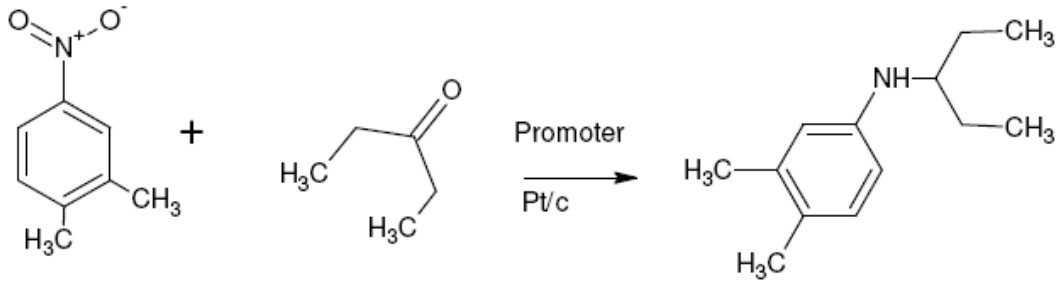
Nitration

Mixed acid is prepared by adding nitric acid to Sulfuric acid and water in reactor at below room temperature. NAX and EDC is mixed in reactor. Add slowly EDC and NAX mixture to mixed acid prepared above at room temperature. Maintain temperature for few hours to complete the reaction. When reaction is completed allow to settle the reaction mass. Separate spent acid as bottom layer. Apply water wash to organic layer and separate organic layer. Aqueous layer containing acid which is back extracted with EDC and then neutralized and transferred to ETP.

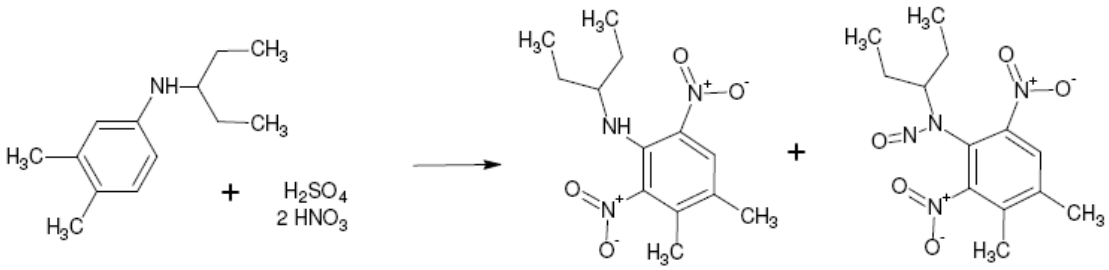
Denitrososation: To remove N Nitroso impurity, reaction mass is treated with acetone and Hydrochloric acid at elevated temperature in Glass lined vessel. After completion of reaction neutralize excess hydrochloric acid with caustic lye and then washed with water. Aqueous phase was separated Distilled out EDC from organic mass first at atmospheric and then under vacuum to remove EDC. This will generate crude Molten Pendimethalin.

Purification: During distillation and earlier reactions tar is formed in crude molten Pendimethalin. Molten Pendimethalin is dissolved in n Hexane, clarified to remove tarry mass and from clear solution Hexane is removed by distillation to get Pendimethalin, which is packed as per requirement.

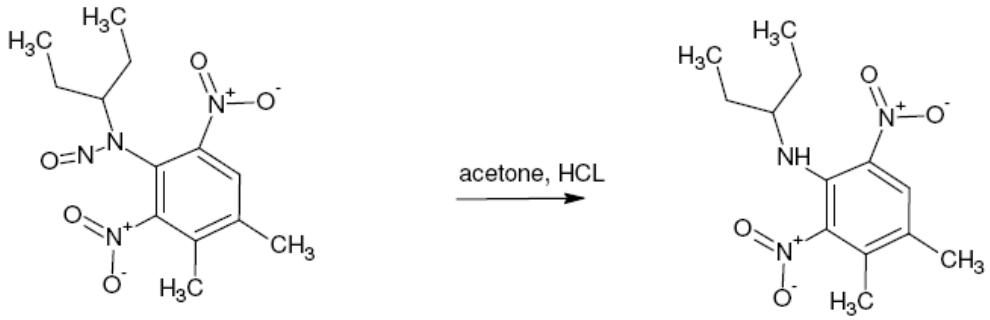
Chemical Reaction



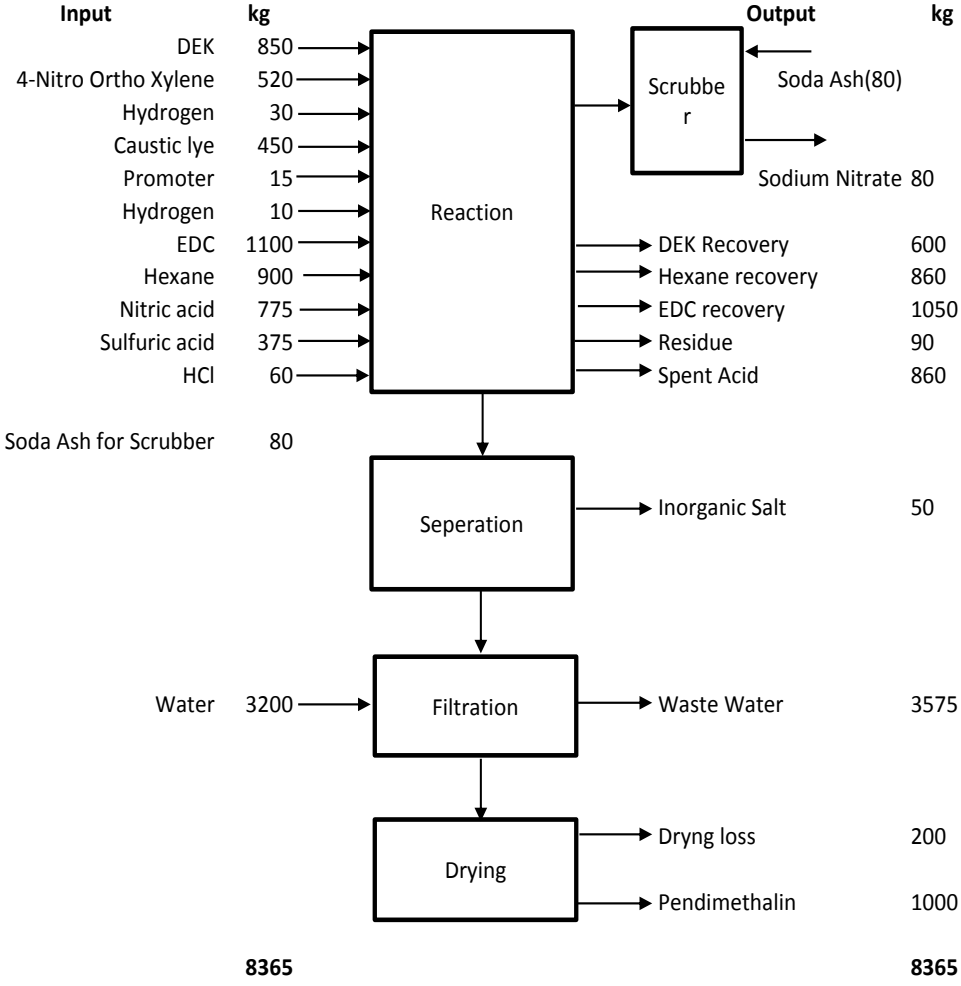
Nitration



Denitrososolation



Flow Diagram

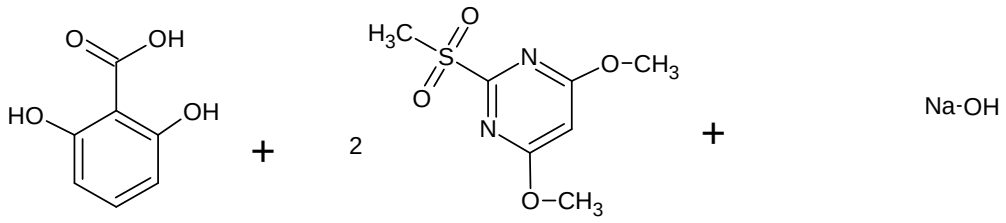


11. Bispyribac Sodium

Manufacturing Process

Toluene, TBAB Caustic soda and 2,6 Dihydroxy Benzoic acid is charged in reactor and followed by addition of 4,6 Dimethoxy 2 Methoxy Sulfonyl Pyrimidine. The reaction mass is heated for several hours to complete the reaction. After completion of reaction mass is cooled and filtered. Crude is crystallized using n Butanol, ethyl acetate and water. After filtration wet cake is dried to get BisPyribac Sodium.

Chemical Reaction



2,6 Dihydroxy Benzoic acid

154

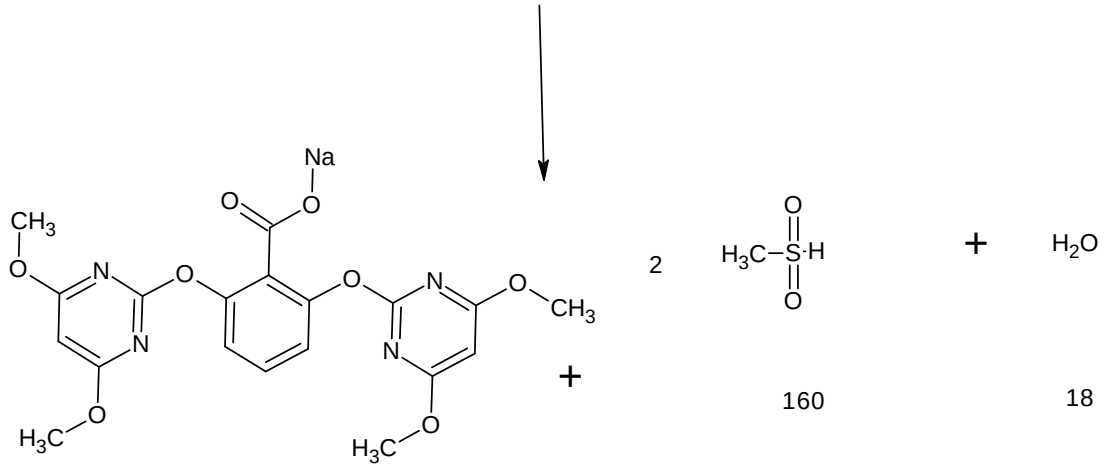
2

4,6 Dimethoxy 2 methyl Sulfonyl Pyrimidine

218

Na-OH

40



452

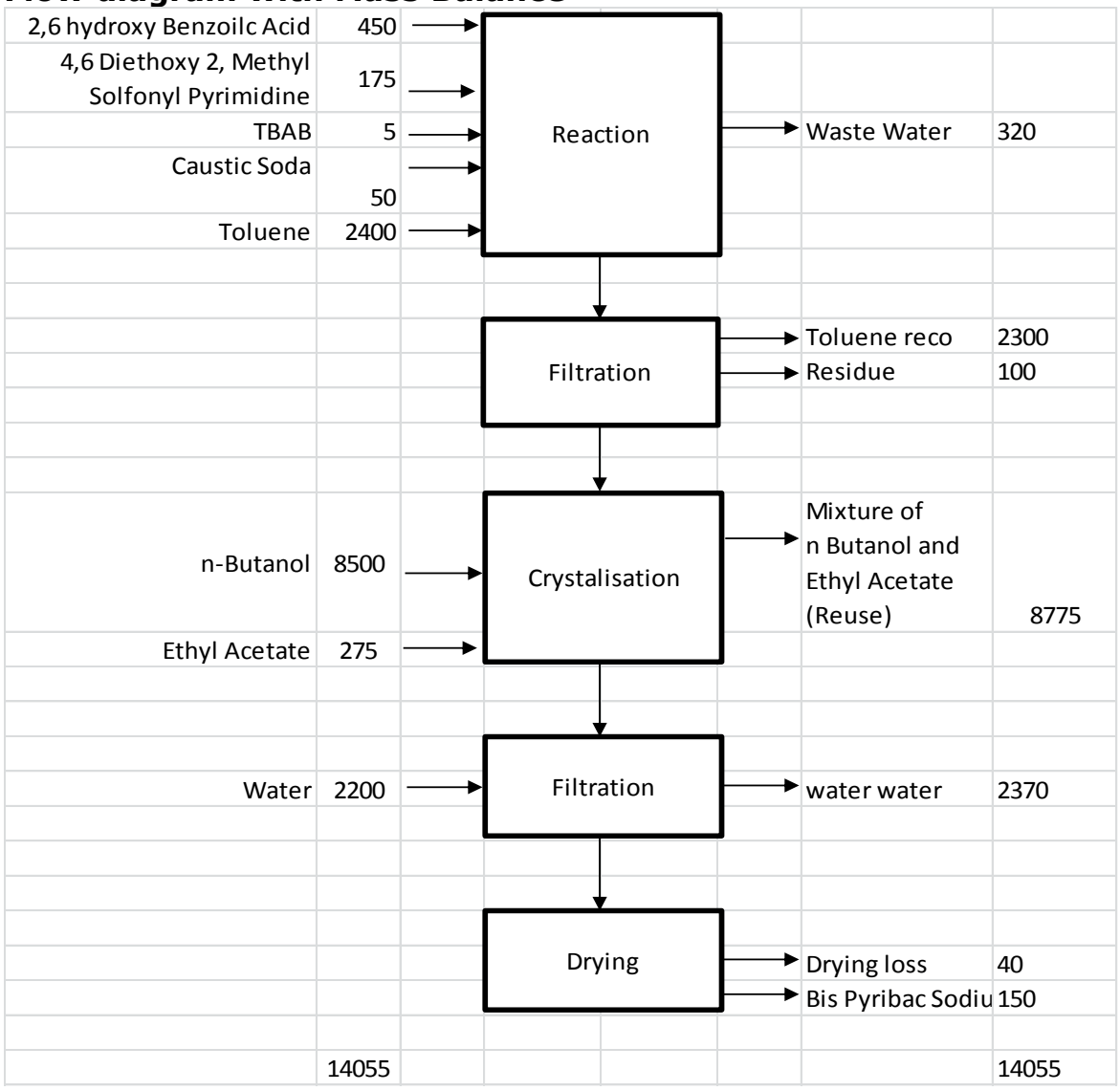
Bis Pyribac Sodium

2

160

18

Flow diagram with Mass Balance



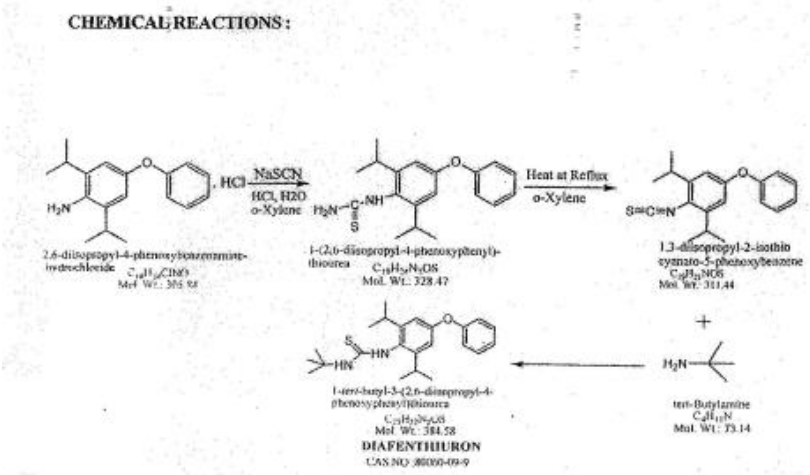
B. Insecticides

1. Diafenthiuron

Manufacturing Process

2,6-Diisopropyl-4-phenoxylbenzeamine reacted with hydrochloric acid to give 2,6-Diisopropyl-4-phenoxylbenzeamine hydrochloride, which reacts with NaSCN in the presence of xylene as solvent to give 1-(2,6-diisopropyl-4-phenoxyphenyl)-thioures. This is heated to reflux to yield 1,3-dissopropyl-2-isothiocyanato-5-phenoxybenzene. Finally condensed with tert-butyl amine to give Diafenthiuron Technical.

Chemical Reaction:



Flow diagram with Mass Balance

MASS BALANCE OF DIAFENTHIURON						
INPUT	**KGS**				**OUTPUT**	**KGS**
Xylene	400	→	**Reaction 1**			
DIPBA	250	→				
NaSCN	95	→				
HCl, 30%	135	→				
			↓			
			Washing			
Water	375	→		→	Effluent	550
			↓			
			Reaction Filtration	→	Diafenthiuron	350
tert-butylamine	75	→				
			↓			
			Distillation	→	Xylene (recovery)	380
				→	Residue	50
TOTAL	**1330**					**1330**

2. Imidacloroprid

MANUFACTURING PROCESS

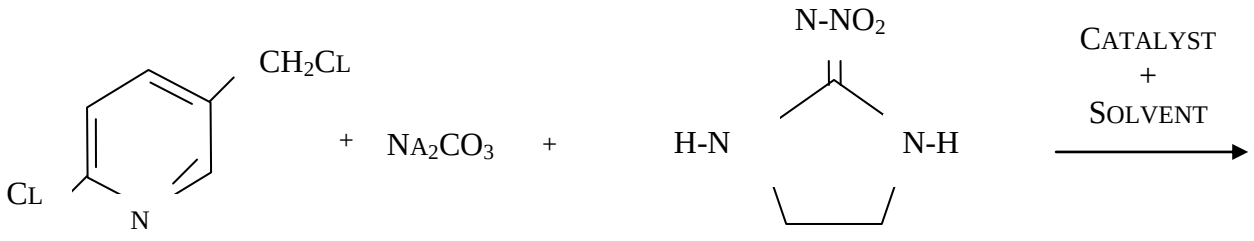
2 – Chloro, 5 – Chloro methyl Pyridine (CCMP) is reacted with N – Nitro iminoIdmidazolidine (N-Nll) in present of catalyst and solvent.

The Hydrochloric acid, which is formed during the reaction, is scavenged by putting Sodium carbonate as acid scavenger. The resulting mass is diluted by water and filtered to remove the salts of Sodium Chloride (NaCl) & Sodium bicarbonate.

The organic mass is then treated with water and finally solvent is removed by distillation. The concentrated mass is then crystallized to get pure product – Imidacloprid (Tech).

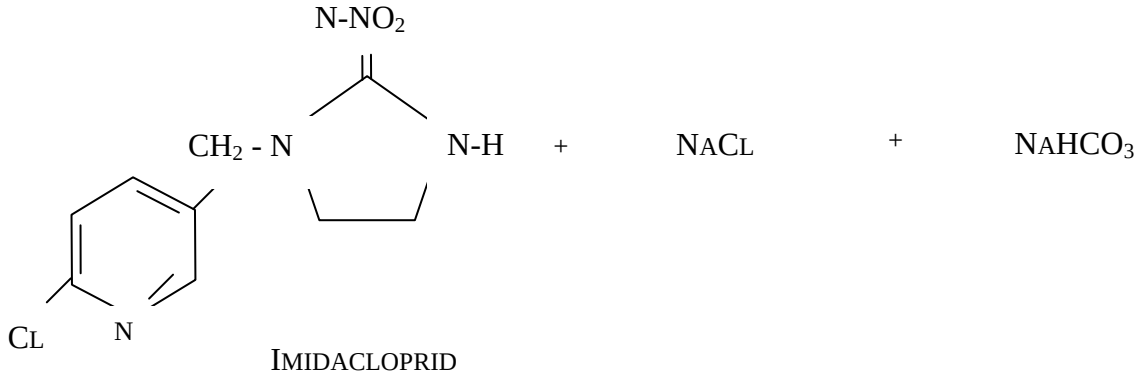
Finally Toxic Effluent which contains traces of Pesticides is taken to Hydrolysis stage for detoxification. Where aqueous mass is treated at high temperature. By Alkali for the rapid hydrolysis of pesticides to simpler non-toxic compounds.

CHEMICAL REACTION



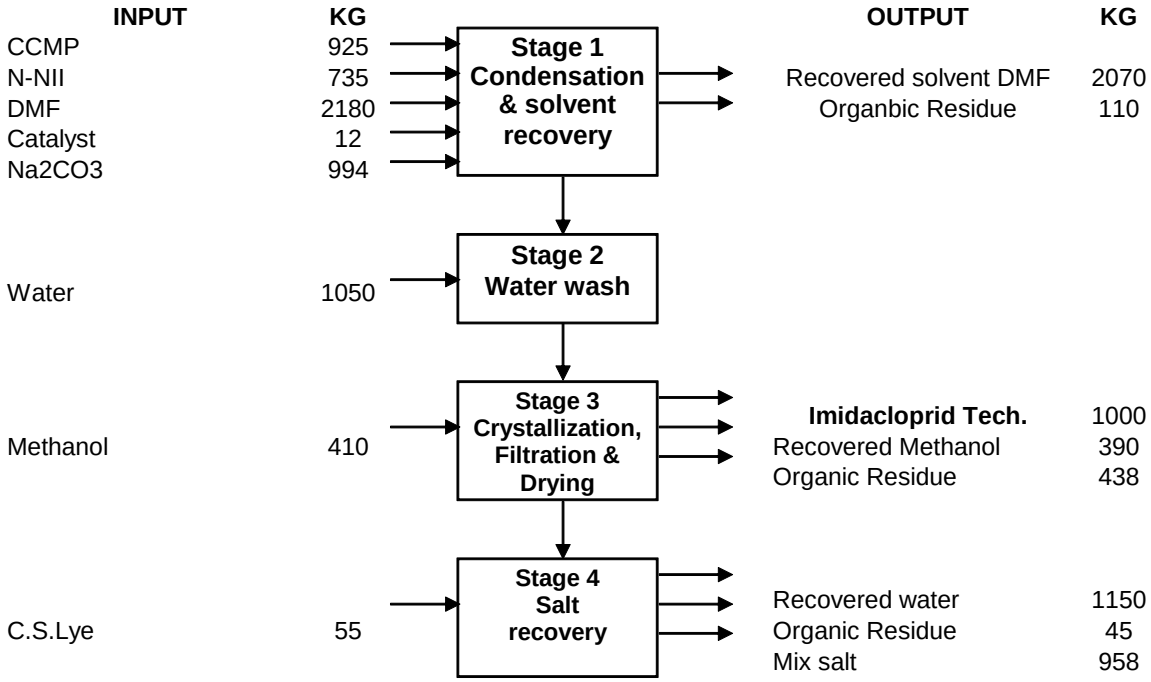
CCMP
M.W.162

N-NII



IMIDACLOPRID

Flow diagram & Mass Balance:

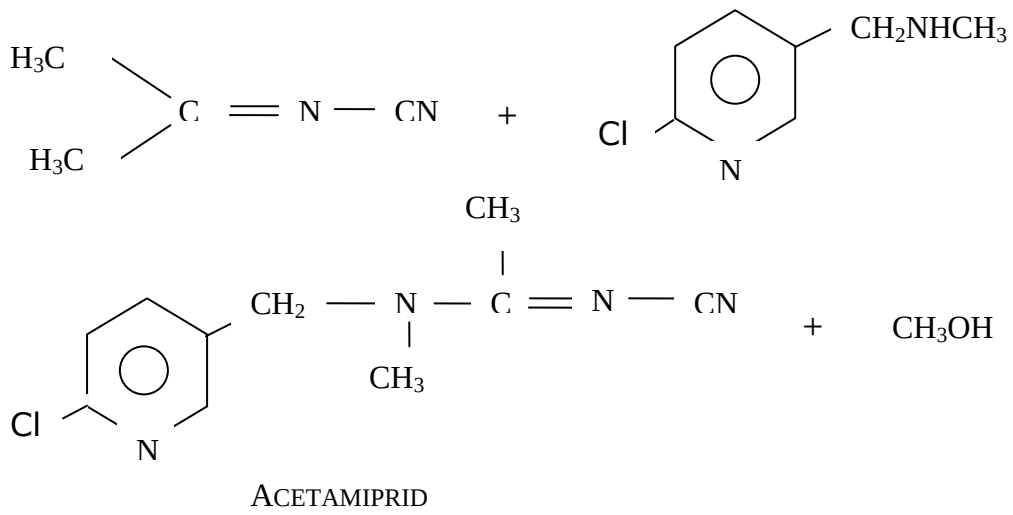


3. Acetamiprid

Manufacturing Process:

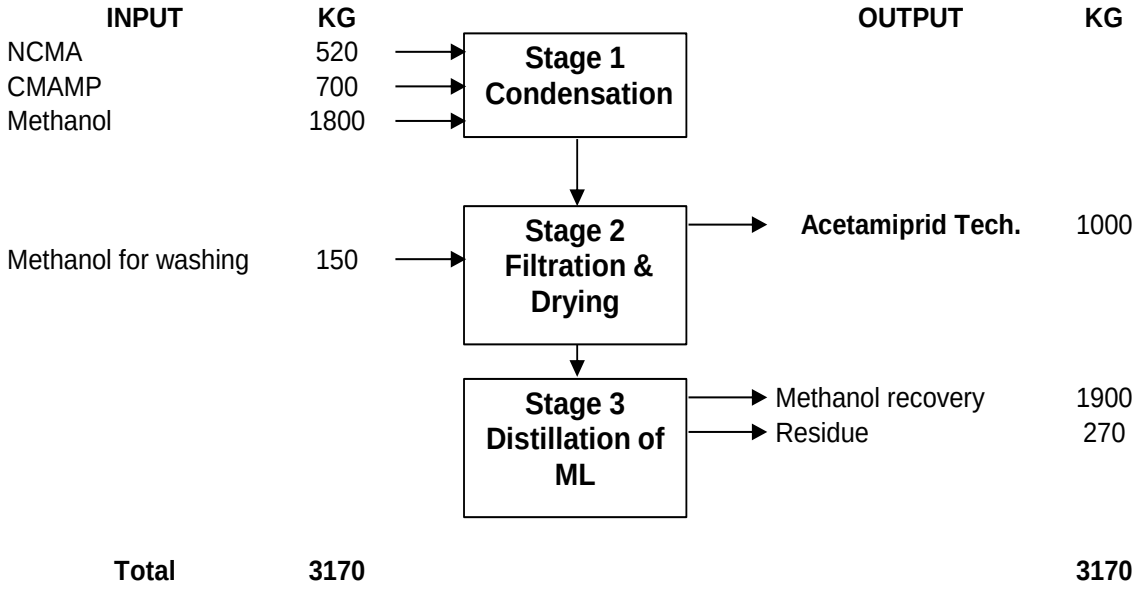
N-Cyano methyl Acetamidate (NCMA) is reacted with 2-Chloro 5-(methyl amino methyl) Pyridine (CMAMP) in solvent media. After the reaction is completed the product is filtered and solvent is concentrated to yield more products as well as recover solvent which is recycled.

Chemical Reaction



ACETAMIPRID

Flow diagram & Mass Balance:



4. Thiamethoxam

Manufacturing Process

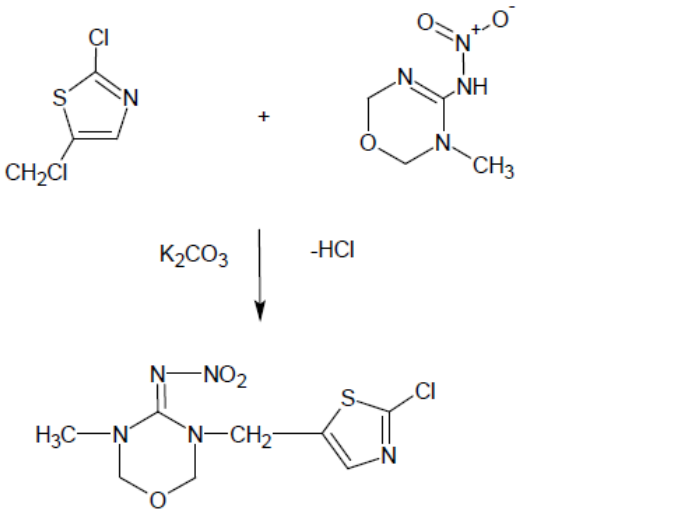
Step-I:

CCMT and MNIO are reacted in DMF media using K_2CO_3 as catalyst and reaction mass thus obtained is taken for water washing.

Step-II:

Organic mass obtained in step-I is of crude thiamethoxam and is purified with methanol and is dried.

CHEMICAL REACTION OF THIAMETHOXAM



(4Z)-3-[(2-chloro-1,3-thiazol-5-yl)methyl]-5-methyl- *N*-nitro-1,3,5-oxadiazinan-4-imine

Flow diagram with Mass Balance

MASS BALANCE OF THIAMETHOXAM

IN PUT	KG		OUT PUT	KG
CCMT	840	→ Stage 1 Reaction		
MNIO	800	→		
DMF	760	→		
K2CO3	925	→		
Water	1775	→ Stage 2 Filtration	→ Used Solvent/Residue	760
			→ Aqueous Effluent	2590
80% Methanol	1775	→ Purification by Crystalization	→ Thiamethoxam Tech.	1090
			→ Methanol	1375
			→ Aqueous Effluent	1060
Total	**6875**			**6875**

5. Cypermethrin

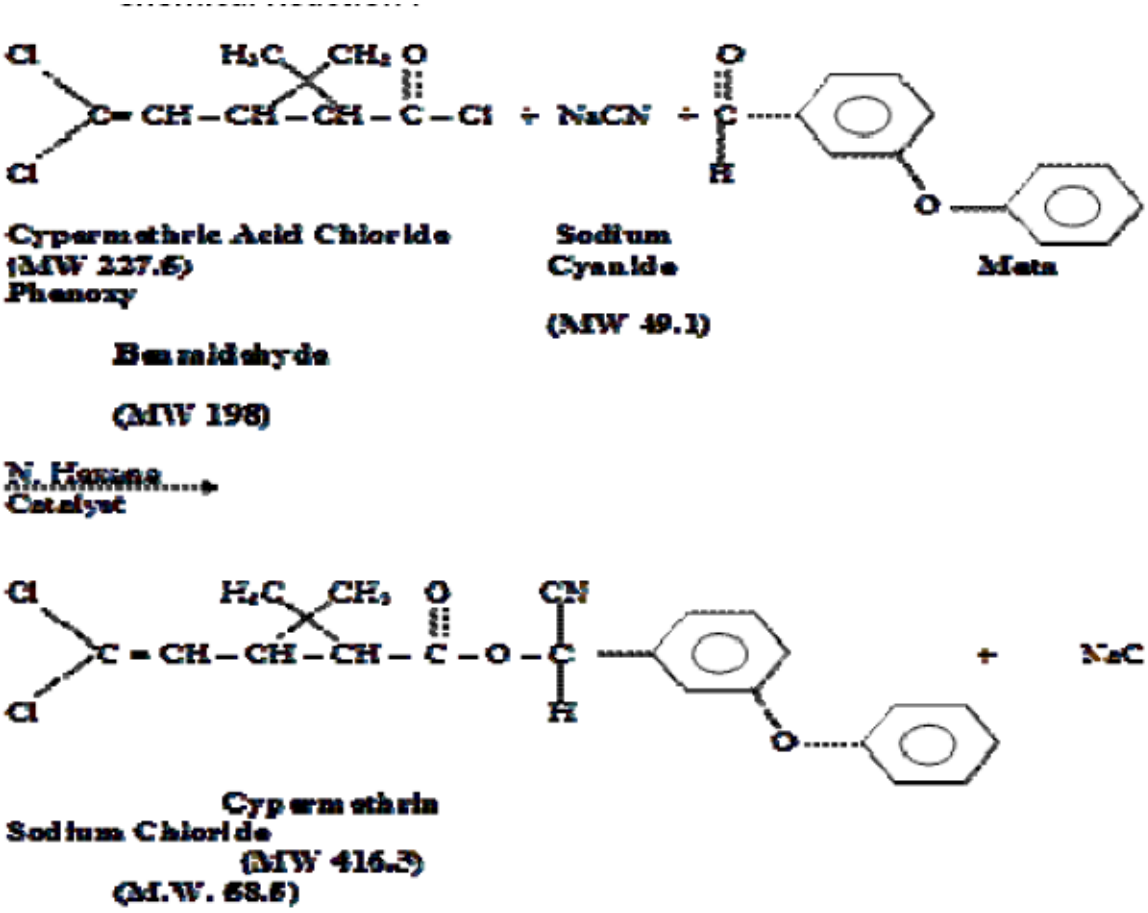
Manufacturing Process

Meta Phenoxy Benzaldehyde is reacted with Sodium Cyanide to form Meta Phenoxy Benzaldehyde Cyanohydrin as an intermediate. This on reaction with Cypermethric Acid Chloride forms the final Product Cypermethrin. In this process n-Hexane is used as solvent along with phase transfer Catalyst.

The reaction mass of Cypermethrin is washed by Soda Ash solution & Water. Finally n-Hexane is stripped off to get pure Cypermethrin.

Aqueous layer which contain traces of Sodium Cyanide is detoxified by the treatment of Sodium Hypochlorite 8 – 10% Solution to < 0.2 ppm Level.

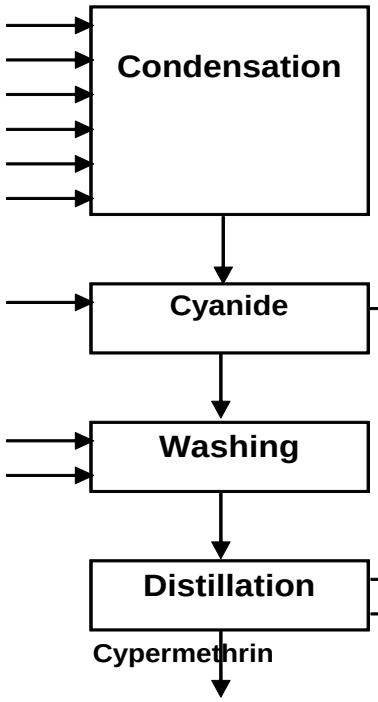
Chemical Reaction



Flow diagram with Mass Balance

Mass balance of Cypermethrin

INPUT	KG	OUTPUT	KG
CMAC	600		
MPB	470		
NaCN	150		
PTC	8		
Water	325		
Hexane	1050		
Hypochlorite	1450	Aqueous effluent	2373
Water	180		
Hypochlorite	190		
		Hexane recovery	1000
		Residue	50
		Cypermethrin	**1000**
Total	**4423**		**4423**



6. Permethrin

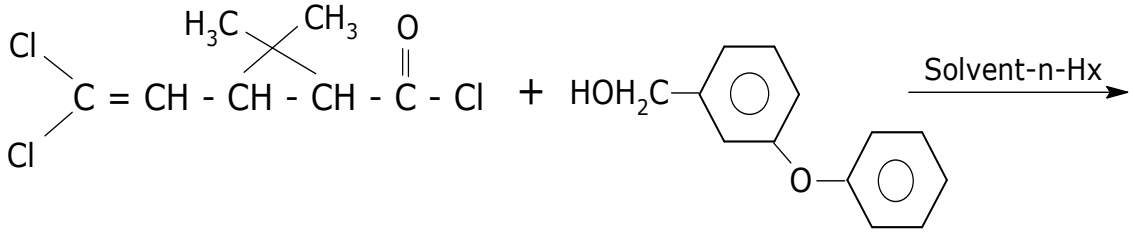
Manufacturing Process:

Meta Phenoxy Benzyl Alcohol is reacted with Cypermethric Acid Chloride (CMAC) in presence of solvent n-Hexane to give the permethrin mass. Hydrochloric acid gas is generated during the reaction which is scrubbed in water to get 30% solution of hydrochloric acid.

The resulting mass is then washed by soda ash solution as well as water. Finally solvent is stripped off to recover it & to get the pure Permethrin Tech.

Chemical Reaction:

Permathrin (Tech.)

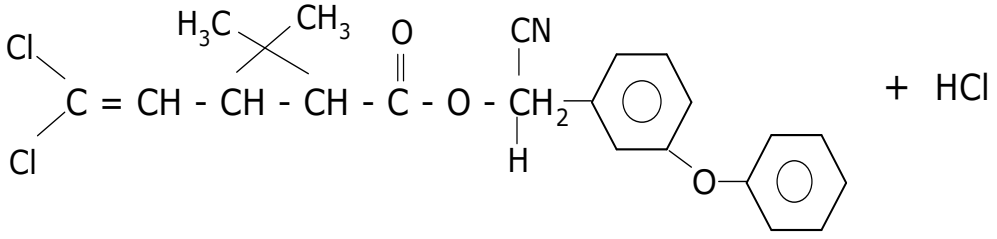


CMAC

(MW- 227.5)

MPBAL

(MW- 200.3



Permethrin

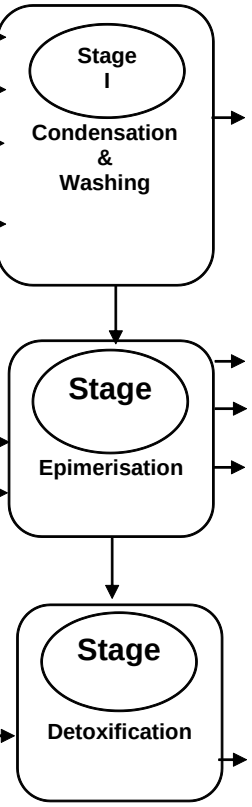
(MW- 391.3)

Hydrochloric Acid

(MW- 36.5)

Flow diagram & Mass Balance:

INPUT	KG	OUTPUT	KG
MPBAL	575		
CMAC	650	30% HCl Solution	350
n-Haxane	3000		
Water for HCl srubbin	250		
		Recover n-Hexane	2850
		Residue	150
5% Soda-ash soln	1000	**Permethrin Tech.**	**1000**
Water	450		
C.S. lye. 48%	45	Detoxified Aq. Effluent	1620
TOTAL	**5970**	**TOTAL**	**5970**



7. Delta Cypermethrin

Manufacturing process

Stage 1: Ester of Bicisthemic acid is reacted with Thionyl Chloride to form Bicisthemic acid chloride. In presence of Caustic soda.

Stage 2: M-phenoxybenzaldehyde is reacted with Sodium cyanide to form Metaphenoxy benzaldehyde cyanohydrin as an intermediate. This on reaction with Bicisthemic acid Chloride forms the product deltamethrin. The reaction mass of deltamethrin is washed with water.

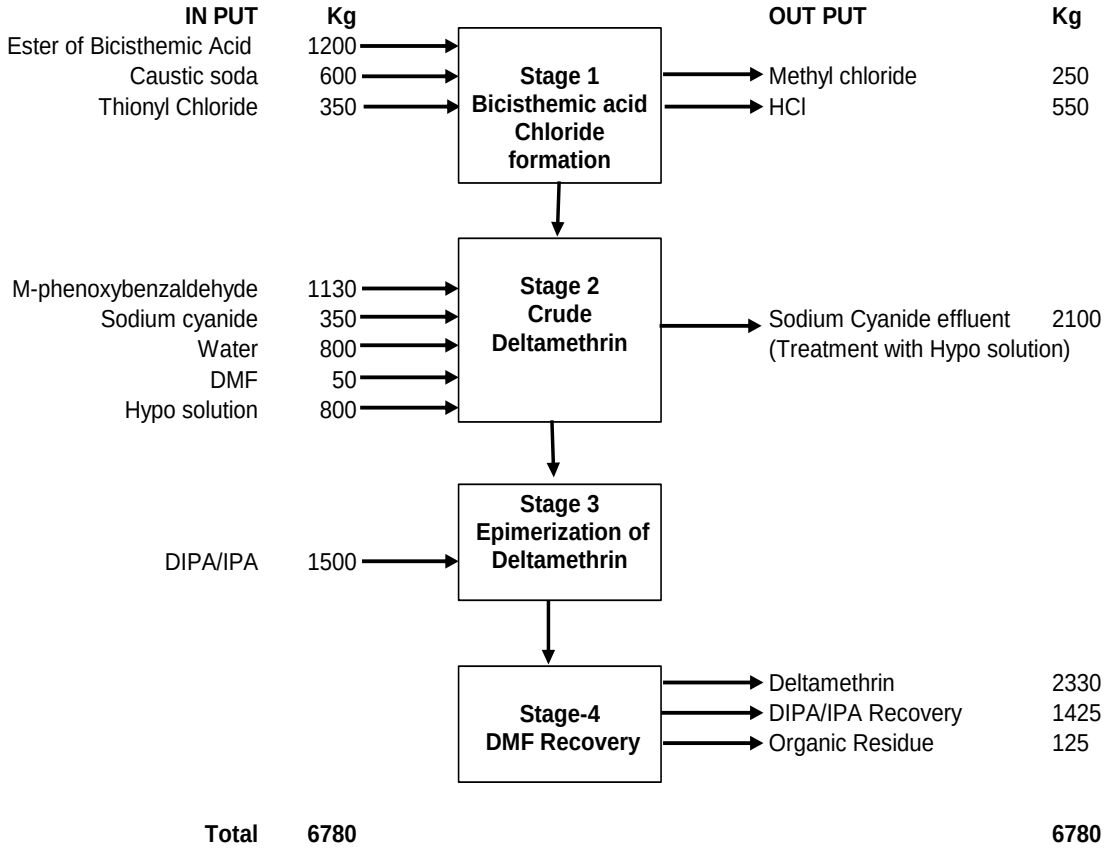
Aqueous layer which contain traces of Sodium cyanide is detoxified by the treatment of Sodium hypo chlorite 10-12% solution to < 0.2 ppm level.

Stage 3: Deltamethrin is epimerized in presence of Di isopropyl amine and isopropyl alcohol at low temperature to form deltamethrin.

Stage 4: Finally DMF is distilled off to get pure deltamethrin technical.

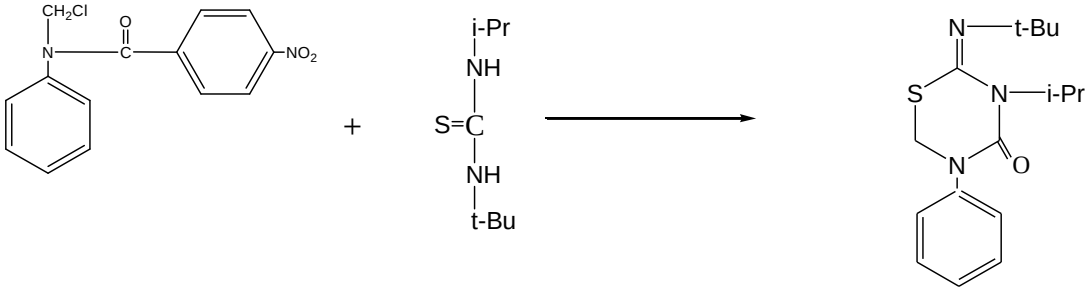
Flow diagram

Mass balance of Deltamethrin



8. Buprofezin

CHEMICAL REA CTION:



p - Nitrophenyl N - Chloromethyl Carbamate

N-isopropyl- N-tert-butyl Thiourea

BUPROFEZIN

Flow diagram & Mass Balance:

Mass balance of Buprofezin

IN PUT	Kg		Kg	OUT PUT
1-isopropyl 3-t-butyl thiourea	475	Reactor		
N-chloromethyl -N-phenyl carbamoyl chloride	650			
MCB	2300			
Ammonium bicarbomate	2350			
Water	1900			
		Separation	4350	Aqu. Layer to ETP
		Distillation	2190	MCB recovery
			110	Residue
Methanol	1500	Crystallization		
		Filtration & Drying	1420	Methanol Recovery
			105	Drying Loss
			1000	Buprofezin
Total	**9175**		**9175**	

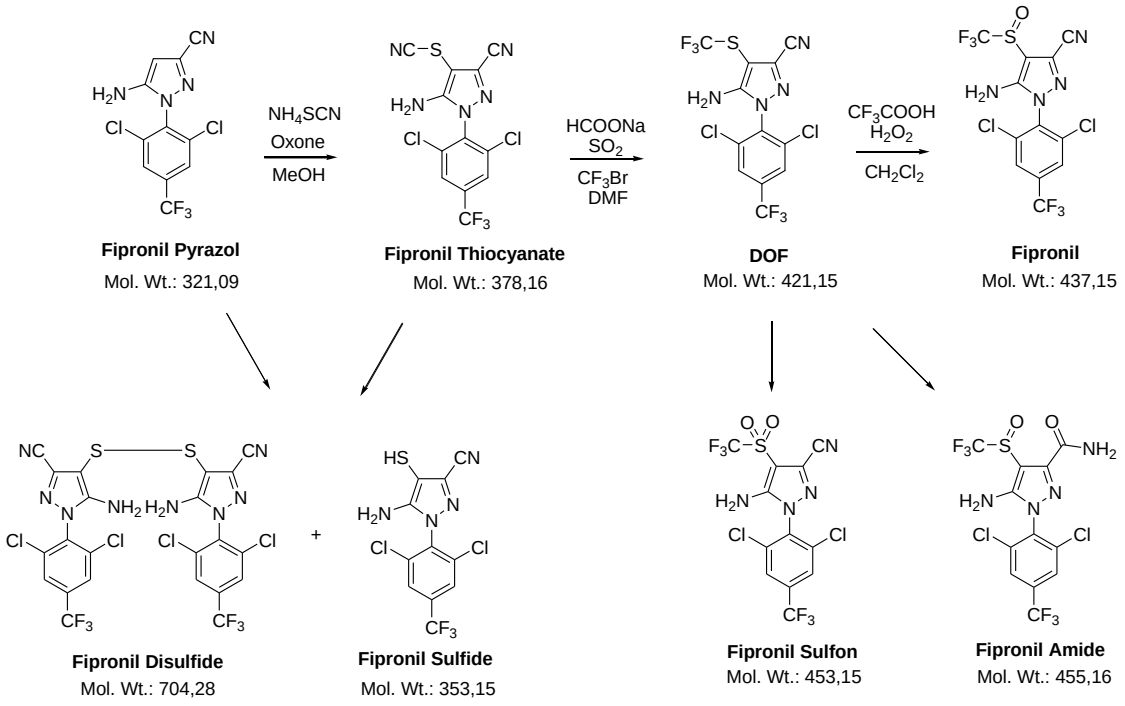
9. Fipronil

Process Description

- Fipronil Pyrazole and Ammonium Thiocyanate are condensed in the presence of oxidant Oxone® and MeOH as solvent.
- Reaction is completed in 3.0 hrs at 39 – 40 °C.
- An inorganic salt is filtered, washed with MeOH and dried.
- MeOH is recovered from filtrate partially under reduced pressure. Recovered MeOH is recycled.
- Partially concentrated mass is dumped in to water at RT. Stirred for 3 – 4 Hrs at RT.
- Product (FPT) is filtered at RT and washed with water.
- Product (FPT) is dried at 50 °C till constant weight is obtained.
- Fipronil Thiocyanate and CF3Br are reacting in the presence of SO_2 (g), Sodium formate and DMF as solvent.
- Reaction is carried out under pressure in Auto clave at 70°c.
- Reaction mixture is cooled down at 40 °C.
- The pressure in autoclave is released and scrubbed in 7 % NaOCl soln.
- Reaction mass is transferred to mixture of water + Isopropyl acetate solution and stirred for ½ hrs at RT.
- Organic and Aq. phases are separated. Aq. phase is extracted with IPAc and then treated with NaOCl solution and incinerated.
- Combined organic phase is washed with water. Washed organic phase taken for partial IPAc recovery under reduced pressure. Recovered IPAc is recycled. Partial concentrated mass is taken for crystallization.
- Product is crystallized out and filtered out and dried.
- Mother liquor is subjected for isopropyl acetate recovery. Reco. IPAc is recycled and organic residue is incinerated.
- Des-Oxy Fipronil, Trifluoro acetic acid and chloro benzene are mixed at RT.
- H_2O_2 is added for 30 min. at low temperature.
- After completion of reaction chloro benzene is charged and CF3COOH is distilled out.
- Product is crystallized out in Ethanol and water, filtered and dried.

Chemical Reaction:

Fipronil Synthesis - Step 1 to 3 - and possible impurities



/MN

Flow diagram & Mass Balance:

Mass balance of Fipronil

IN PUT	Kg		Kg	OUT PUT
CF3COOH	2500	Oxidation	2400	CF3COOH recovery
Monochloro benzene	1500		1475	MCB recovery
H2O2	1040		1165	Solid waste
Thiopyrazole derivative	2500			
Water	2500	Washing	4000	To ETP
			1000	Fipronil
Total	10040		10040	

10. Thiophenate methyl

Manufacturing Process

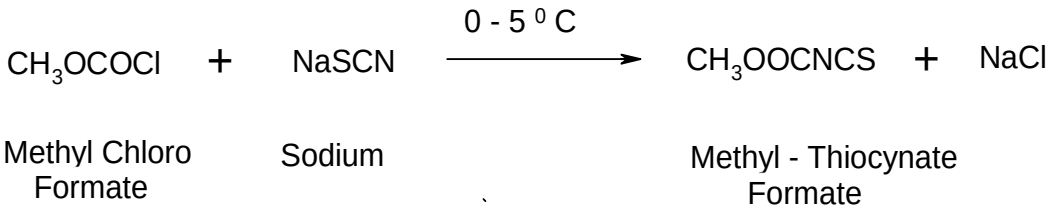
Ethylene dichloride is taken into a reactor provided with gear – motor agitator and distillation column – condenser assembly.

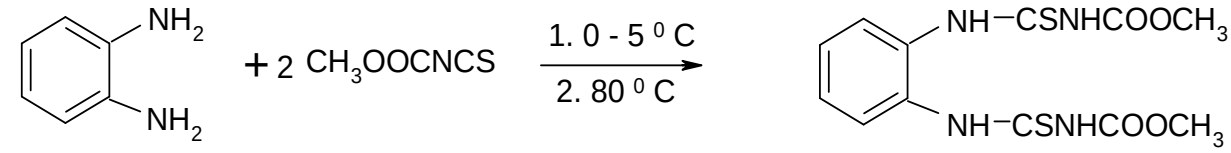
Sodium Thiocyanate is added in Ethylene dichloride. Then is reacted with Methyl Chloro formate in the ratio of 1 mol: 1 mol at temp. < 5^0C and Methyl Thiocyanateformate is formed.

In above ethylene dichloride layer, solution of O-PhenyleneDiamine prepared in EDC is added and after addition the reaction mass is heated to reflux for 3.0 hrs and then Reaction product is filtered off, washed with water and then dried and pulverized and packed as Thiophanate Methyl Technical.

Filtrate and washes are collected and distilled to recover EDC. Final aqueous layer is then sent to ETP.

CHEMICAL REACTIONS:



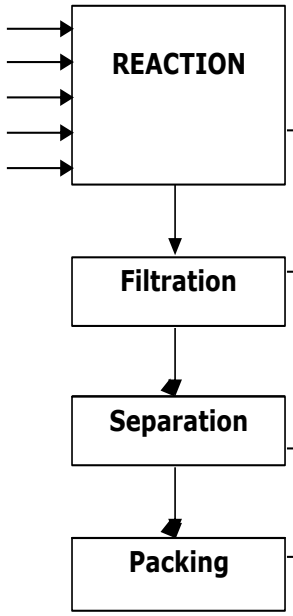


O-Phynelene Diamine

Thio PhanateMethyl

Flow diagram & Mass Balance:

INPUT	KG
EDC	1900
Sodium Thio cyanate	500
Methyl chloro formate	350
OPDA	375
Water	2000



OUTPUT	KG
EDC Recovery	1800
Liquid effluent	2150
Solid waste	175
Product	1000

Total	**5125**		**5125**

11. Emamectin benzoate

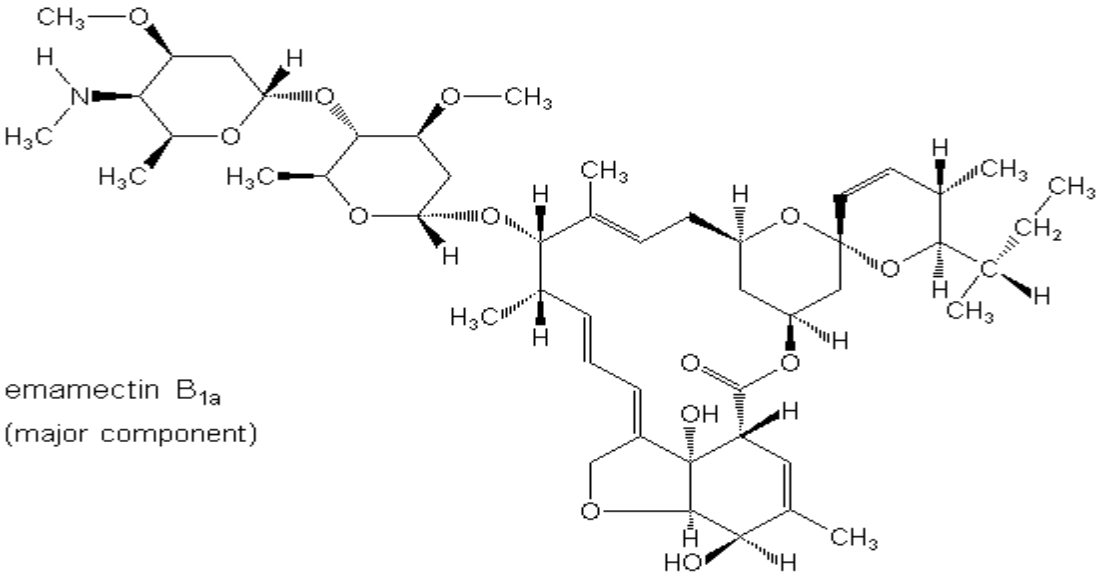
Manufacturing process

It is a composite mixture of 90% emamectin B1a and 10% emamectin B1b as their benzoate salts. It is isolated from fermentation of streptomycessavermitis with an anthelminic and acaricidal. Then methylamine is added in the mixture. Finally benzoate salt is prepared by reaction with methyl benzoate.

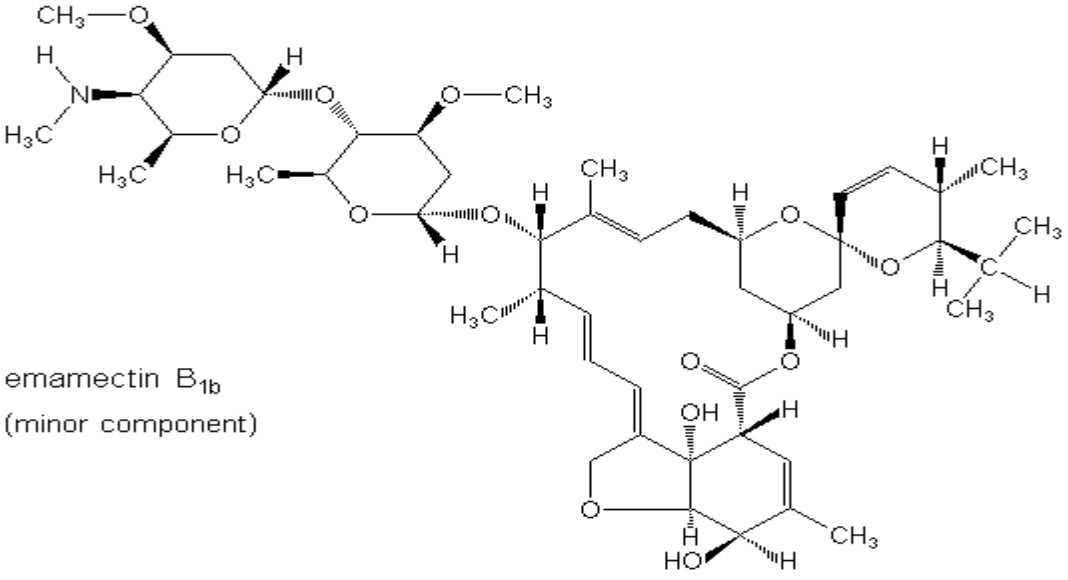
The molecular formula is as below:

C49H75NO13 (emamectin B1a) + C48H73NO13 (emamectin B1b)

Chemical Reaction



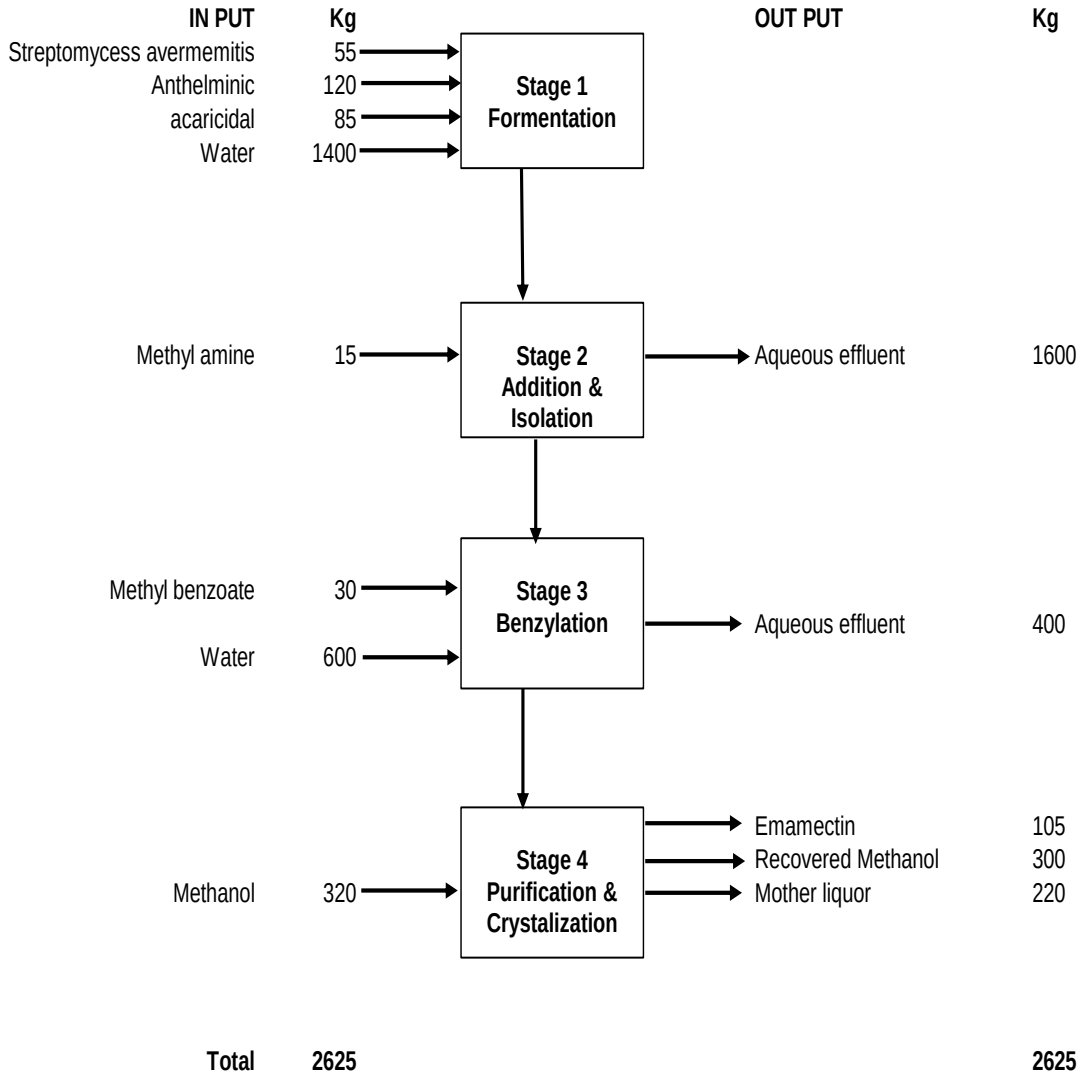
emamectin B_{1a}
(major component)



emamectin B_{1b}
(minor component)

Mass Balance

Mass balance of Emamectin benzoate



12. Bifenthrin

Manufacturing Process for Bifenthrin

Step-I:

Charge DMF, 2-Methyl 3-biphenyl methyl chloride (BPC), Cyhalothric acid (MTH-Acid), K_2CO_3 in presence of catalyst (TBAB) under stirring. Heat it to 60°C and maintain. Remove DMF from the reaction mixture. (8 hrs).

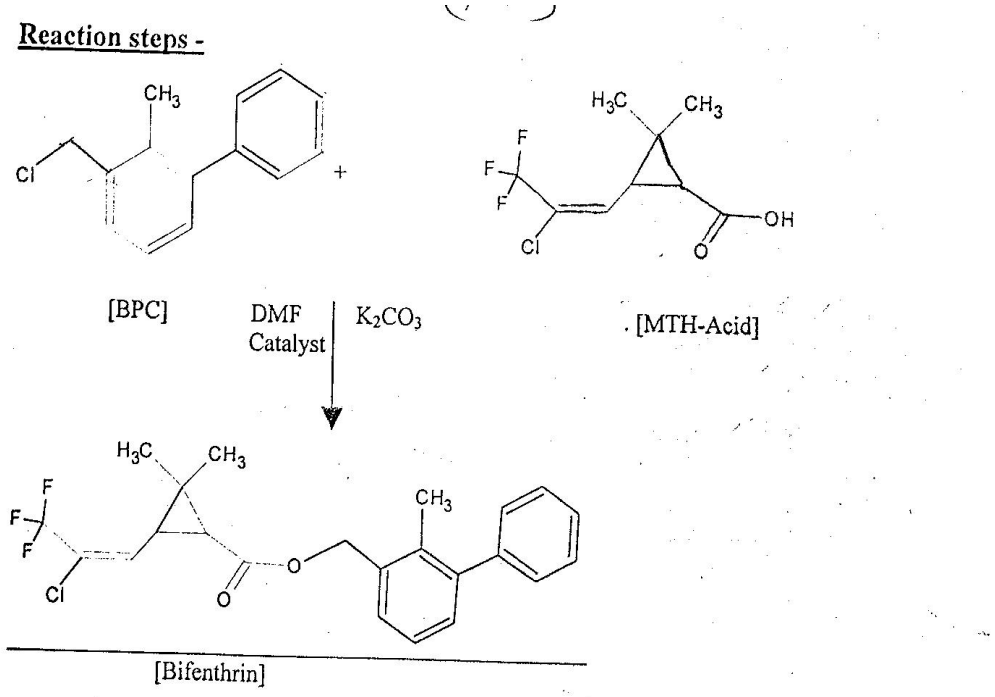
Step-II:

Add water to the reaction mass and extract with n-Hexane. Take the organic layer by discarding aqueous layer and wash the organic layer with 10% $NaHCO_3$. Finally wash the organic layer with water. Remove hexane by distillation. (4 hrs)

Step-III:

The crude Bifenthrin was finally crystallized with 10% methanol in n-Hexane to obtain the pure Bifenthrin (4 hrs).

Chemical Reaction



Flow Diagram

MASS BALANCE OF BIFENTHRIN					
IN PUT	**KG**			**OUT PUT**	**KG**
MTH Acid	490	→	Stage 1 Reaction		
BPC	450	→			
DMF	1020	→			
K2 CO3	150	→			
			↓		
			Recovery	→ DMF Recovery	970
				→ Residue	50
			↓		
Hexane	550	→	Washing	→ Aqueous Layer	700
Water	500	→			
10% $NaHCO_3$ Solution	60	→			
			↓		
			Recovery	→ Hexane Recovery	520
				→ Residue	30
			↓		
			Crystalization	→ Bifenthrin	800
10% Methanol in Hexane	1400	→			
Water	280	→		→ Aqueous Effluent	480
			↓		
			Recycle	→ Methanol	100
				→ Hexane	1250
Total	**4900**				**4900**

13. DDVP

Manufacturing Process

Stage 1

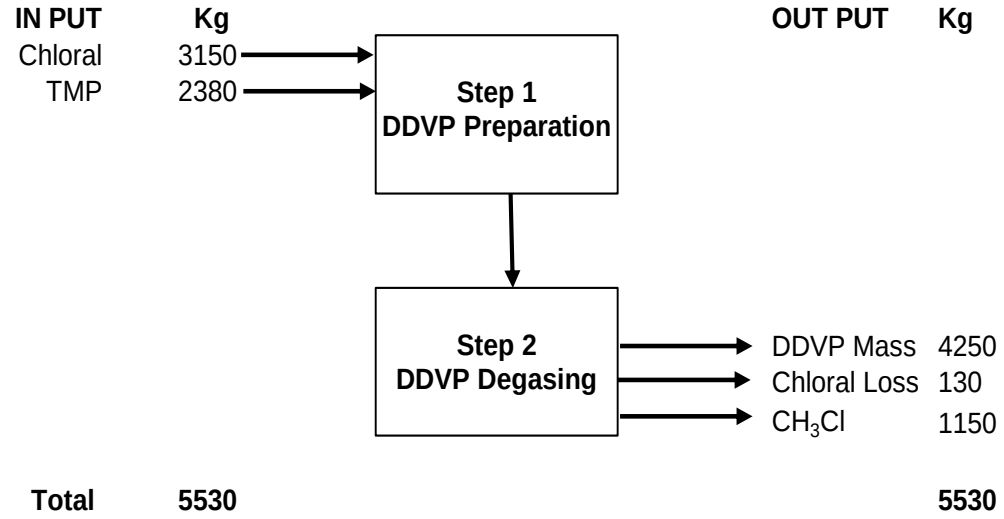
Charge Chloral in the reaction vessel. Stir the reaction mass at room temperature. Charge TMP slowly in the reaction mass in 8-10 hrs and stir the reaction mass at room temperature until reaction is complete.

Stage 2

After completion of the reaction (stage 1) degas the reaction mixture for methylene chloride removal. After degassing is completed, material is filtered and packed.

Process Flow Diagram

Mass balance of DDVP



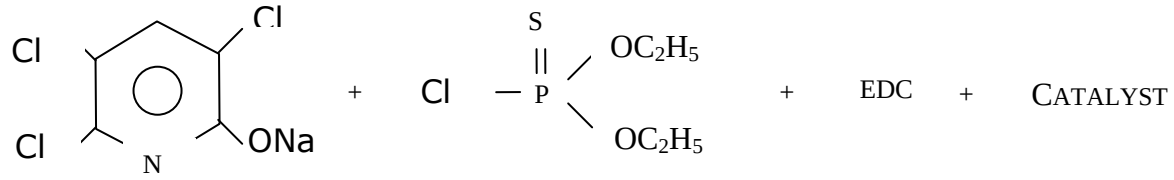
14. Chlorpyriphos

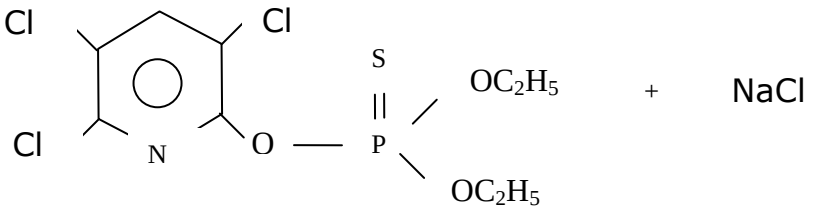
Manufacturing Process

Sodium Salt of trichloro Pyridinol (NaTCP) is reacted with Diethyl Thio Phosphoryl Chloride (DETC) in presence of catalyst and solvent to get Chlorpyrifos Tech. of 94% purity. Recovered solvent is recycled in next batch.

Finally Toxin Effluent which contains traces of pesticides is taken to Hydrolysis stage for detoxification. Where Aqueous Mass is treated at high temperature By Alkali for the rapid hydrolysis of pesticides to simpler non- toxic compounds.

CHEMICAL REACTION





Flow diagram & Mass Balance:

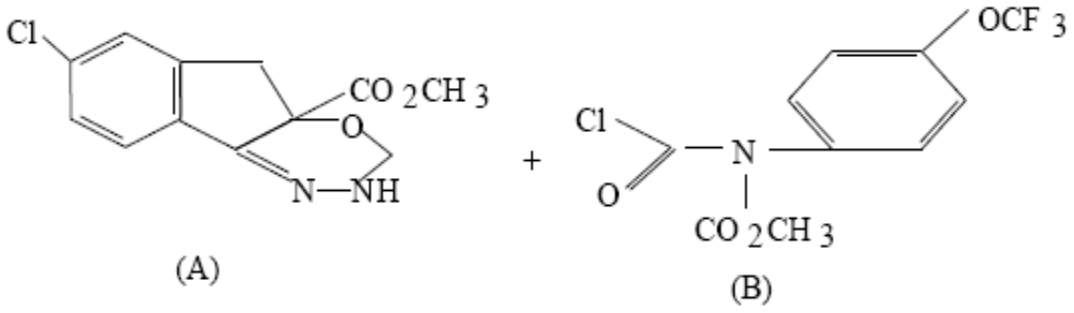
Mass balance of Chlorpyrifos						
INPUT	**KG**				**OUTPUT**	**KG**
NaTCP	780	→	**Stage 1 CPP Preparation**	→	Chlorpyrifos	1000
DETC	540	→		→	Recovered solvent- EDC	2570
Water for Reaction	565	→		→	Residue	78
Water for washing	2700	→		→	Effluent	3595
Catalyst	8	→				
EDC	2650	→				
	7243					**7243**
Detoxification treatment						
Effluent	3595	→	**Stage 2 Alkali Hydrolysis**			
C. S. lye 48%	55	→		→	DETOXIFIED Aq. Mass	3650
Total	**3650**					**3650**

15. Indoxacarb:

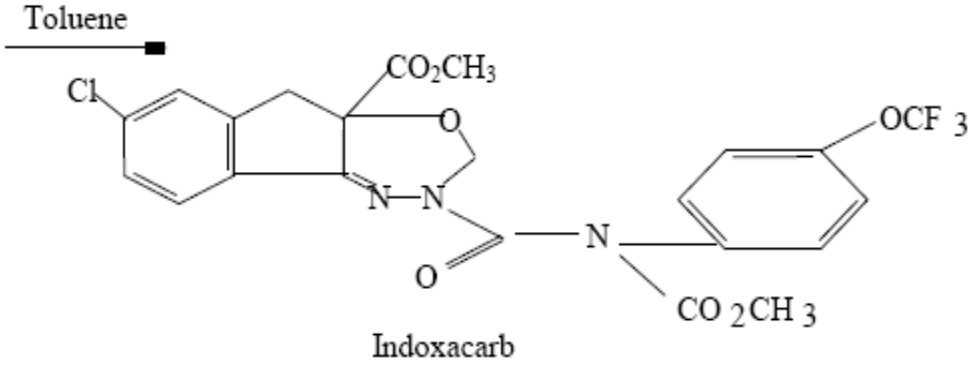
Manufacturing Process:

Take Methyl 7-Chloro-2,5-dihydroindeno [1,2-e][1,3,4] oxadiazine-4a(3H)-carboxylate (A), Toluene, Catalyst in the reactor. Add Methyl (Chlorocarbonyl) [4-(trifluoromethoxy) phenyl] carbamate (B) till the reaction is completed. Filter the organics layer and recover solvent by distillation and packed the Indoxacarb in the drum for dispatch.

Chemical Reaction:



(A) (B)



Indoxacarb

A = Methyl 7-Chloro-2,5 - dihydroindens [1,2 - e] oxadiazine -4a (3H) - carboxylate

B = Methyl (Chlorocarbonyl) [4-trifluoromethoxy) phenyl] carbonate

Mass Balance:

Indoxacarb

	Input (kg)			Output (kg)
A	600	→ Reactor		
B	300	→ Reactor		
Catalyst	200	→ Reactor		
Toluene	550	→ Reactor		
		Reactor → Filteration		
Caustic Ly	80	Filteration →	cata. Recycle	200
Water	1200			
		Filteration → Neutralisation		
		Neutralisation →	ETP	1180
		Neutralisation → Distillation		
		Distillation →	Toluene for recycle	550
		Distillation →	**Indoxacarb**	1000
Total	**2930**		**Total**	**2930**

A = Methyl 7-Chloro-2,5 - dihydroindens [1,2 - e] oxadiazine -4a (3H) - carboxylate

B = Methyl (Chlorocarbonyl) [4-trifluoromethoxy) phenyl] carbonate

16. Novaluron

Manufacturing Process

1. Novaluron technical is prepared by reaction of 2,6-difluoro benzoyl isocyanate with 2-chloro-4-amino phenoxy ether in presence of monochloro benzene as a solvent.
2. After completion of the reaction, the reaction mass is cooled, filtered and washed with water.
3. Novaluron wet cake is then recrystallised with toluene, filtered and dried to get Novaluron technical

Mass balance of Novaluron

IN PUT	Kg		OUT PUT	Kg
2,6-difluoro benzoyl isocyanate	1010	→ Stage 1 Reaction		
2-chloro-4-amino phenoxy ether	2450	→ Stage 1 Reaction		
Monochloro benzene	1650	→ Stage 1 Reaction		
		Stage 1 Reaction → Stage 2 Cooled & Filtered		
		Stage 2 Cooled & Filtered →	Mother liquor	1615
		Stage 2 Cooled & Filtered →	Salt	185
		Stage 2 Cooled & Filtered → Stage 3 Water washing		
Water	2800	→ Stage 3 Water washing		
		Stage 3 Water washing →	Aqueous effluent	3170
		Stage 3 Water washing → Stage 4 Crystalisation		
		Stage 4 Crystalisation →	Novaluron	3000
Toluene	2400	→ Stage 4 Crystalisation		
		Stage 4 Crystalisation →	Recovered toluene	2340
Total	**10310**			**10310**

17. Fenpyroximate

Manufacturing Process

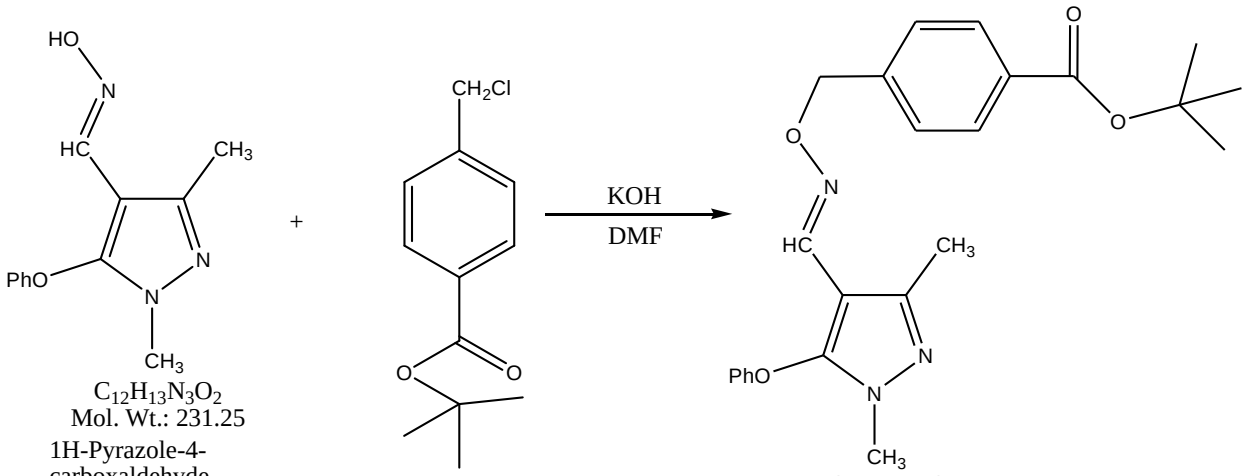
Step-1: Charge H- pyrazole-4-carboxaldehyde, 1, 3-dimethyl-5-phenoxy-oxime (PCDPO) and tertiary butyl-4-(chloro methyl benzoate (TBCMB) in presence of KOH as base and DMF as solvent in a vessel for carrying a reaction

Step-2: After completion of the reaction organic layer is separated as a salt from a reaction mass

Step-3: The separated mass is then washed with water to get separate organic, recovery of solvent and aqueous phase

Step-4: The organic mass is again washed with water which after processing get recovered a solvent as product Fenpyroximate

CHEMICAL REACTION:

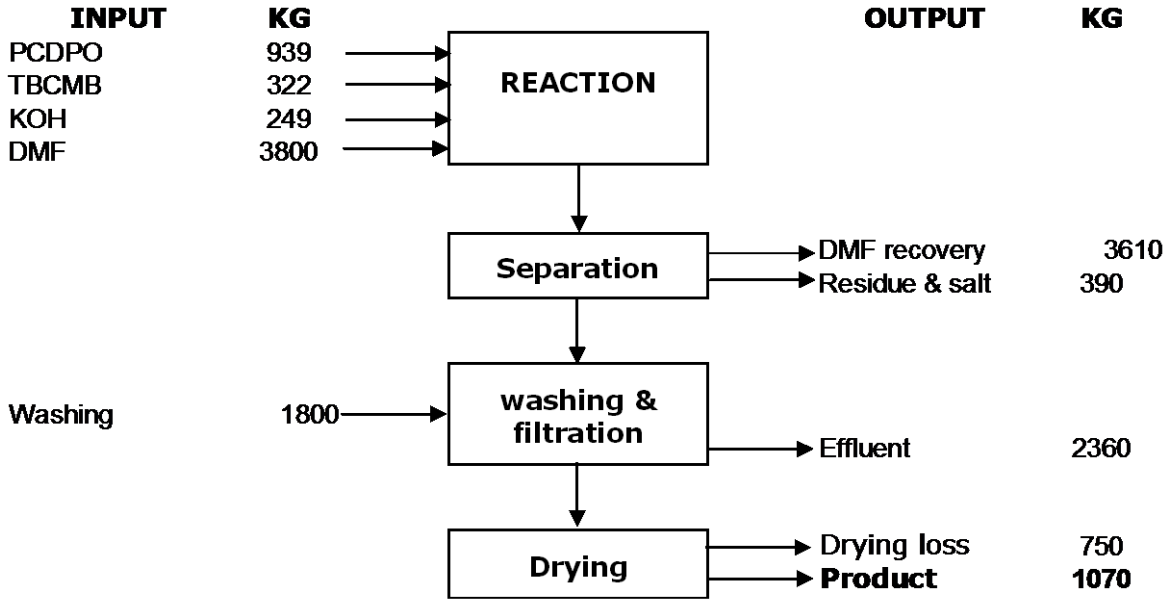


$C_{12}H_{13}N_3O_2$
Mol. Wt.: 231.25
1H-Pyrazole-4-carboxaldehyde, 1,3-dimethyl-5-phenoxy-oxime

$C_{12}H_{15}ClO_2$
Mol. Wt.: 226.7
tert-butyl 4-(chloromethyl)benzoate

$C_{24}H_{27}N_3O_4$
Mol. Wt.: 421.5
FENPYROXIMATE

MATERIAL BALANCE



C. Fungicide

1. Azoxystrobin

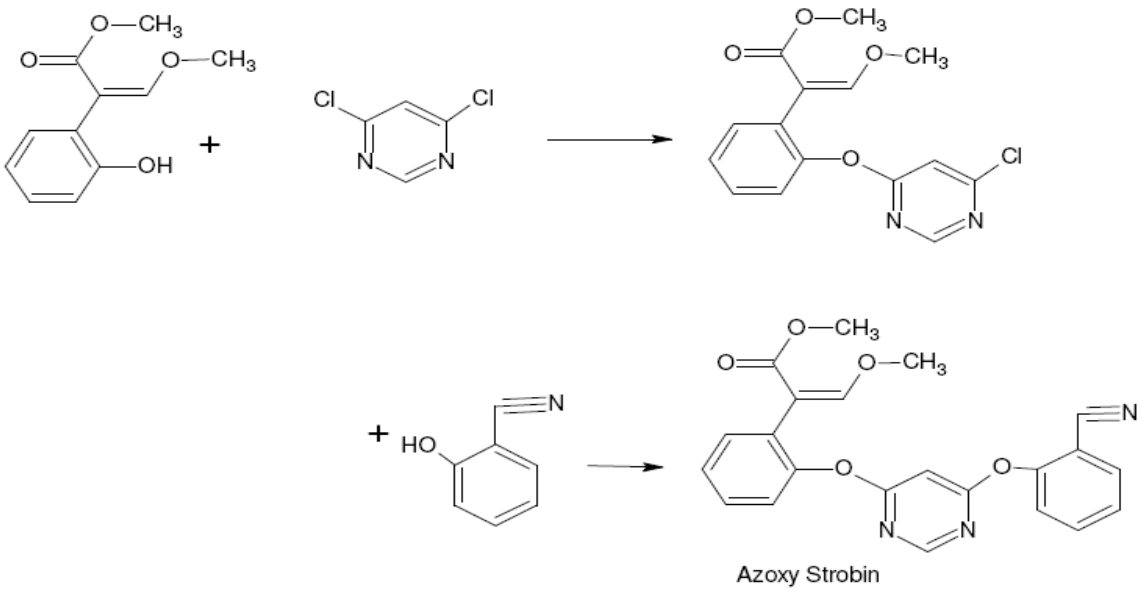
Process Description

2,6 Dichloro Pyrimidine and anhydrous Potassium carbonate is charged in DMF. Solution of Methyl- 2-(2 Hydroxy phenyl)-3 methoxyPropenoate in DMF is charged to above solution. When addition is over, warm the reaction mass to complete the reaction. Charge 2 cyano Phenol to the reaction mass and add catalytic amount of Cuprous Chloride and heat the reaction mass to 100^0C for few hours.

Filter the reaction mass to remove inorganics and distilled out DMF from reaction mass. Add hexane and wash the reaction mass with dilute caustic to remove unreacted cyano phenol from the reaction mass.

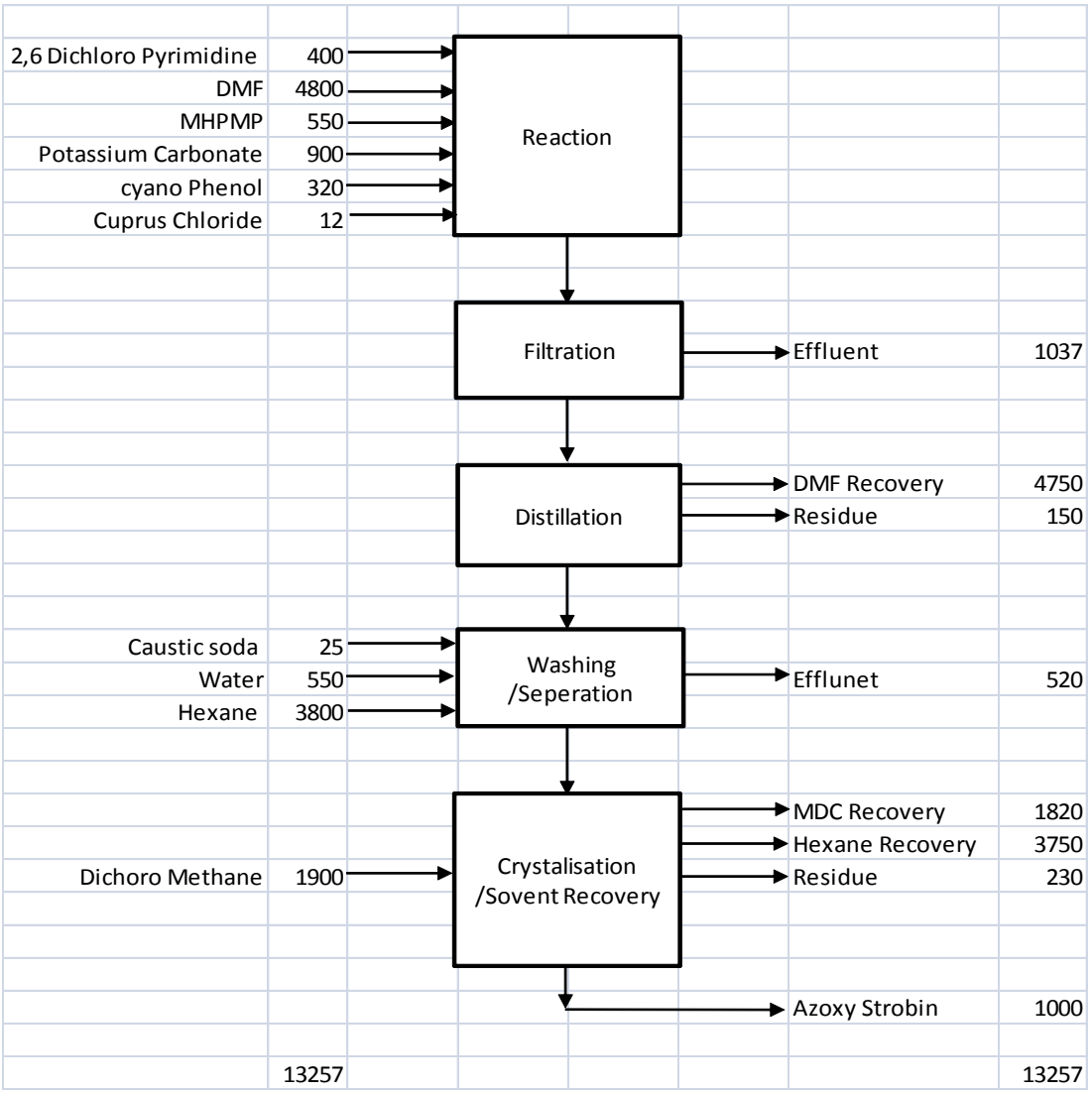
Crystallize the crude with ether/dichloromethane and n Hexane, precipitate is filtered, centrifuged and dried to get technical grade white crystalline solid.

Chemical Reaction



Azoxy Strobin

Mass Balance



2. Tricyclozole

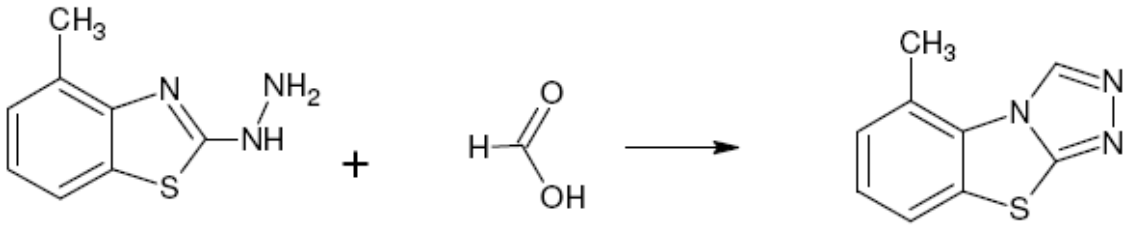
Process Description

2- Hydrazino -4-Methyl BenzoThiazol is charged in formic acid at 90-100 c in four hours time. Temperature is raised to complete the reaction. After completion of reaction formic acid is distilled out along with some water.

After most of formic acid is distilled out water is charged in to the reactor and residual acid is neutralized with Caustic soda lye

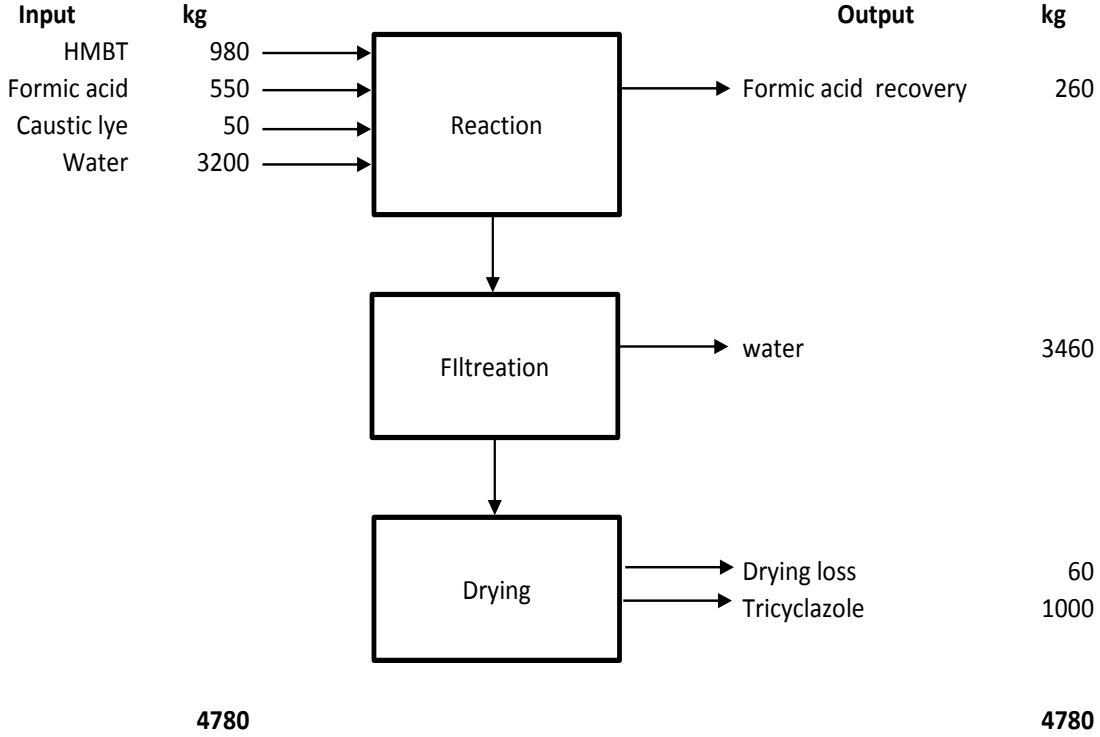
Slurry is filtered out, centrifuged and dried. Filtrate is sent to ETP

Chemical Reaction



HMBT Tricyclazole

Flow Diagram



3. Hexaconazole

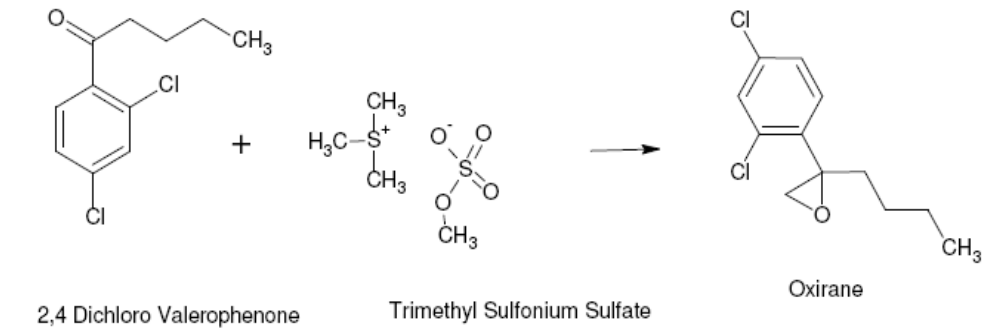
Process Description

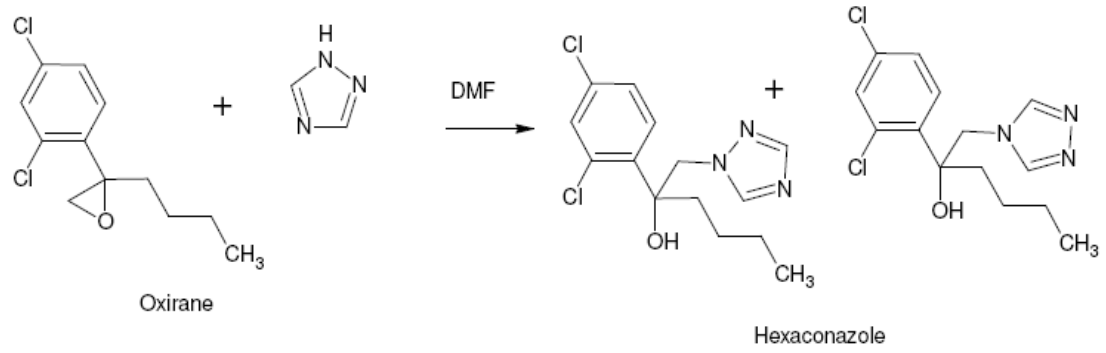
Trimethyl sulfonium sulfate preparation

Di Methyl sulfate is charged in Di Methyl Sulfide at 33^0C to form Trimethyl sulfonium sulfate.

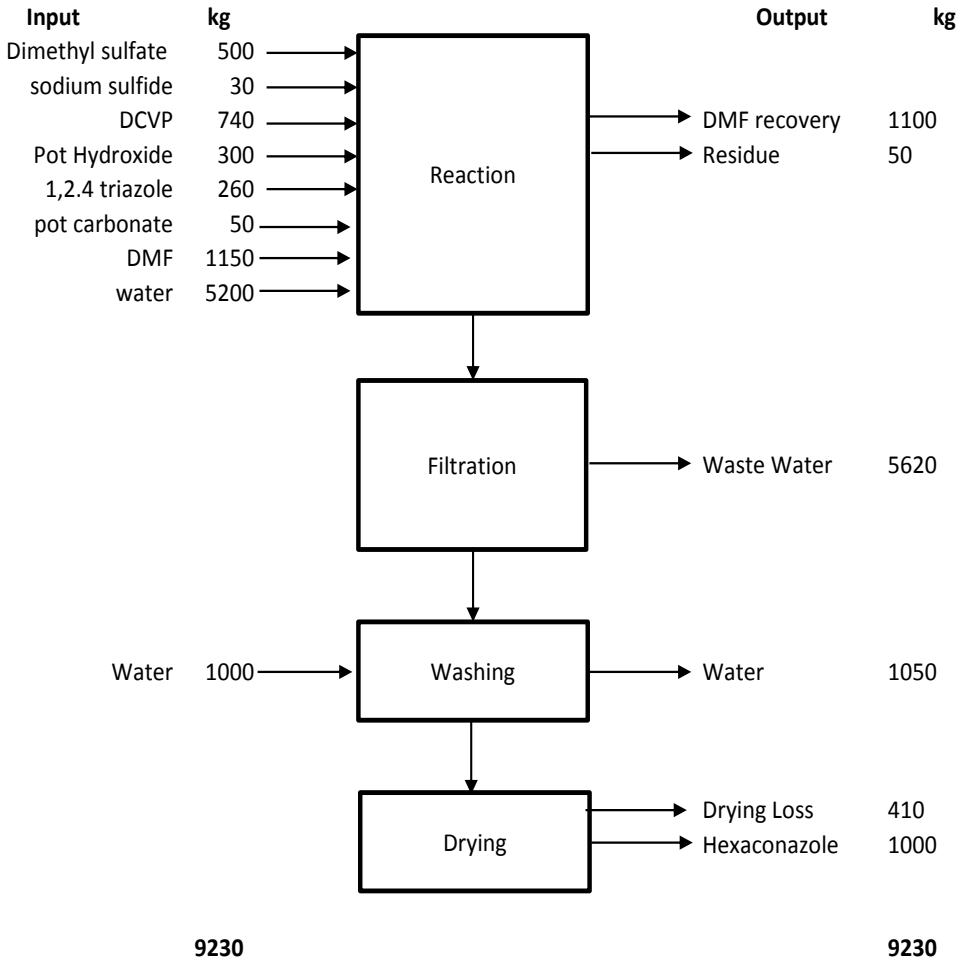
2,4 Di Chloro Valerophenone is reacted with Trimethyl sulfonium sulfate in presence of potassium Hydroxide to form Oxirane. Solvent Di Methyl sulfide is recovered by distillation and product (Oxirane) is separated from Potassium Hydrogen sulfate water is added to dissolve salt and back extracted with Methylene dichloride and then Aqueous is transferred to ETP.1,2,4 1H Triazole and Potassium Carbonate is charged in Di Methyl formamide solvent and Previously prepared Oxirane is added at elevated temperature to form Hexaconazole. After completion of reaction, organic phase is separated by filtration. Carbonate sludge is washed with DMF and collected with organic filtrate. Sludge is transferred to solid waste DMF is distilled out from reaction mass first at atmospheric distillation and then by vacuum distillation. Hexaconazole is isolated from molten mass with help of water. Slurry is filtered, centrifuged and dried.

Chemical Reaction





Mass Balance



4. Mancozeb

Manufacturing Process:

Stage 1

Carbon Disulphide and Ethylene Diamine and Sodium Hydroxide are reacted in the presence of water to form the Di Sodium salt of Ethylene BisDithio Carbamate Hexa hydrate (DBH).

Stage 2

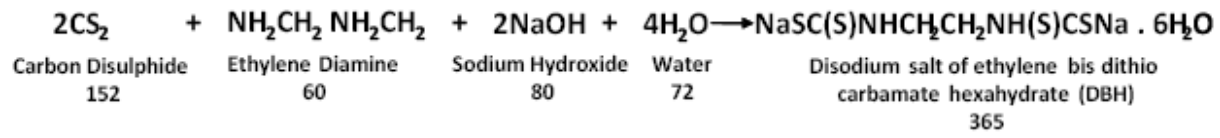
Di Sodium salt of Ethylene BisDithio Carbamate Hexa hydrate is reacted with manganese sulphate to form manganese salt of Bis-Dithio Carbamate.

Stage 3

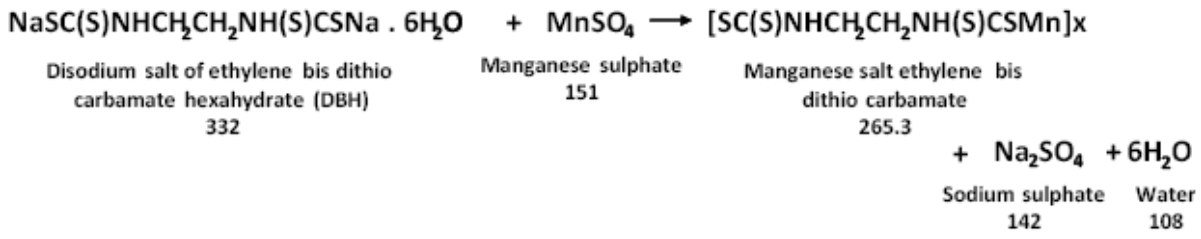
The manganese salt further reacts with Zinc Sulphate to convert into Mancozeb. Slurry is initially spray dried and subsequently vacuum dried for Mancozeb powder formulation.

Chemical Reaction

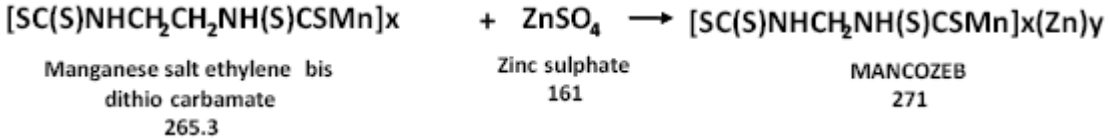
Stage 1



Stage 2



Stage 3



Mass Balance

Mass balance of Mancozeb

IN PUT	Kg		Kg	OUT PUT
EDA	198	→ Sodium salt formation		
Water	200	→ Sodium salt formation		
NaOH (48%)	570	→ Sodium salt formation		
CS2	515	→ Sodium salt formation		
		↓ Stripping		
Water	25	→ Washing		
MnSO4	85	→ Mancozeb salt formation		
Water	450	→ Mancozeb salt formation		
MnSO4 (27%)	1790	→ Mancozeb salt formation		
Water	210	→ Homonization		
ZnSO4 (32%)	138	→ Homonization		
Water	1180	→ Washing & Filtration	3951	Effluent to MEE
		Drying →	410	loss
		Drying →	1000	Mancozeb
Total	5361		5361	

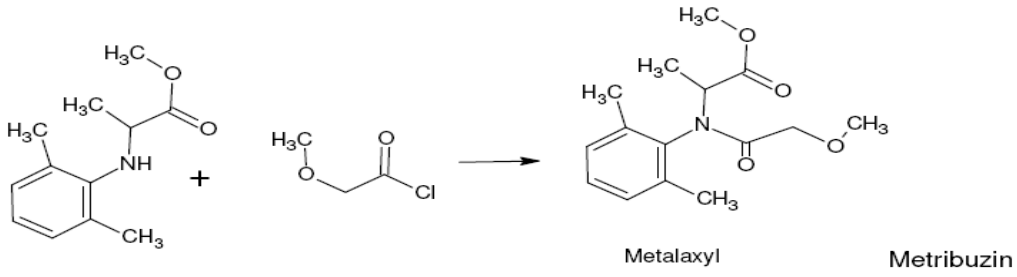
5. Metalexyl

Process Description

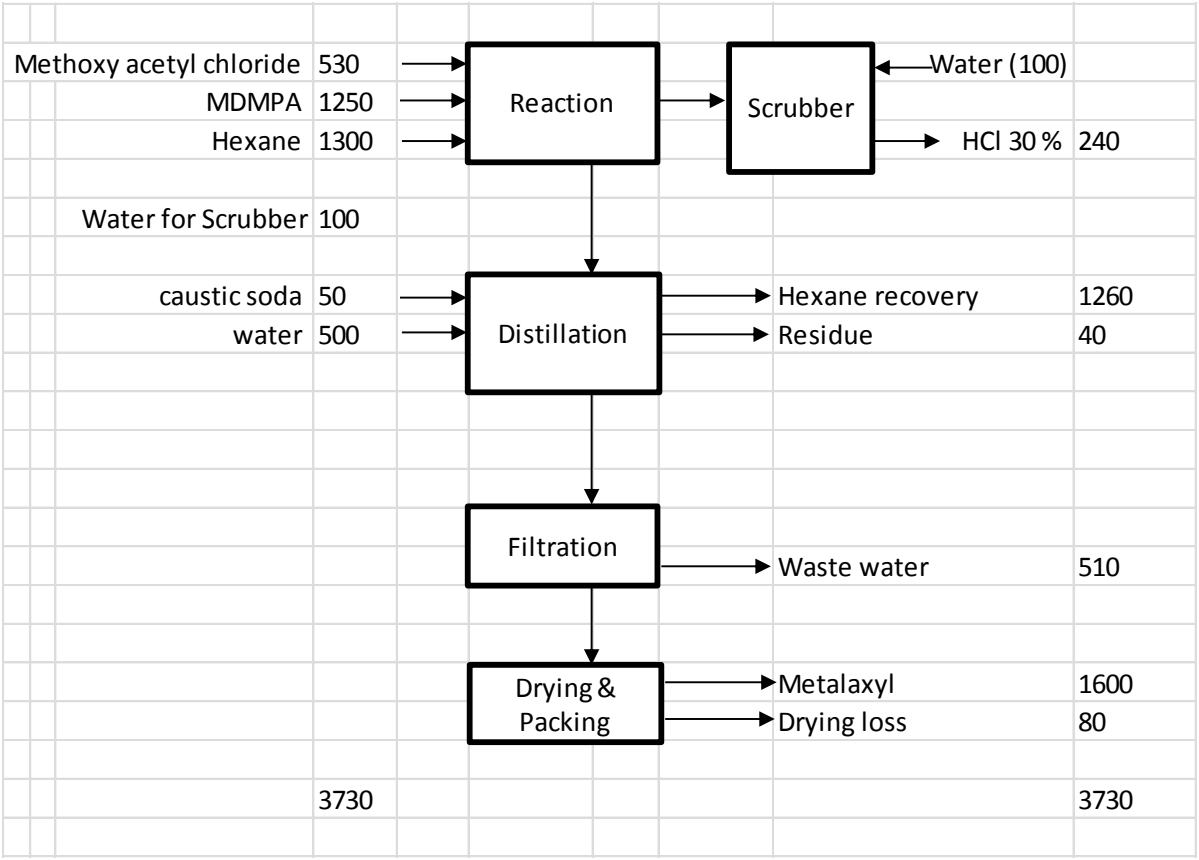
MDMPA (Methyl-2-[(2,6 dimethyl phenyl) amino] propionate) is charged in n-Hexane and Methoxy acetyl chloride is charged slowly at reflux temperature. HCl formed is taken out by applying mild vacuum and scrubbed by water and Caustic soda lye. Residual acid is neutralized by alkali and aqueous phase is separated out.

Product is filtered out, centrifuged and dried. Hexane is recovered from Mother Liquor.

Chemical Reaction



Flow Diagram



6. Difenaconzole

Manufacturing process

Stage 1

Charge 4-methyl-1, 3-dioxolane in the reactor and stir for 30 minute and charge 2-chloro-4-(4-chlorophenoxy) benzyl chloride slowly in the reaction mass for 2-3 hrs and maintain the temperature for 3 hrs and check the sample for reaction complete. After reaction is complete add KOH flakes slowly. Maintain the reaction mass for 4 hrs until the reaction is complete.

Stage 2

Charge intermediate, Dimethyl Formamide, 1,2,4-Trizole and K2CO3 in the reactor and maintain the reaction for 3 hrs at high temperature until the reaction is complete.

Stage 3

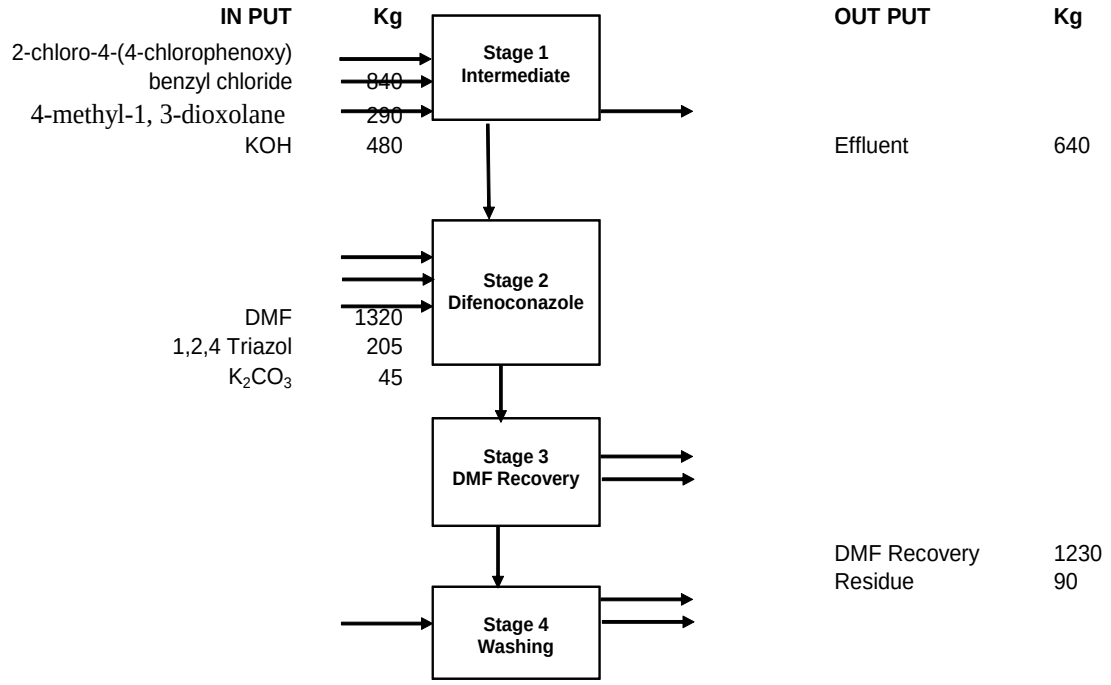
Recover DMF under vacuum partially.

Stage 4

Wash the reaction mass with water. Dry the wet cake of difenoconazole in drier.

Flow Diagram

Mass balance of Difenoconazole



7. Propiconazole

Manufacturing process

Stage 1

Charge 4-propyl-1, 3-dioxolane and Dimethyl Sulphide in the reactor and stir for 30 minute and charge 2,4-dichloro Benzyl Chloride slowly in the reaction mass for 2-3 hrs and maintain the temperature for 3 hrs and check the sample for reaction complete. After reaction is complete add KOH flakes slowly. Maintain the reaction mass for 4 hrs until the reaction is complete.

Stage 2

Charge intermediate, Dimethyl Formamide, 1,2,4-Trizole, K2CO3 and Iso propanol in the reactor and maintain the reaction for 3 hrs at high temperature until the reaction is complete.

Stage 3

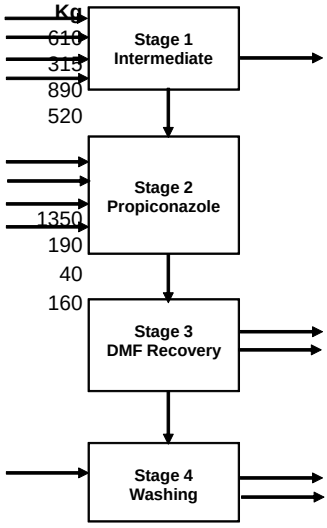
Recover DMF under vacuum partially.

Stage 4

Wash the reaction mass with water. Dry the wet cake in drier.

Flow Diagram

Mass balance of Propiconazole



IN PUT	Kg
2,4-dichloro benzyl chloride	610
4-propyl-1, 3-dioxolane	315
Dimethyl sulphide	890
KOH	520
DMF	1350
1,2,4 Triazol	190
K_2CO_3	40
Iso Propanol	160
Water for washing	995
Total	**5070**

OUT PUT	Kg
O. Effluent	1450
DMF Recovery	1280
Residue	70
Propiconazole	800
Aqueous effluent	1470
	5070

18. Tebuconazole

Manufacturing Process

Step: - 1Process for the preparation of Dimethyl Sulfide (Solvent)

Dimethyl sulfate is reacted with aqueous solution of Sodium sulfide at 75 - 800C, to form dimethyl sulfide. The Product is condensed and collected in receiver. Then nitrogen is purged into the reactor to get maximum possible dimethyl sulfide recovery.

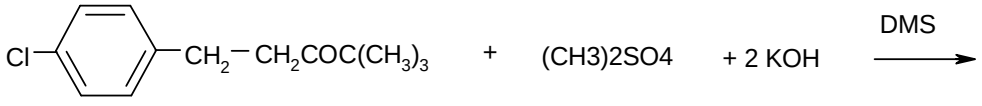
Spent liquor containing sodium sulfate is then transferred to ETP.

$$(CH_3)_2SO_4 + Na_2S + H_2O = (CH_3)_2S + Na_2SO_4 + H_2O$$

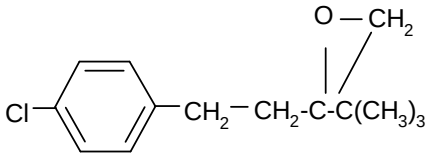
Step: - 2Process for the preparation of Oxirane

1-(4-Chlorophenyl)-4, 4'-dimethyl-pent-3- one (CPDP) is made to react with dimethyl sulphate and potassium hydroxide in presence of dimethyl sulfide to give tebuoxirane. The solvent dimethyl sulfide is recovered by distillation and then the intermediate product (tebuoxirane) separated from the reactor. Then water is added in the reactor to dissolve salt formed during the reaction and transferred to ETP.

TEBU OXIRANE SYNTHESIS



1-(4-CHLOROPHENYL)-4,4'-DIMETHYL-PENT-3-ONE (CPDP)



+ K_2SO_4 + H_2O

Oxirane

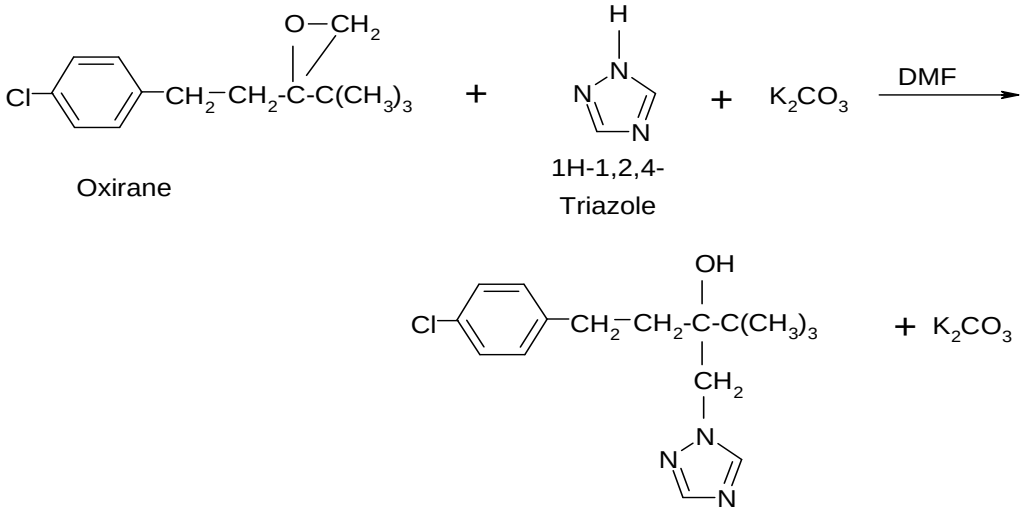
Step: - 3CONDENSATION

In dimethyl formamide, potassium carbonate, 1, 2, 4-triazole is added and then above prepared oxirane is added at reflux temperature. After completion of the reaction the mass is filtered and then solvent DMF is

distilled out. Then the product Tebuconazole is isolated by adding water. The slurry is filtered, centrifuged and dried.

The filtered potassium carbonate sludge is washed with DMF to recover the product. Treated sludge is then transferred to solid waste.

The mother liquor is transferred to ETP.



Oxirane

1H-1,2,4-Triazole

Tebuconazole

Flow diagram & Mass Balance:

INPUT	KG		OUTPUT	KG
Dimethyl Sulfate	500	→ REACTION		
Sodium sulfide	30	→		
Ketal	740	→		
KOH	330	→		
1,2,4-triazole	250	→		
K2CO3	35	→		
DMF	1380	→		
Water	7700	→		
		↓		
		Distillation	→ DMF Recovery	1340
			→ Residue	40
		↓		
		Filtration	→ Liquid effluent	6920
		↓		
		Centrifuge	→ Effluent	1000
		↓		
		Drying	→ Drying loss	665
			→ **Tebuconazole**	**1000**
Total	**10965**			**10965**

D. Intermediate

1. MPBD

Manufacturing process

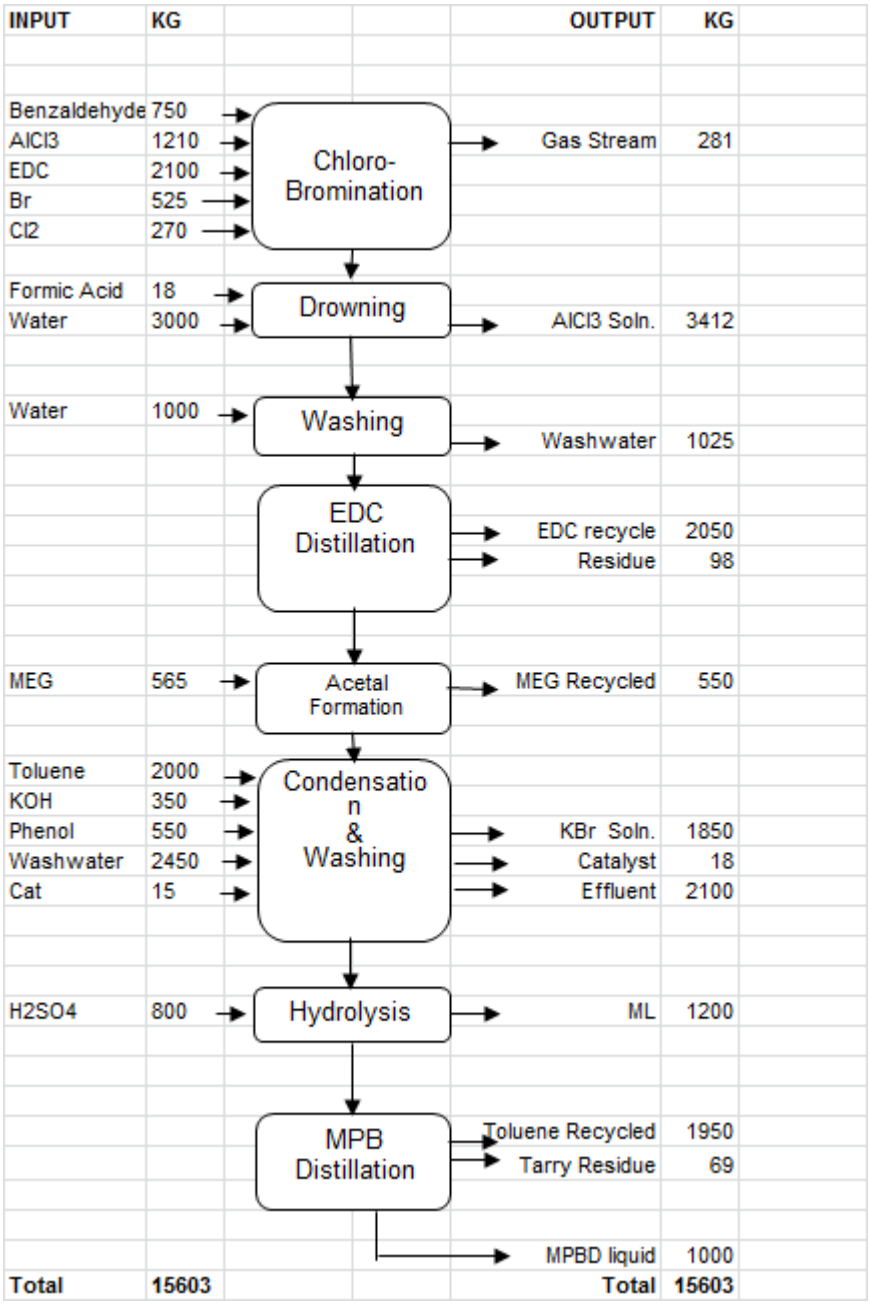
A. Chloro Bromination

Bromination of Benzaldehyde is carried out in a glass-lined reactor in presence of Aluminum Chloride and in solvent EDC. The organic layer of this reaction mixture is drowned in water and given a water wash. The solvent is distilled out to given pure intermediate metaBromoBenazaldehyde (MBB).

B. MBB Condensation

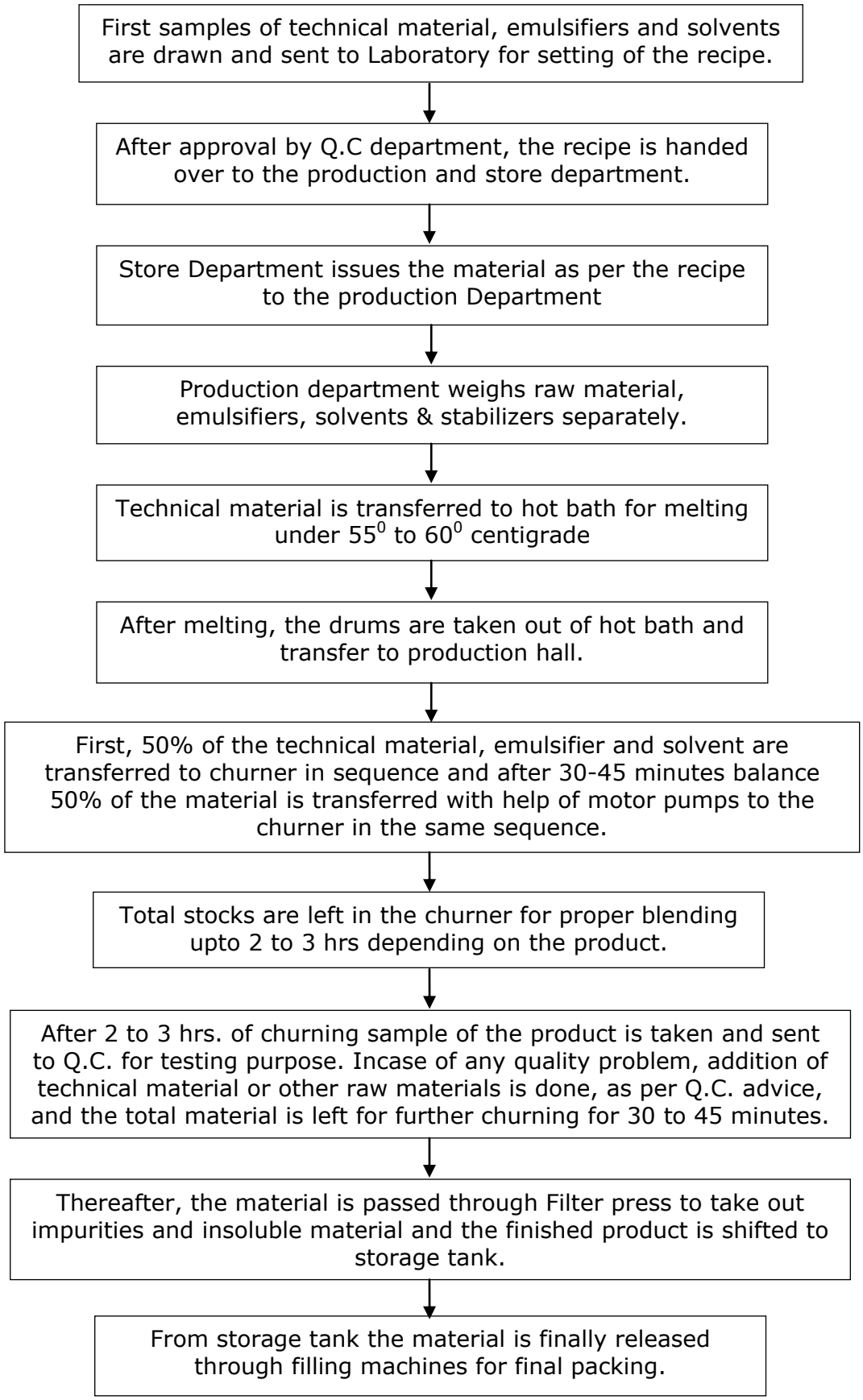
This intermediate reacts with Phenol is SS reactor in presence of Potassium hydroxide and a catalyst to give crude Metaphenoxyenzaldehyde (MPBD). This mass is fraction distilled under vacuum to yield the pure product, and subsequently packed in drums.

Flow Diagram & Mass Balance:



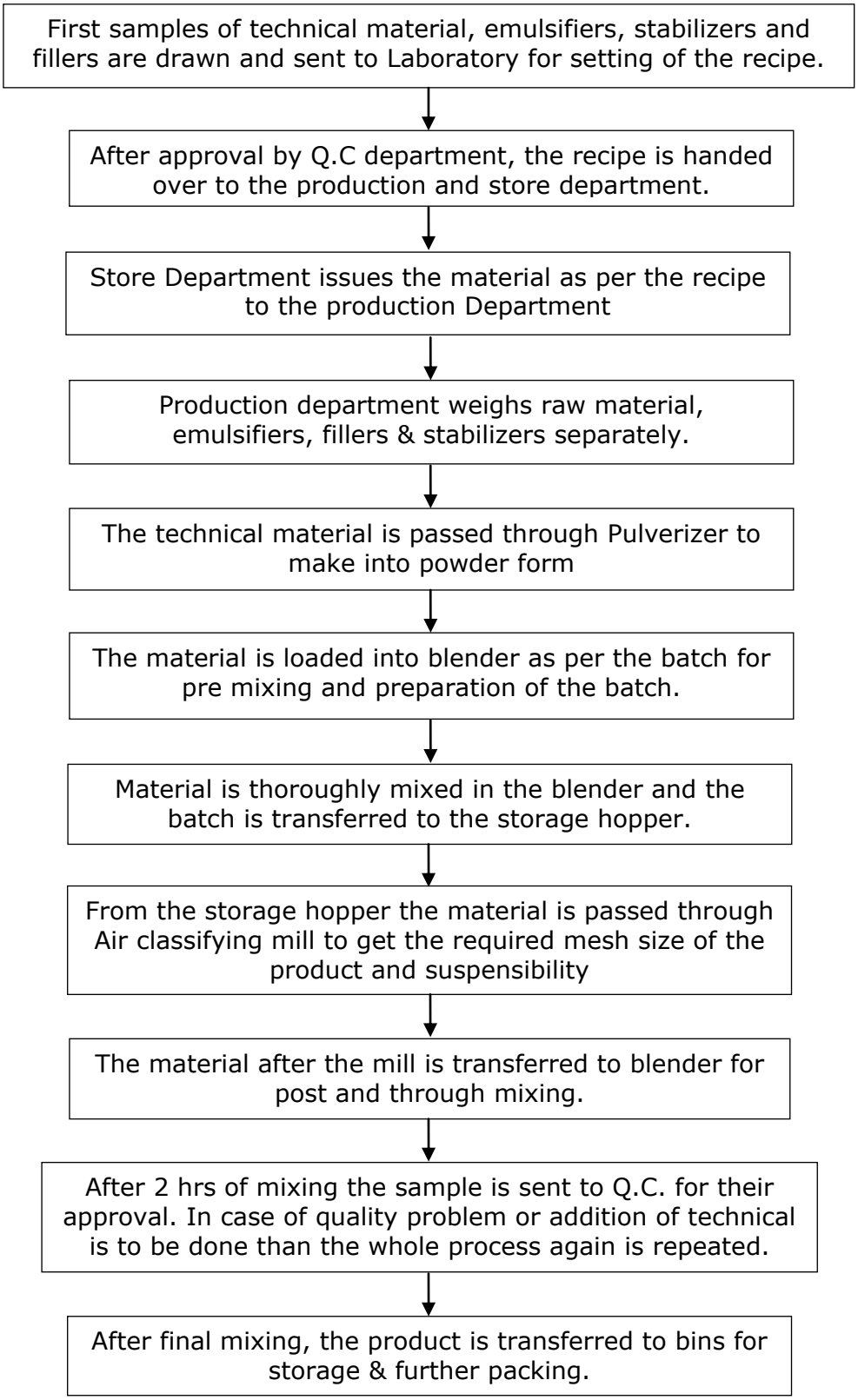
Liquid Pesticide Formulation

Manufacturing Process



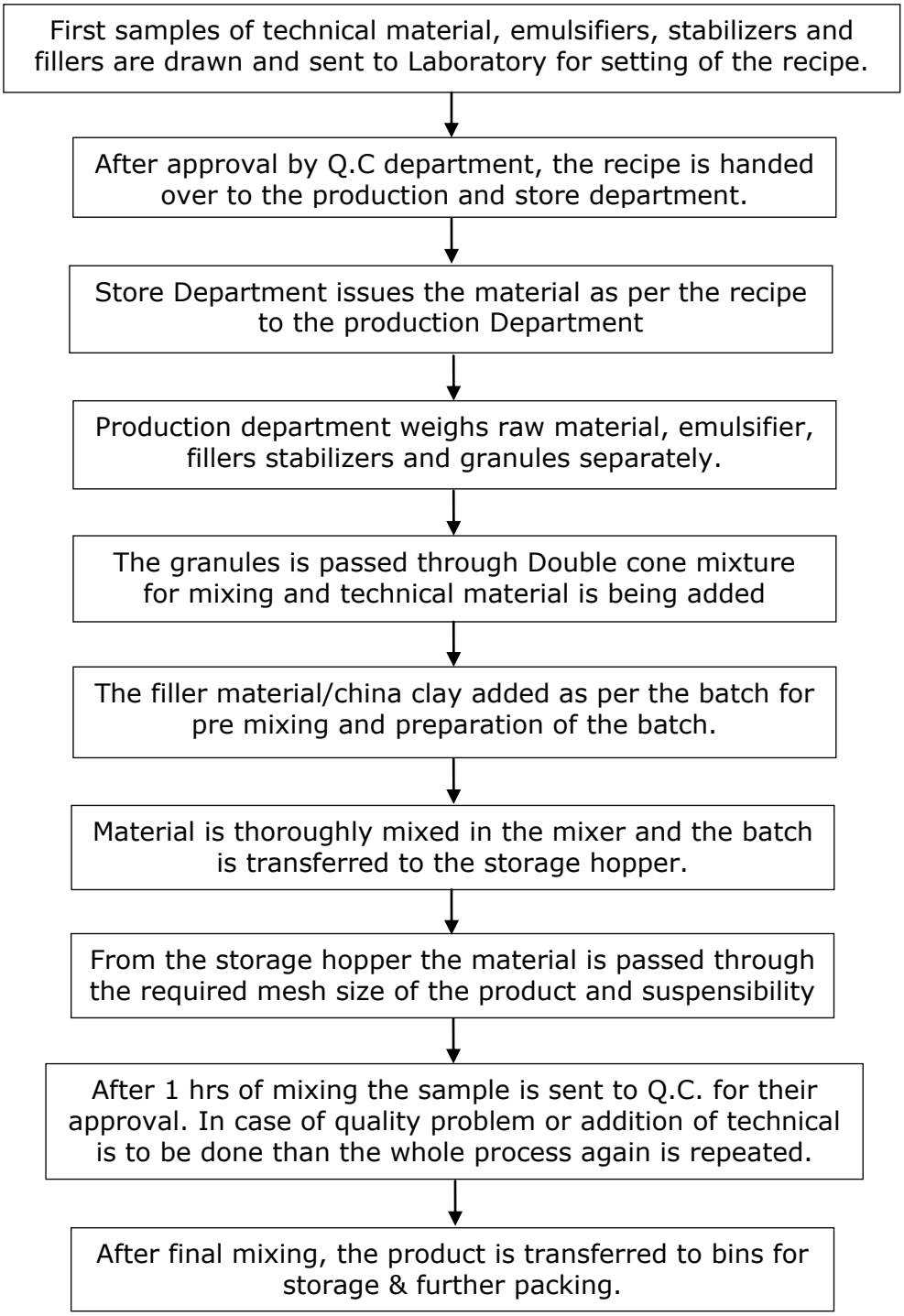
Powder Formulation

Manufacturing Process



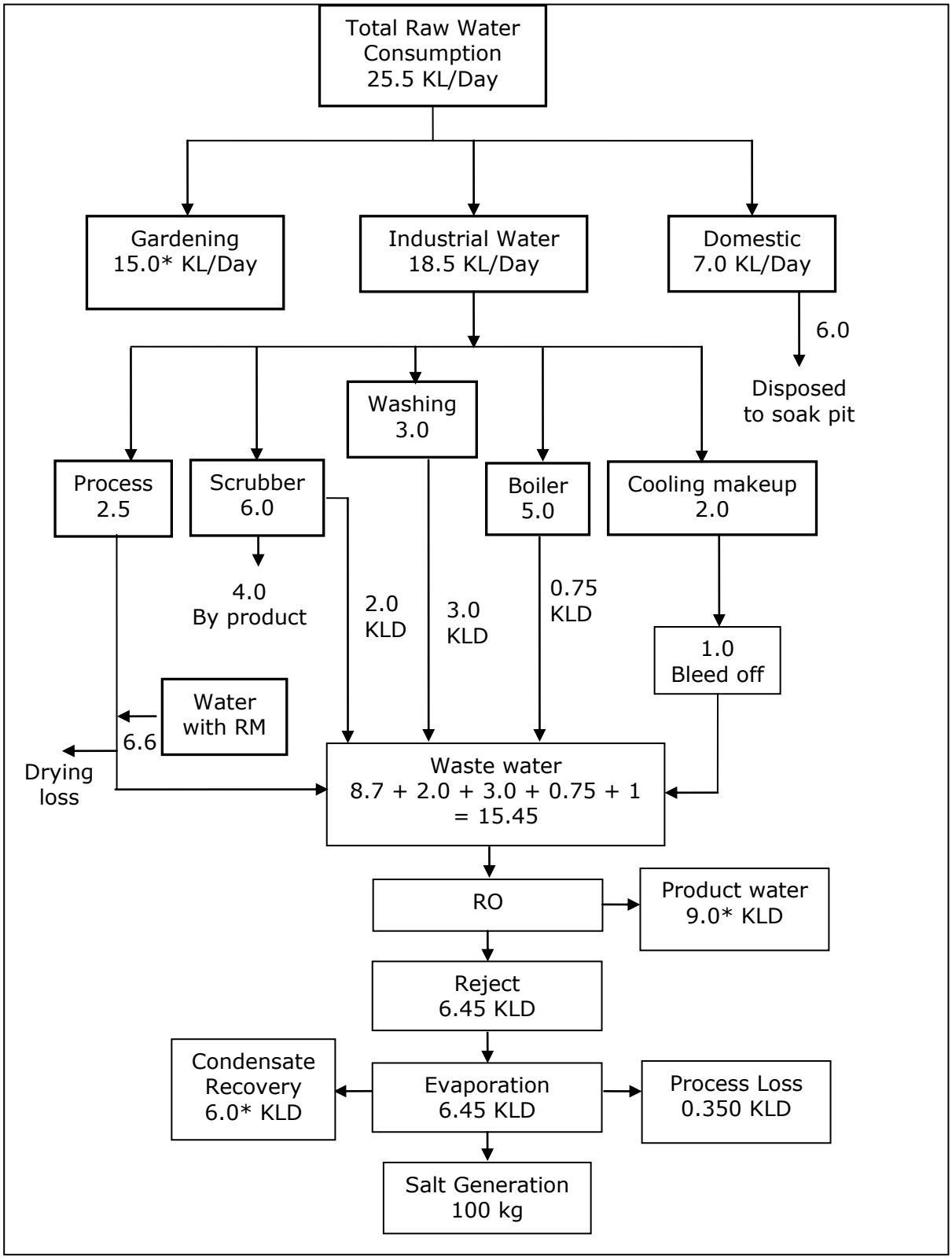
Granules Formulation

Manufacturing Process

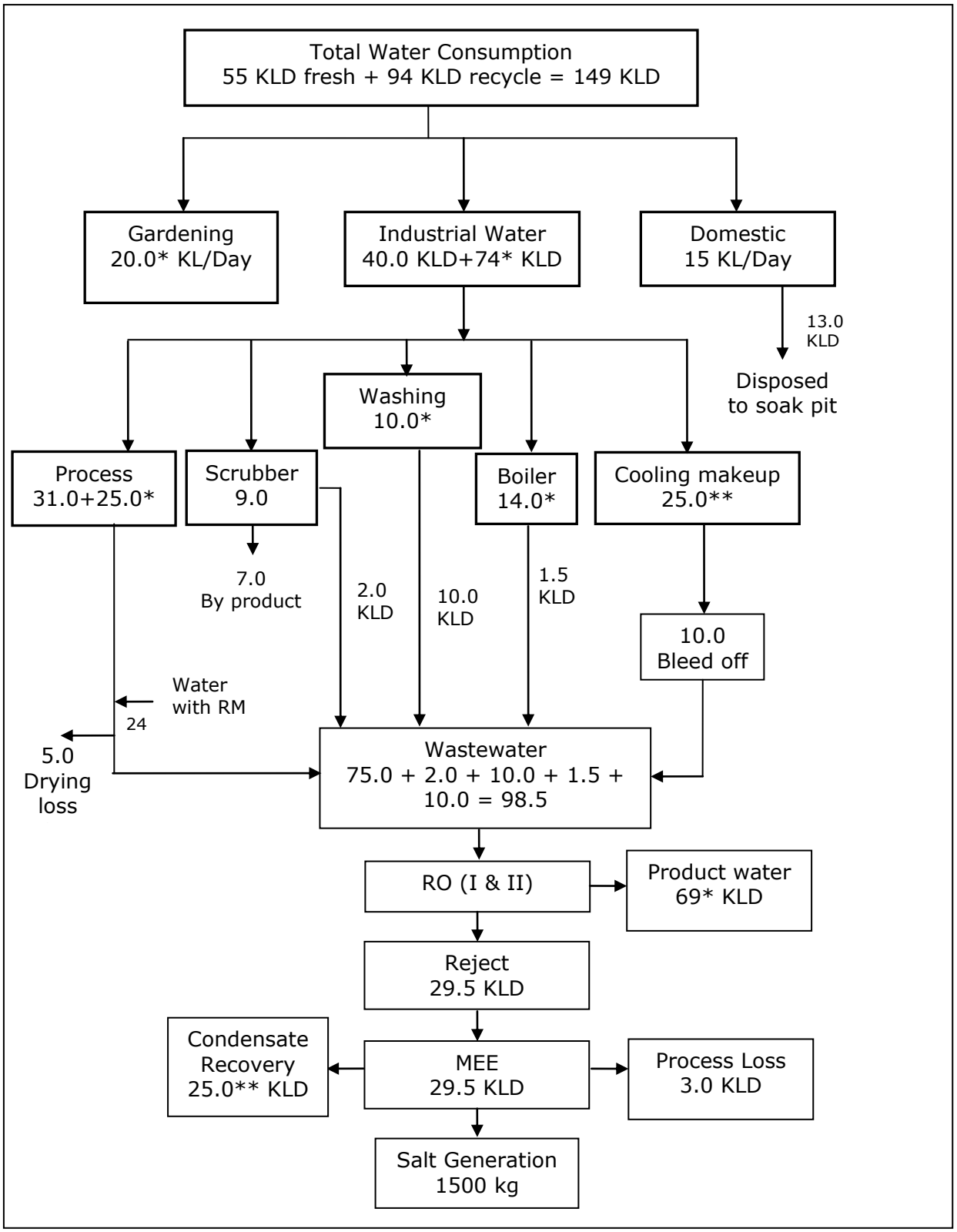


Annexure-IIIA

Water Balance (Existing)



Water Balance (Total After expansion)



Annexure-IIIB

Wastewater Treatment Process

Effluent collection and equalization:

All the effluent streams coming from plant and utilities are collected in a collection sump, where it is directed to ETP as per the hydraulic flow diagram for further treatment.

Primary Treatment:

All the equalized effluent taken for neutralization tank, where hydrated lime will be use as neutralizing agent. Then it is to be pumped to flash mixture in a batch wise manner, where partial organic matter is remove by coagulation, flocculation and precipitation with the help of Ferric Alum/ Poly aluminum Chloride/Lime and polyelectrolyte. After completion of precipitation, treated effluent is passed through primary settling tank to separate out solid sludge. Clear effluent from primary settling tank is allowed to Final treated effluent sump.

Effluent from Lamda Cyhalothrin:

Small quantities of Cyanide containing effluent generated from manufacturing process of Lamda Cyhalothrin. This will be separately treated with 8-10% of Sodium Hypochlorite solution to detoxify of Cyanide Toxicity.

Both the treated effluent finally collected into treated collection tank, where it is pumped to evaporation system to achieve zero discharge of effluent from plant premises.

Details of ETP units

Sr. No.	Description	Number of Unit	Size of Unit
1	Detoxification Reactor	1	2.5 kl capacity
2	Sodium Hypochlorite storage tank	1	1 kl capacity
3	Oil & Grease Trap	4	1.0 x 1.0 x 1.5 m 0.5 m free board
4	Collection Tank	1	2.5 x 2.5 x 3.5 m 0.5 m free board
5	Neutralization Tank	1	2.5 x 2.5 x 3.5 m 0.5 m free board
6	Chemical Dosing Tanks	3	1 kl capacity
7	Primary Settling Tank	1	3.5 x 2.5 x 3.0 m
8	Treated Effluent Sump	1	15 kl capacity
9	Evaporator	1 Set	1.0 kl/hr evaporation capa.
10	Sludge Drying Beds	4	2.5 x 2.5 x 1.5 m

Proposed ETP will be worked out based on the final treatability study and incorporate in EIA report

Annexure-IV

Hazardous waste detail

Sr. No.	Type of Waste	Category of waste as per HWM Rules 2008	Quantity		Disposal facility
			Existing	Total after expansion	
1.	ETP waste	34.3	5 MT/month	30 MT/month	Collection, storage, Transportation and disposal to TSDF.
	MEE salt	-	2.5 MT/month	35 MT/month	
	Inorganic salt from process	-	0	115 MT/month	
2.	Process residue	29.1	-	40 MT/month	Collection, Storage, Transportation, Disposal at CHWIF approved by SPCB
3.	Used Oil	5.1	0.5 kl/yr.	1.0 Kl/yr.	Collection, storage & reuse for internal lubrication purpose. In case of excess, sell to registered re-processors.
4.	Discarded Containers, Bags	33.3	500 Nos./month 250 kg/month	2000 Nos./month 1000 kg/month	Collection, storage and disposal by selling to authorized dealers.
5.	Distillation Residue	23.1	5.5 MT/month	10 MT/month	Collection, storage, transportation and disposal at CHWIF site or send to cement industry for co-processing.

Annexure-V

Details of Stacks

Sr. No.	Stack attached to	Stack Height (m)	Fuel	Fuel consumption rate	APC measures	Probable Emission
➢ **Flue Gas Stack- Existing**						
1.	Boiler (2 tons/hour)	30	Coal	30 TPD	Cyclone + Bag filter	PM<150 mg/NM^3 SO_2<100 ppm NO_x<50 ppm
2.	Hot Air Generator					
3.	D.G. Set (2 nos.) (300 KVA each)	11	HSD	300 lit/day	--	
➢ **Process Gas Stack- Existing**						
1.	Chlorination vessel of phenol	15	--	--	Two stage water, one stage Alkali scrubber	HCl<20 mg/m^3 Cl_2 <9 mg/m^3
➢ **Flue Gas Stack- Proposed**						
1.	Boiler (5 TPH)	30	Coal	50 TPD	Cyclone + Bag filter	PM<150 mg/NM^3 SO_2<100 ppm NO_x<50 ppm
2.	D.G. Set (2 nos.) (500 KVA each)	11	HSD	500 lit/day	--	
➢ **Process Gas Stack- Proposed**						
1.	Reaction vessel of Pretilachlor & Metalexyl	11	-	-	Two stage water, one stage Alkali scrubber	HCl<20 mg/m^3
2.	Reaction vessel of Pendimathalien	11	-	-	Alkali (Soda ash) scrubber	NOx<25 mg/m^3
3.	Reaction vessel of Permethrin & Delta Metrion	11	-	-	Two stage water, one stage Alkali scrubber	HCl<20 mg/m^3

Annexure-VI

Noise level of existing plant

Sr. No.	Location	Noise level dB(A)
1.	Main Gate	60.1
2.	Process plant	62.3
3.	Nr. D.G. set	79.5
4.	Nr. Boiler	65.4
5.	Nr. ETP	60.9
6.	Raw material storage area	58.7