Annexure-I

List of Products

Sr. No.	Name of product	Quantity (MT/month)
1	2-4 D Acid	2000
2	Azoxystrobin	250
3	Bispyribac Sodium	200
4	Bifenthrin	500
5	ClodinafopPropargyl	100
6	Chlorpyriphos	1000
7	Cypermethrin	500
8	Carbendazim	1000
9	CMAC	1000
10	Captan	300
11	Deltamethrin	100
12	Diafenthuron	300
13	Difenconazole	300
14	Ethephon	500
15	Fipronil	300
16	Glyphosate	2000
17	Imizathapyr	100
18	Lambdacyhalothrin	500
19	Metribuzine	500
20	Metalaxyl	100
21	MPBD	1000
22	Met Sulfuron Methyl	30
23	Permethrin	200
24	Pendimethalin	500
25	Profenophos	500
26	Propiconazole	500
27	Sulfosulfuron	50
28	Tebuconazole	300
29	Tricyclazole	500
30	Thiomethoxam	400
31	Thiram	500
32	Thiophanate Methyl	500
33	Ziram	300
	TOTAL	**17830**

List of Raw Materials

Sr. No.	Name of product	Name of raw material	Quantity (MT/month)
1.	**2-4 D Acid**	HCl	1140
		2,4 D-sodium salt	2400
2.	**Azoxystrobin**	2,6 dichloro pyrimidine	102.50
		DMF	28.75
		MHPMP	143.25
		potassium carbonate	105.00
		2 Cayno phenol	82.50
		cuprous chloride	2.50
		caustic soda	5.00
		hexane	21.25
		Dichloro Methane	35.00
3.	**Bispyribac Sodium**	2,6 hydroxy benzolic acid	480.00
		4,6 Diethoxy 2,Methyl sulfonyl pyrimidine	178.60
		TBAB	6.60
		caustic soda	51.00
		Toluene	20.00
		n-Butanol + ethyl acetate	20.00
4.	**Bifenthrin**	MTH Acid	314.00
		BPC	284.00
		DMF	7.50
		K_2CO_3	91.00
		hexane	10.00
		10 % Methanol in Hexane	900.00
		10 % $NaHCO_3$ solution	33.00
5.	**Clodinafop Propargyl**	2,3–Di Fluoro-5-Chloro Pyridine	44.80
		PMIDA	54.80
		2-(4-Hydroxy Phenoxy)Propionic Acid	24.00
		Sodium Hydroxide	3.50
		DMF	18.00
		Propargyl chloride	2.00
		Toluene	44.80
6.	**Chlorpyriphos**	NaTCP	658.00
		DETC	560.00
		Catalyst	8.00

		EDC	163.00
		C. S. lye 48%	43.00
7.	**Cypermethrin**	CMAC	295.00
		MPB	192.50
		NaCN	164.00
		PTC	3.00
		Hexane	40.00
		Hypochlorite	103.00
8.	**Carbendazim**	2- Amino Benzimidazole	718.00
		Methyl chloro format	510.00
		Catalyst	10.00
		C.S. Lye 48%	250.00
		Toluene	25.00
9.	**CMAC**	CTC	1458.00
		CAN	505.00
		Acetonitrile	36.00
		Catalyst 1	19.00
		HCl	19.00
		H_2SO_4	1845.00
		$SOCl_2$	873.00
		DMF	27.00
		IB	595.00
		Hexane	390.00
		TEA	630.00
		10% NaHCO3	826.00
		Caustic lye	1488.00
		Catalyst 2	9.00
10.	**Captan**	CS_2	79.50
		HCl	436.50
		EDC	54.00
		Cl_2	360.00
		toluene	82.50
		THPI	153.00
		NaOH	492.00
11.	**Deltamethrin**	Ester of Bicisthemic Acid	40.00
		Caustic soda	25.50
		Thionyl Chloride	15.00
		MDC	3.00
		M-phenoxybenzaldehyde	48.50
		Sodium cyanide	15.00

		Hexene	60.00
		Hypo solution	34.50
		DIPA/IPA	3.00
12.	**Diafenthuron**	Xylene	372.00
		DIPBA	247.50
		NaSCN	81.00
		HCl, 30%	115.50
		tert-butylamine	66.00
13.	**Difenconazole**	2-chloro-4-(4-chlorophenoxy) benzyl chloride	279.00
		4-methyl-1, 3-dioxolane	84.00
		KOH	168.60
		DMF	30.00
		1,2,4 Triazol	70.50
		K_2CO_3	16.80
14.	**Ethephon**	BCEP	932.50
		HCl	395.00
15.	**Fipronil**	CF_3COOH	15.00
		Mono chloro benzene	7.50
		H_2O_2	15.00
		Thiopyrazole derivatives	267.0
16.	**Glyphosate Tech**	$FeSO_4$(10%)	596.00
		PMIDA	3980.00
		H_2O_2(50%)	1490.00
		Catalyst	20.00
		C.S. Lye 48%	1430.00
17.	**Imizathapyr**	EPCA	81.80
		DMMI	68.20
		DMF	9.60
		Catalyst	0.90
		Sodium Carbonate	63.60
		Methanol	36.30
		Caustic lye	4.50
18.	**Lambdacyhalothrin**	MPBAD	335.00
		TFP Acid Chloride	370.00
		NaCN	164.00
		n-Hexane	55.00
		Catalyst	2.50
		Soda ash Soln. 5%	529.50

		IPA-Solvent	27.50
		Catalyst - 2	45.00
		Caustic lye	335.00
19.	**Metribuzine**	sulfuric acid	62.25
		Triazinone	50.00
		Dimethyl sulfate	32.00
		Soda ash	94.00
20.	**Metalaxyl**	N-(2,6- Dimethyl phenyl) alanine-methyl ester	76.50
		methoxy acetyl chloride	40.50
		Catalyst	1.50
		Toluene	11.00
		C.S.Lye 48%	25.00
21.	**MPBD**	Benzaldehyde	748.00
		$AlCl_3$	1230.00
		EDC	2100.00
		Br	550.00
		Cl_2	258.00
		Formic acid	20.00
		MEG	34.00
		Toluene	120.00
		KOH	335.00
		Phenol	562.00
		Catalyst	22.00
		H_2SO_4	490.00
		NaOH lye	25.00
22.	**Met Sulfuron Methyl**	O-sulfoisocyante Methyl Benzoate	19.02
		2-Amino 4-methoxy 6-methyl 1,3,5 Triazine	11.01
		Toluene	2.40
23.	**Permethrin**	MPBAL	96.00
		CMAC	103.20
		n-Hexane	571.40
		5% Soda-ash soln	190.40
		C.S. lye. 48%	9.60
24.	**Pendimethalin**	1-Chloro 2,6 Dinitro 3,4	412.50
		3-Pentane amine	157.50
		Toluene	400.00
		Catalyst	2.50

25.	**Profenophos**	PFA	475.00
		Na-DMDT	180.00
		Catalyst	9.00
		Toluene	6.50
		n-Propyl bromide	152.50
		C.S.lye 48%	22.00
26.	**Propiconazole**	2,4-dichloro benzyl chloride	272.50
		4-propyl-1, 3-dioxolane	152.50
		Dimethyl sulphide	437.50
		KOH	337.50
		DMF	20.00
		1,2,4 Triazol	140.00
		K_2CO_3	32.50
		Iso Propanol	117.50
27.	**Sulfosulfuron**	Dichloromethane	7.50
		ESPO	24.00
		ADCP	22.50
		TEA	18.50
		HCl	20.50
28.	**Tebuconazole**	Dimethyl Sulfate	150.60
		Sodium sulfide	7.80
		CPDP	96.90
		KOH	76.50
		1,2,4-triazole	12.00
		K_2CO_3	7.50
		DMF	150.60
29.	**Tricyclazole**	HMBT	490.00
		Formic acid	275.00
		Caustic lye	25.00
30.	**Thiomethoxam**	CCMT	308.00
		MNIO	294.00
		DMF	280.00
		K_2CO_3	180.00
		80% Methanol	36.00
31.	**Thiram**	CS_2	200.00
		Dimethyl Amine	500.00
		NaOH	165.00
		H_2O_2	75.00
		H_2SO_4	100.00

32.	**Thiophanate Methyl**	EDC	40.00
		Sodium Thiocyanate	263.00
		Methyl chloro formate	300.00
		OPDA	175.00
33.	**Ziram**	CS_2	180.00
		Dimethyl Amine	270.00
		NaOH	96.00
		$ZnSO_4$	285.00

Annexure -II
Manufacturing Process

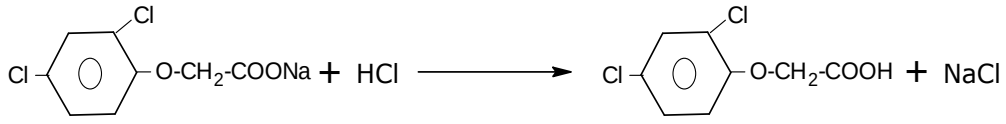
1. 2,4-Dichlorophenoxyacetic acid (2,4-D Acid)

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

MASS BALANCE OF 2,4-D Acid							
Input	**Kg**					**Output**	**Kg**
30% HCl	570	→	REACTOR				
2,4-D Sodium salt	1200	→					
Water	300	→					
			↓				
			CENTRIFUGE			→ Effluent	770
			↓				
			DRYER			→ Drying Loss	300
						→ **Product**	**1000**
Total	**2070**						**2070**

2. Azoxystrobin

Manufacturing Process:

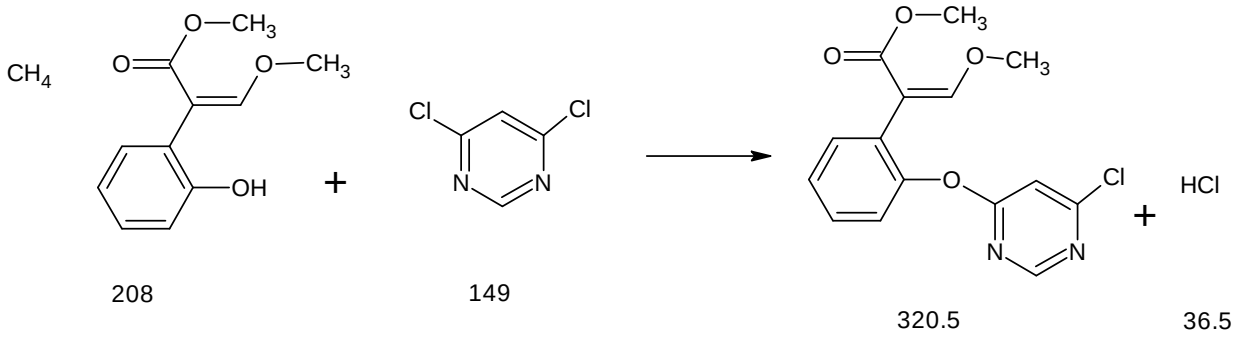
2,6 Dichloro Pyrimidine and anhydrous Potassium carbonate is charged in DMF. Solution of Methyl- 2-(2 Hydroxy phenyl)-3 methoxy Propenoate in DMF is charged to above solution. When addition is over, warm the reaction mass to complete the reaction.

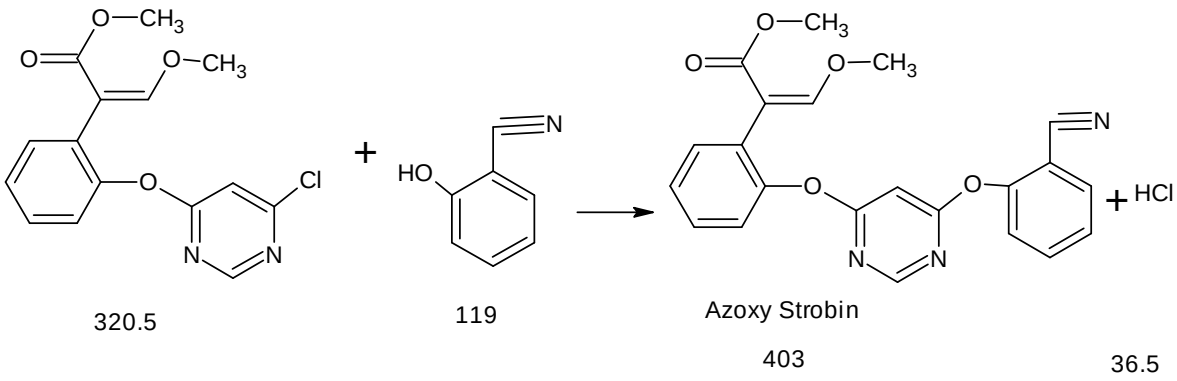
Charge 2 cyano Phenol to the reaction mass and add catalytic amount of Cuprous Chloride and heat the reaction mass to 100^0C for few hours.

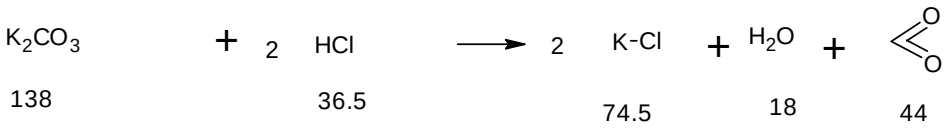
Filter the reaction mass to remove inorganics and distilled out DMF from reaction mass. Add hexane and wash the reaction mass with dilute caustic to remove unreacted cyano phenol from the reaction mass.

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

Chemical Reaction:







Mass Balance

MASS BALANCE OF AZOXY STROBIN

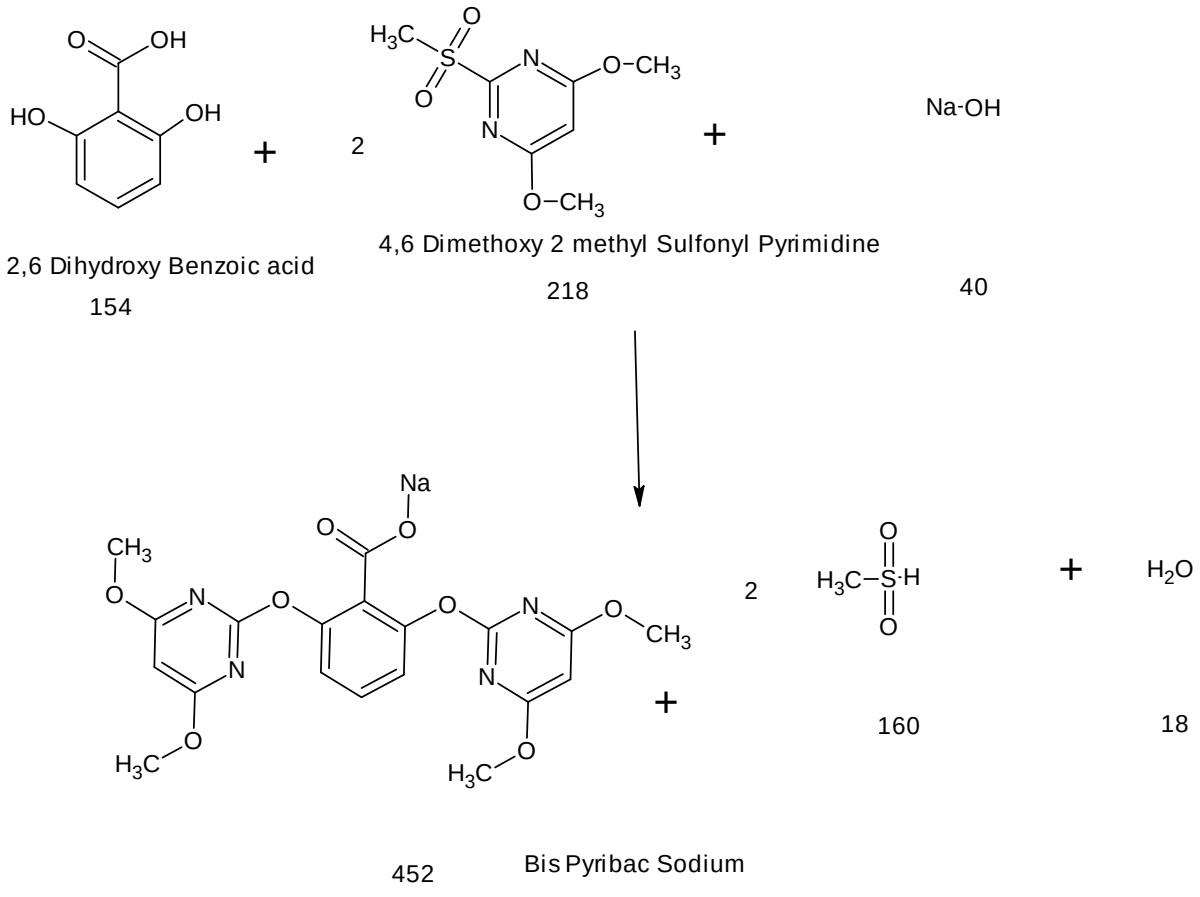
INPUT	KG		OUTPUT	KG
2,6 DICHLORO PYRIMIDINE	410	Reaction		
DMF	2405			
MHPMP	573			
POTASSIUM CARBONATE	420			
2 CYNO PHENOL	330			
CUPRUS CHLORIDE	10			
		Filteration	Process Residue	740
		Distillation	DMF RECOVERY	2290
			RESIDUE	45
CAUSTIC SODA	20	washing/ Seperation		
WATER	540		WATER	478
HEXANE	2325			
		Crystalisation/ Solvent Recovery	DCM RECOVERY	2020
			HEXANE RECOVERY	2240
DICHLORO METHANE (DCM)	2160		Residue	85
		Drying & Packing	Drying Loss	295
			AZOXY STROBIN	**1000**
TOTAL	**9193**			**9193**

3. 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:



Mass balance

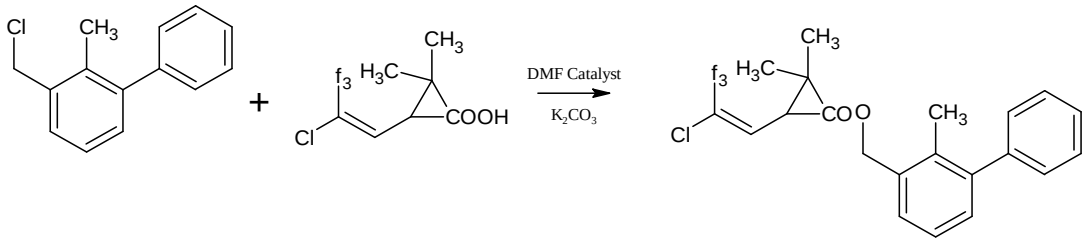
MASS BALANCE OF BISPYRIBAC SODIUM			
INPUT	KG	OUTPUT	KG
2,6 hydroxy Benzoilc Acid	2400		
4,6 Diethoxy 2, Methyl Solfonyl Pyrimidine	893		
TBAB	33	REACTION → Effluent	2133
Caustic Soda	255		
Toluene	4000		
		FILTRATION → Toluene Recovery	3900
		FILTRATION → Residue	748
n-Butanol	4500	CRYSTALIZATION → Mixture of n Butanol	5900
Ethyl Acetate	1500	CRYSTALIZATION → (Reuse)	
Water	4600	FILTRATION → Effluent	4200
		DRYING → Drying Loss	300
		DRYING → **byspyribac sodium**	**1000**
TOTAL	**18181**		**18181**

4. Bifenthrin

Manufacturing Process:

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:



Mass Balance

MASS BALANCE OF BIFENTHRIN

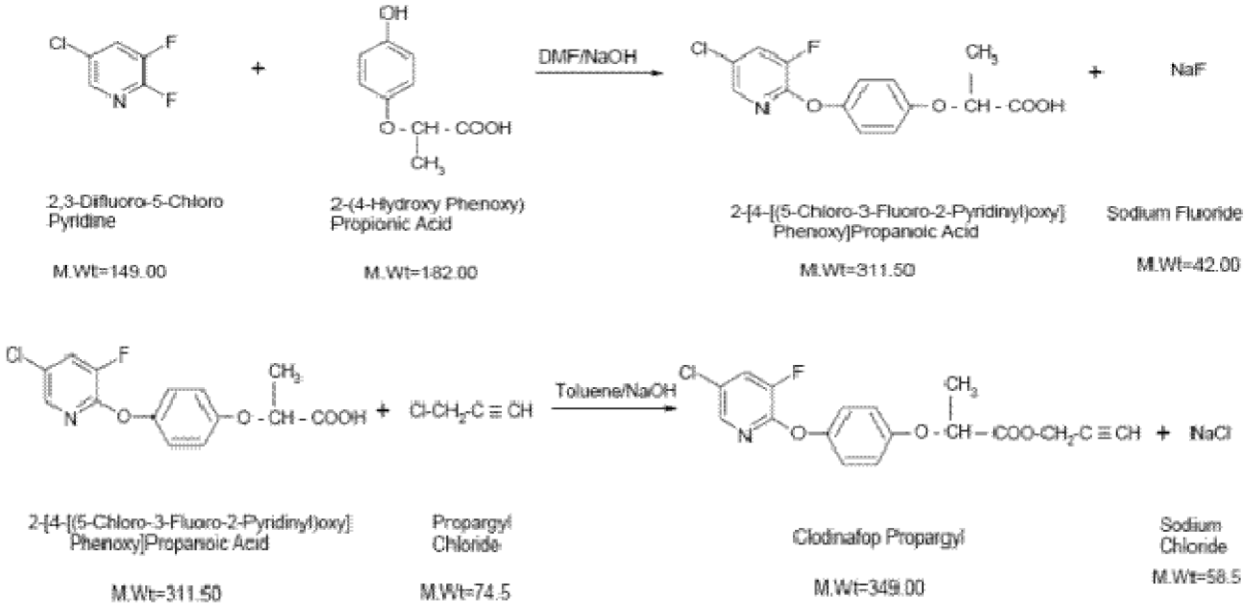
IN PUT	KG		OUT PUT	KG
MTH Acid	628	→ **Stage 1 Reaction**		
BPC	568	→		
DMF	1200	→		
K2 CO3	182	→		
		↓		
		Recovery	→ DMF Recovery	1185
			→ Residue	85
		↓		
Hexane	690	→ **Washing**		
Water	690	→	→ Effluent	950
10% $NaHCO_3$ Solution	66	→		
		↓		
		Recovery	→ Hexane Recovery	670
			→ Residue	71
		↓		
10% Methanol in Hexane	1800	→ **Crystalization**		
Water	400	→		
		↓		
		Filtration	→ Effluent	815
		↓		
		Solvent Distillation	→ Methanol	158
			→ Hexane	1000
		↓		
		Drying & Packing	→ Drying Loss	290
			→ **Bifenthrin**	**1000**
Total	**6224**			**6224**

5. Clodinafop-propargyl

Manufacturing Process:

2,3 – Di Fluoro -5 - Chloro Pyridine is reacted with 2 - (4- Hydroxy Phenoxy) Propionic Acid in presence of Solvent - Di Methyl Formamide (DMF) and Sodium Hydroxide to form 2- [-4 – {(5 Chloro -3- Fluoro -2- Pyridinyl) Oxy} Phenoxy] Propionic Acid.
2- [-4 – {(5 Chloro -3- Fluoro -2- Pyridinyl) Oxy} Phenoxy] Propionic Acid is reacted with Propargyl chloride in Presence of Sodium Hydroxide as well as Solvent -Toluene to form final product as Clodinafoppropargyl

Chemical Reaction:



Mass Balance

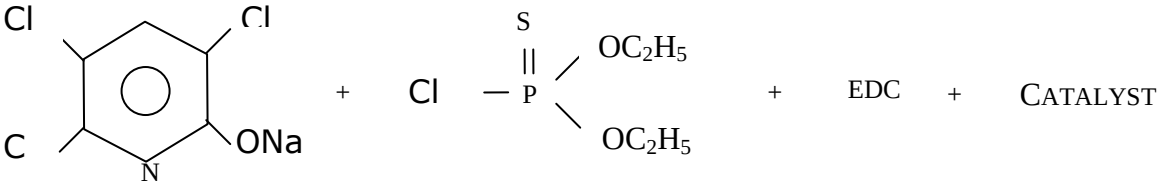
MASS BALANCE OF CLODINAFOP PROPARGYL							
INPUT	**KGS**					**OUTPUT**	**KGS**
2,3–Di Fluoro-5-Chloro Pyridine	448	→	**Reaction 1**		→	Sodium Floride	180
2-(4-Hydroxy Phenoxy)Propionic Acid	548	→					
Sodium Hydroxide	240	→					
DMF	1200	→	**Reaction 2**		→	DMF recovered	1165
Propargyl chloride	180	→			→	Toluene recovered	980
Toluene	1000	→					
		→	**Filtration**		→	Effluent	537
Water	450				→	Process residue	128
			Distillation		→	**Clodinafop propargyl**	**1000**
					→	Distillation Residue	76
Total	**4066**						**4066**

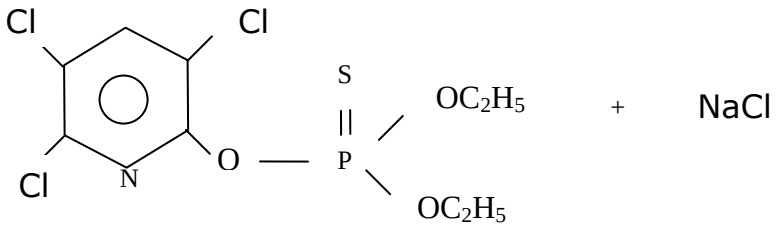
6. Chlorpyriphos

Manufacturing Process:

Sodium Salt of trichloroPyridinol (NaTCP) is reacted with Diethyl ThioPhosphoryl 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 temp. By Alkali for the rapid hydrolysis of pesticides to simpler non- toxic compounds.

Chemical reaction:





Mass Balance

Mass Balance of Chlorpyriphos

INPUT	KG		OUTPUT	KG
NaTCP	658	→ Reaction, seeparation & Distillation		
DETC	560			
Water	3371		→ Recovered EDC	2596
Catalyst	8		→ Residue	276
EDC	2759			
		→ Filtration	→ Effluent	3130
		→ Drying & Packing	→ Drying Loss	354
			→ **Chlorpyrifos**	**1000**
Water for washing	3130	→ Detoxification by Alkali Hydrolysis		
C. S. lye 48%	43		→ Liquid effluent	3173
Total	**10529**			**10529**

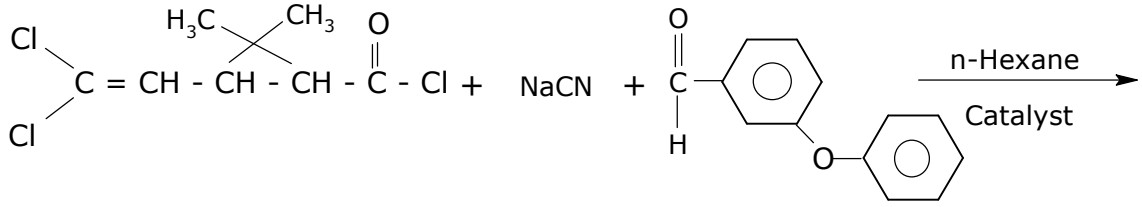
7. CYPERMETHRIN

Manufacturing process:

Meta PhenoxyBenzaldehyde is reacted with Sodium Cyanide to form Meta PhenoxyBenzaldehyde 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:

Cypermethrin



Cypermethric Acid Chloride

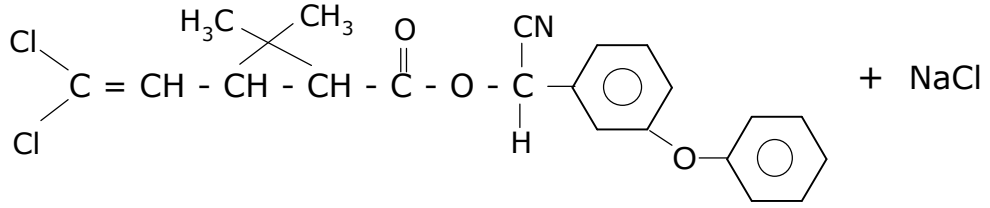
(MW- 227.5)

Sodium Cyanide

(MW- 49.1)

Meta Phenoxy Benzaldehyde

(MW- 198)



Cypermethrin

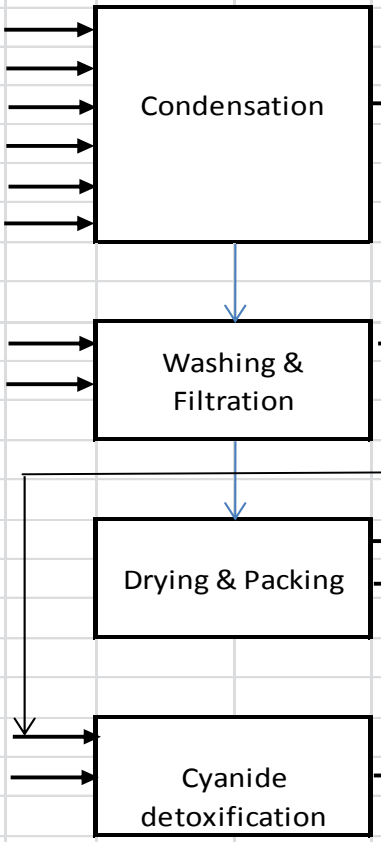
(MW- 416.3)

Sodium Chloride

(MW- 58.5)

Mass Balance

Mass balance of Cypermethrin			
IN PUT	**KG**	**OUT PUT**	**KG**
CMAC	590		
MPB	385		
NaCN	328	Hexene Recovery	1010
PTC	6		
Water	350		
Hexane	1090		
Water	1176	Aqueous effluent	1714
		Drying Loss	201
		Cypermethin	**1000**
Effluent	1714		
Hypochlorite	206	Effluent	1920
Total	**5845**		**5845**

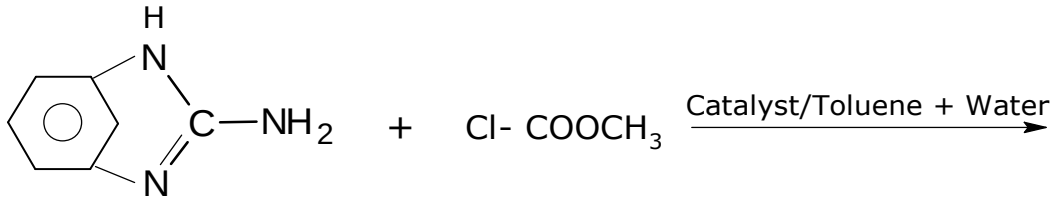


8. CARBENDAZIM

Manufacturing process:

2-Amino Benzimidazole immediately reacts with methyl Chloro Carbonate / Formate in presence of catalyst and solvent to get Carbendazim. During reaction, HCl gas is generated which is absorbed in water by scrubbing system. 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:

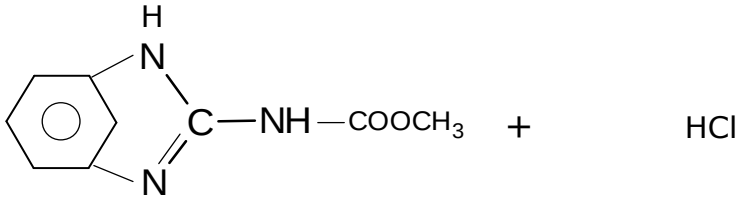


2- Amino Benzimidazole

($C_7H_7N_3$) MW-133

Methyl Chloro Carbonate/Formate

($C_2H_3ClO_2$) MW-94.5



Carbendazim (Crystalline Powder)

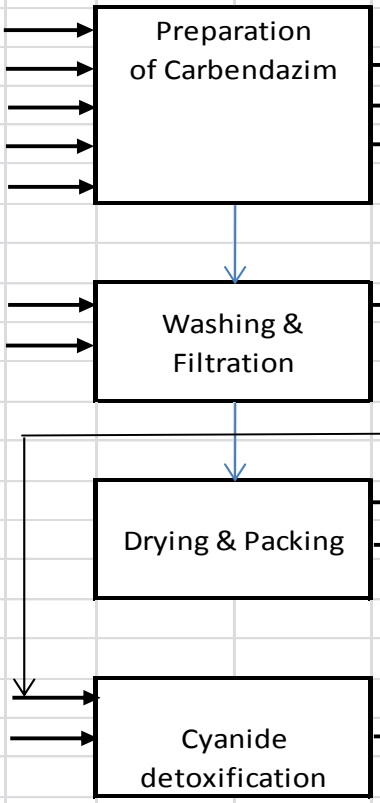
MW-191.2

Hydrochloric Acid

MW-36.5

Mass Balance

Mass balance of Carbendazim			
IN PUT	**KG**	**OUT PUT**	**KG**
2- Amino Benzimidazo	718		
Methyl chloro format	510	HCl Gas	193
Catalyst	10	Recovered Toluene	675
C.S. Lye 48%	100	Residue	35
Toluene	700		
Water	1250	Aqueous effluent	1150
		Drying Loss	235
		Carbendazim	**1000**
Effluent	1150		
C. S. Lye 48%	150	Effluent	1300
Total	**4588**		**4588**



9. CMAC

Manufacturing process:

CNB Formation: Carbon tetra chloride is reacted with acrilonitrile in MSGL reactor. Catalyst is used and solvent is acetonitrile.
CBN Purification: CBN is purified by distillation, fore cut is collected separately and pure CBN is sent down for further processing.
CBA Formation: Pure CBN is hydrolyzed by dilute Sulphuric acid in MSGL reactor to yield CBA.
CBC Reaction:CBA is reacted with Thionyl chloride. Hydrochloric acid gas and SO_2 gas are generated during this reaction. These gases are scrubbed through a sequential scrubbing system.
CBC Purification: Crude CBC is purified by vacuum distillation in MSGL reactor. Vacuum device used is rejecter.
2CB Reaction: Pure CBC and Isobutylene are reacted in presence of Tri ethyl amine HCl in solvent Hexane Tri ethyl amine. HCl dissolved in water in the process is sent for Tri ethyl amine recovery.
2CBPurification and Crystallization:2CB reaction mass is transferred to crystallizer. Excess solvent is recovered and reaction mass is chilled below 50 and then centrifuged.
4CB Reaction: The 2CB crystals are charged in MSGL reactor and isomerized using Tri ethyl amine.
Favorski reaction: The above mass is heated with caustic solution to get sodium salt of CMA.
De-hydrohalogenations: The above mass is heated with caustic solution to get sodium salt of CMA.
Isolation: This mass is acidified with sulphuric acid to get Cypermethric Acid (CMA) with Hexane as solvent.
CMA Concentration: from the above mass excess Hexane is distilled out and CMA slurry is transferred for CMAC reaction.
CMAC Reaction: CMA is reacted with Thionyl chloride. SO_2 and HCl gas are generated in this process. These gases are scrubbed through a sequential scrubbing system.
CMAC Purification: Crude CMAC is distilled out by vacuum distillation in MSGL purified CMAC is packed in lined drums as per requirement.

Mass Balance

Mass balance of CMAC						
INPUT	**KG**				**OUTPUT**	**KG**
CTC	1696	→	**CBN Formation**	→	CTC recycled	238
CAN	505	→		→	Residue	70
Acetonitrile	36	→		→	Effluent	401
Water	286	→				
Catalyst	19	→				
HCl	19	→				
			↓			
H2SO4	1610	→	**CBA Formation**	→	Effluent	3360
Water	1903	→				
			↓			
SOCl2	873	→	**CBC Formation**	→	HCl & SO2 gas	689
DMF	27	→		→	residue	217
			↓			
IB	595	→	**2CB**			
Hexane	2417	→				
TEA	630	→		→	Effluent	4312
Water	1487	→				
10% NaHCO3	826	→				
			↓			
Water	2975	→	**CMA Formation**			
Caustic lye	1488	→		→	Aq. Effluent	5145
H2SO4	235	→		→	Hexane recycled	4572
Hexane	2545	→		→	Residue	108
Catalyst 2	9	→				
			↓			
SOCl2	405		**CMAC Formation**	→	HCl & SO2 gas	314
				→	Residue	160
			↓			
			CMAC Liquid			**1000**
Total	**20586**					**20586**

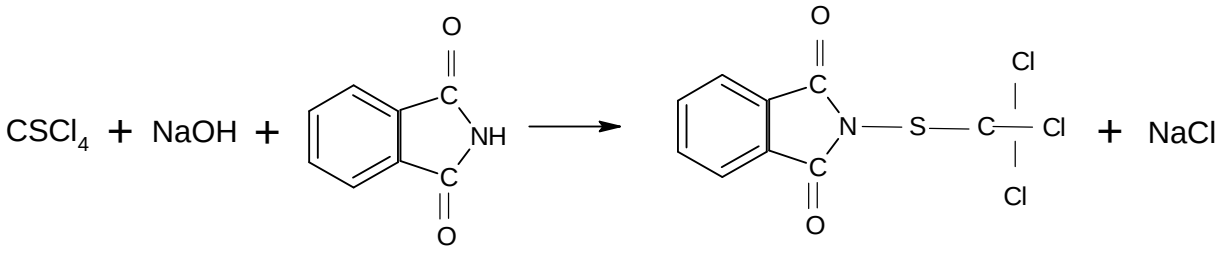
10. Captan

Manufacturing process:

Captan Technical is manufactured with the first chlorination of carbon disulphide to form trichloro methyl sulphonate chloride ($CSCl_4$), which is worst with water and diluted with toluene prior to condensation. After dilution $CSCl_4$ is condensed with tetra hydro phthalic amide (THPA) temperature less than 10^0C form Captan Technical. Toluene is added for slurry preparation. then the rude mass is centrifuged to remove other impurities and then dried in rotary drier.

Chemical Reaction:

$$CS_2 + 6HCl + 4H_2O + 5Cl_2 \longrightarrow 6HCl + H_2SO_4 + 6HCl + CSCl_4$$



Tetra hydro phthalic Amide

Captan

Mass Balance

MASS BALANCE OF CAPTAN

IN PUT	Kg		OUT PUT	Kg
CS2	265	Chlorination	HCl gas	1510
HCl	1455			
EDC	180			
Cl2	1200			
water	900			
water	455	CSCl4 washing	Effluent	1190
toluene	165	CSCl4 dilution		
Tetra Hydro Phthalic Amide	510	Condensation		
NaOH	640			
water	400			
Water	500	washing	Efflurent	1180
Toluene	110			
		filteration & Drying	Effluent	1600
			Drying loss	300
			captan technical	**1000**
Total	**6780**			**6780**

11. Deltamethrin Technical

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 Metaphenoxybenzaldehyde 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.

Mass Balance

Mass balance of Deltamethrin

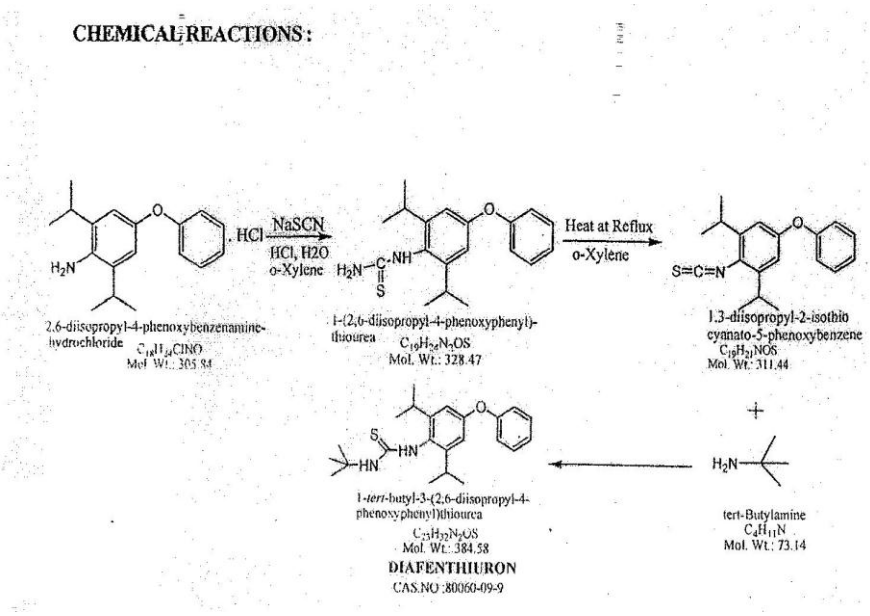
IN PUT	Kg		OUT PUT	Kg
Ester of Bicisthemic Acid	400	→ **Bicisthemic acid Chloride formation**		
Caustic soda	255	→	→ HCl & SO2 gas	140
Thionyl Chloride	150	→	→ MDC Recovery	1370
MDC	1400	→	→ Residue	45
M-phenoxybenzaldehyde	485	→ **Crude Deltamethrin**		
Sodium cyanide	150	→	→ Sodium Cyanide effluent	1280
Water	350	→	(Treatment with Hypo solution)	
Hexene	600	→		
Hypo solution	345	→		
DIPA/IPA	640	→ **Epimerization of Deltamethrin**		
		DIPA/IPA Recovery	→ DIPA/IPA Recovery	610
			→ Residue	50
		Drying & Packaging	→ Drying Loss	280
			→ Deltamethrin	1000
Total	**4775**			**4775**

12. Difenthiuron

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:



Mass Balance

MASS BALANCE OF DIAFENTHIURON							
INPUT	**KGS**					**OUTPUT**	**KGS**
Xylene	1240	→	**Reaction**				
DIPBA	825	→					
NaSCN	270	→					
HCl, 30%	385	→					
			↓				
Water	1050	→	**Washing**		→	Effluent	1600
			↓				
tert-butylamine	220	→	**Reaction Filtration**		→	**Diafenthiuron**	**1000**
			↓				
			Distillation		→	Xylene (recovery	1160
					→	Organic residue	230
TOTAL	**3990**						**3990**

13. Difenconazole

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.

Mass Balance:

MASS BALANCE OF DIFENCONAZOLE

IN PUT	Kg		OUT PUT	Kg
2-chloro-4-(4-chlorophenoxy) benzyl chloride	930	→ **Intermediate**	→ Effluent	650
4-methyl-1, 3-dioxolane	280	→		
KOH	562	→		
		↓		
DMF	1485	→ **Difenoconazole**		
1,2,4 Triazol	235	→		
K_2CO_3	56	→		
		↓		
		DMF Recovery	→ DMF Recovery	1385
			→ Residue	75
		↓		
Water	1120	→ **Washing**		
			→ Effluent	1300
		↓		
		Drying & Packing	→ Drying Loss	258
			→ **Difenoconazole**	**1000**
Total	**4668**			**4668**

14. Ethephon

Manufacturing process:

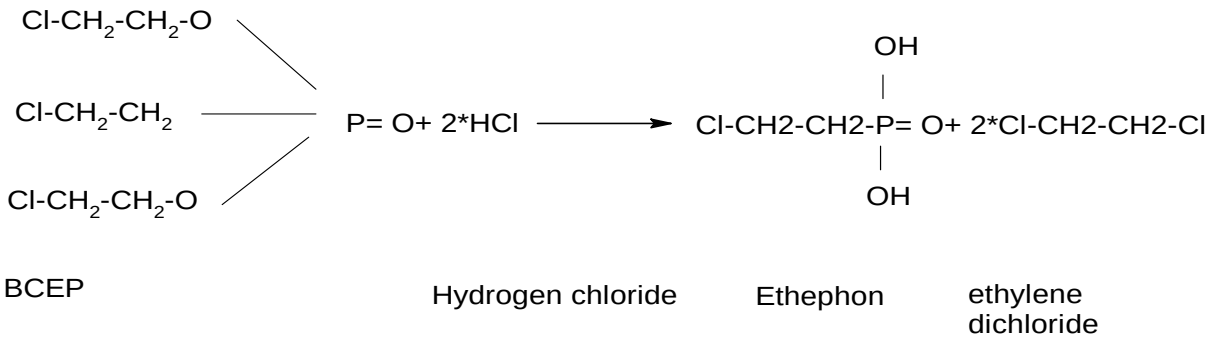
Stage-1 (a): Reaction

Required quantity of Bis (2- chloroethyl) 2 chloro ethyl phosphonate (BCEP) is taken in a batch reactor and heated with the help of steam in the reactor jacket. Hydrogen chloride gas at measured flow rate is introduced at the bottom of the reactor. The reaction takes place and the flow rate of HCl and temperature of the reactor are maintained for some time till the reaction is complete. The reactor is fitted with reflux condenser to condense and reflux the vapors back into the reactor. The reaction product consisting or Ethephon technical and ethylene dichloride (EDC) are then subject to distillation.

Stage-1 (b): Distillation

Vaccum distillation is carried out to recover the by-product EDC formed; EDC vapors are condensed and collected in a storage vessel. The residue from distillation is then collected in storage vessels as Ethephon technical product.

Chemical Reaction:



Mass Balance

MASS BBALANCE OF ETHEPHON

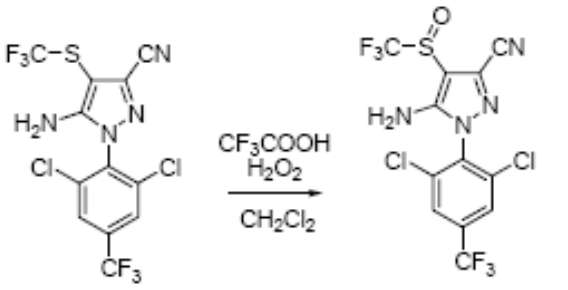
IN PUT	KG		OUT PUT	KG
BCEP	1865	Reactor 1	EDC	1370
HCl	790			
		Reactor 2		
		Drying & Packing	Drying loss	285
			Ethephon Tech	**1000**
Total	**2655**			**2655**

15. Fipronil

Manufacturing Process:

- 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:



DOF
Mol. Wt.: 421,15

Fipronil
Mol. Wt.: 437,15

Mass Balance:

MASS BALANCE OF FIPRONIL

IN PUT	Kg		OUT PUT	Kg
CF3COOH	2450	→ Oxidation	CF3COOH recovery	2400
Monochloro benzene	1500	→ Oxidation	MCB recovery	1475
H2O2	50	→ Oxidation	Solid waste	165
Thiopyrazole derivative	890	→ Oxidation		
Water	4950	→ Washing	To ETP	4485
		→ Drying & Packing	Drying Loss	315
		→ Drying & Packing	**Fipronil**	**1000**
Total	**9840**			**9840**

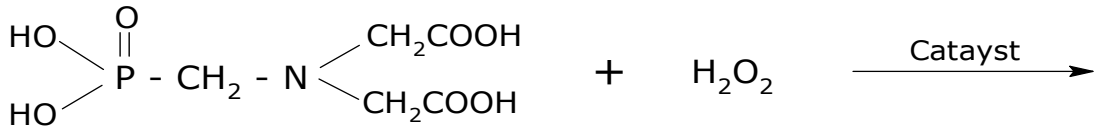
16. GLYPHOSATE

Manufacturing Process:

PMIDA react with Hydrogen Peroxide in presence of Catalyst and cooler after Oxidation, reaction mass treat with Ferrous Sulphate solution get Glyphosate in slurry form during this formaldehyde generates is converted to Foric Acid. Slurry filtered and washes with water. Wet cake dry to get Glyphosate Tech of 95% purity. Finally Toxic Effluent which contains traces of Pesticides is taken to Hydrolysis stage for detoxification. Where Aq. Mass is treated at high temp.by Alkali for the rapid hydrolysis of presticides to simpler non-toxic compounds.

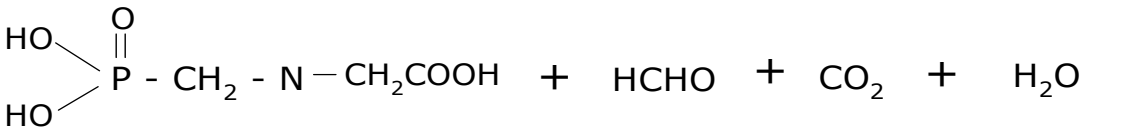
Chemical Reaction:

Glyphosate (TECH)



PMIDA
(MW- 227)

Hydrogen Peroxide
(MW- 34)



Glyphosate
(MW- 169)

M.W.- 30 **M.W.- 44** **M.W.- 18**

Mass Balance

Mass Balance of Glyphosate

INPUT	KG		OUTPUT	KG
FeSO4 (10%)	298	Glyphosate Preparation		
PMIDA	1990			
H2O2 (50%)	745			
Water	995			
Catalyst	10			
		Filtration	Organic ML for detoxification	2768
		Drying & Packing	Drying Loss	270
			Glyphosate	**1000**
Effluent	2768	Detoxification		
Caustic Lye	715		Detoxified Effluent(	3483
TOTAL	**7521**			**7521**

17. Imazethapyr

Manufacturing Process:

Stage 1

5-ethyl-3-pyridine carboxylic acid (EPCA) is reacted with 4,5 Dihydro-4 methyl 4 (1 methyl ethyl)-5-oxo-1 H-imidazoline in present of catalyst and DMF solvent. The Hydrochloric acid, which is formed during the reaction, is scavenged by putting Sodium carbonate as acid scavenger.

Stage 2

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.

Stage 3

The concentrated mass is then crystallized to get pure product – Imazethapyr technical.

Stage 4

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.

Mass Balance

MASS BALANCE OF IMIZATHAPYR

IN PUT	Kg		OUT PUT	Kg
EPCA	818	→ Condensation & solvent recovery		
DMMI	682	→	Recovered DMF	1904
DMF	2000	→	Residue	50
Catalyst	9	→		
Sodium Carbonate	636	→		
Water	910	→ Water Wash		
Methanol	363	→ Crystallization Filtration	Effluent	2164
Caustic lye	45	→		
		Drying & Packing →	Drying loss	345
		→	**Imazethapyr**	**1000**
Total	**5463**			**5463**

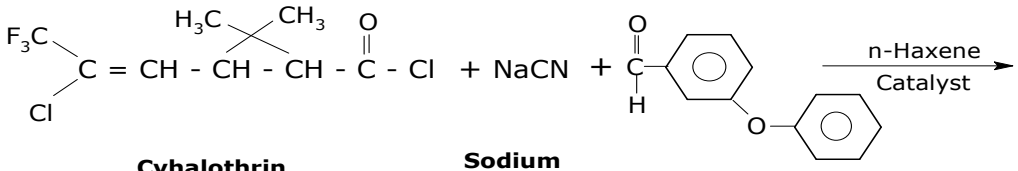
18. Lambda Cyhalothrin

Manufacturing Process:

Meta PhenoxyBenzaldehyde is reacted with Sodium Cyanide to form Meta PhenoxyBenzaldehydeCyanhydrin as an intermediate. This on reaction with FluoroPropenyl Acid Chloride (TFP Acid Chloride) form 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 toget 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:

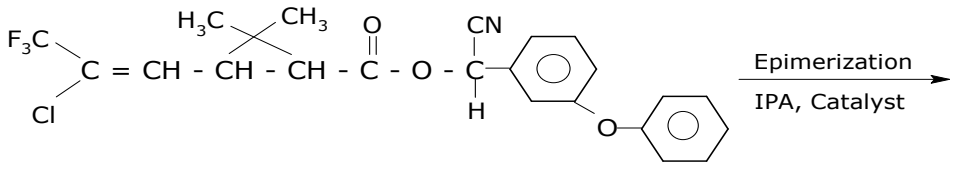
Lambda Cyhalothrin



Cyhalothrin
(MW- 449.9)

Sodium Cyanide
(MW- 49.1)

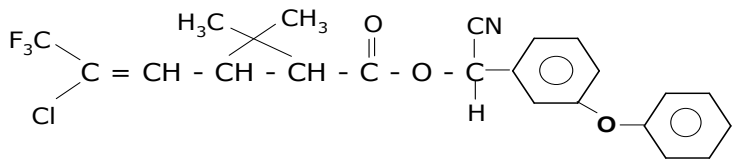
Meta Phenoxy Benzaldehyde
(MW- 198)



Cyhalothrin
(MW- 449.9)

+ NaCl

Sodium Chloride
(MW- 58.5)



Lambda Cyhaloyhrin
(MW- 449.9)

Mass Balance

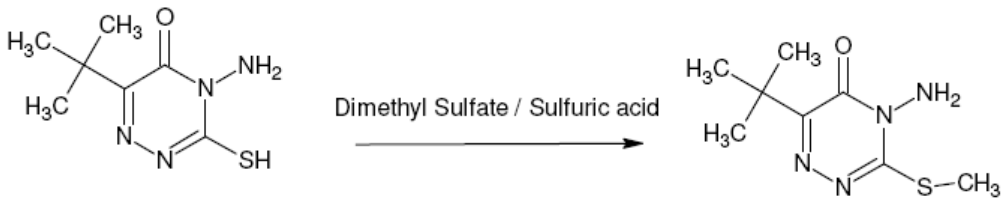
MASS BALANCE OF LAMBDA CYHALOTHRIN							
INPUT	**KG**					**OUTPUT**	**KG**
MPBAD	670	→	Condensation		→	Recovered Hexane	2390
TP Acid Chloride	740	→			→	Residue	120
NaCN	328	→					
Water	470	→					
n-Hexane	2500	→					
Catalyst	10	→					
			↓				
Soda ash Soln. 5%	1059	→	Washing		→	Effluent	**3022**
Water	1000	→					
			↓				
IPA	1050	→	Epimerisation		→	IPA recovery	995
Catalyst	90	→			→	Recovered Catalyst	95
			↓				
			Drying & Packing		→	Drying loss	295
					→	**Lambda Cyhalothrin**	**1000**
			↓				
Effluent	3022	→	Detoxification		→	Detoxified Effluent	3472
Caustic Lye	450	→					
TOTAL	**11389**						**11389**

19. Metribuzine

Manufacturing Process:

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

Mass Balance

MASS BALANCE OF METRIBUZINE

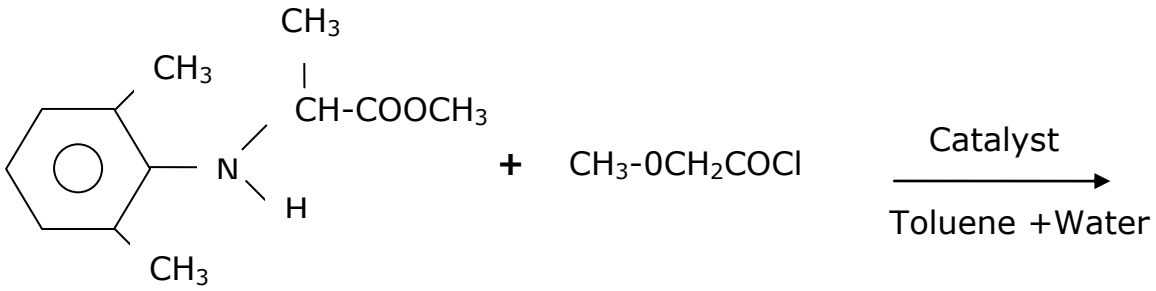
Input	kg		Output	kg
sulfuric acid	1245	Reaction		
Triazinone	1000			
Dimethyl sulfate	640			
Soda ash	1880	Fltration	Effluent	3580
Water	4900			
Water	3650	Washing	Effluent	8545
		Drying	Drying loss	190
			Metribuzin	**1000**
Total	**13315**			**13315**

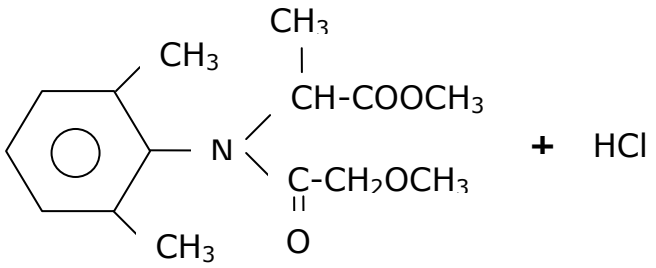
20. Metalaxyl

Manufacturing process:

N-(2, 6 – Dimethyl Phenyl) Alanine – Methyl Ester reacts with Methoxy Acetyl Chloride in presence of catalyst and solvent to get Metalaxyl solution. This solution is then wasted with water & solvent is distilled out to get Metalaxyl (Tech). Finally Toxic Effluent which contains traces of Pesticides is taken to Hydrolysis stage for detoxification where Aqueous Mass is treated at high temp by Alkali for the rapid hydrolysis of pesticides to simpler non-toxic compounds.

Chemical Reaction:





METALAXYL

Mass Balance

		MASS BALANCE OF METALAXYL					
INPUT	**KG**					**OUTPUT**	**KG**
N-(2,6- Dimethyl phenyl) alanine-methyl ester	765	→	**Reaction Vessel**				
methoxy acetyl chloride	405	→					
Catalyst	15	→				→ HCl gas	145
Toluene	2250	→					
Water	1050	→					
			↓				
			Solvent recovery			→ **Metalaxyl Tech.**	1000
						→ Recovered Toluene	2140
						→ Residue	90
			↓				
C.S.Lye 48%	250	→	**Alkali Hydrolysis (Detoxification)**			→ Detoxified Aqueous Mass	1360
Total	**4735**						**4735**

21. MPBD

Manufacturing process:

Chloro Bromination: Bromination of Benzaldehyde is carried out in a glass-lined reactor in presence of Aluminium 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 give intermediate Meta Bromo Benzaldehyde (MBB).

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

Mass Balance

MASS BALANCE OF MPBD

INPUT	KG		OUTPUT	KG
Benzaldehyde	748	→ **Chloro Bromination**		
AlCl3	1230	→	→ Gas stream to Water scrubber	273
EDC	2100	→		
Br	550	→		
Cl2	258	→		
Formic acid	20	→ **Drowning**	→ AlCl3 Solution	4791
Water	3500	→		
Water	1500	→ **washing**	→ Effluent	1524
		EDC Distillation	→ EDC Loss	150
			→ EDC Recycled	2050
			→ Benzaldehyde Recycled	30
			→ residue	48
MEG	573	→ **Acetal Formation**	→ MEG Recycled	191
Toluene	2090	→ **Condensation & Washing**		
KOH	335	→	→ KBr solution	3383
Phenol	562	→		
Wash water	2525	→		
Catalyst	22	→		
H2SO4	490	→ **Hydrolysis**	→ Effluent	453
		MEG Distillation	→ MEG Recycled	348
NaOH lye	25	→	→ residue	128
		MPB Distillation	→ Toluene recycled	1970
			→ Residue	189
		MPB Liquid		**1000**
Total	**16528**			**16528**

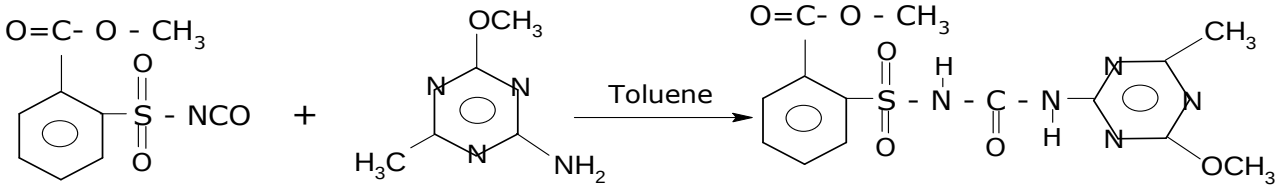
22. Met sulfuron methyl

Manufacturing Process:

O-sulfoisocyante Methyl Benzoate reacts with 2-Amino 4-Methoxy 6-Methyl 1,3,5Triazine 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)

Mass Balance

MASS BALANCE OF MET SULFURON METHYL							
INPUT	**KG**					**OUTPUT**	**KG**
O-sulfo isocyante Methyl Benzoate	634	→	**Stage I Preparation of Metsulfuron Methyl**				
2-Amino 4-methoxy 6-methyl 1,3,5 Triazine	367	→					
Toluene	800	→					
			↓				
			Stage II Filtration, Washing and Solvent Recovery		→	**Metsulfuron Methyl**	**1000**
Toluene	100	→			→	Residue (Organic)	81
					→	Recovered Toluene	820
Total	**1901**						**1901**

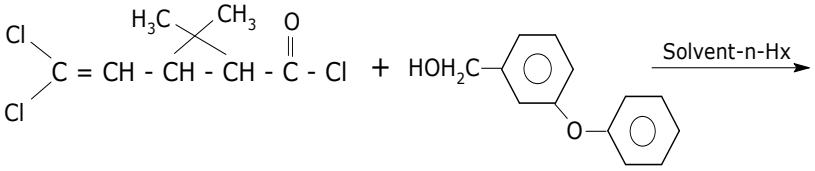
23. Permethrin

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.)

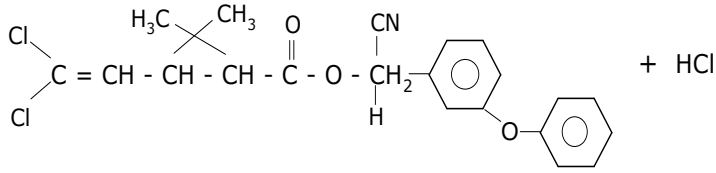


CMAC

(MW- 227.5)

MPBAL

(MW- 200.3



Permethrin

(MW- 391.3)

Hydrochloric Acid

(MW- 36.5)

Mass Balance

Mass Balance of Permethrin

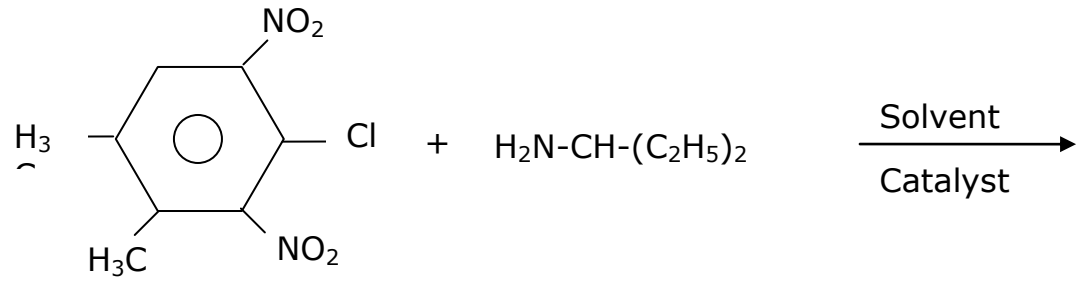
INPUT	KG		OUTPUT	KG
MPBAL	480	Condensation		
CMAC	516		HCl gas	100
n-Hexane	2857			
5% Soda-ash soln	952	Epimerisation	Recovered Solvent	2666
Water	470		**Permethrin Tech.**	**1000**
Caustic Lye	48	Detoxification	Detoxified Effluent	1557
TOTAL	**5323**			**5323**

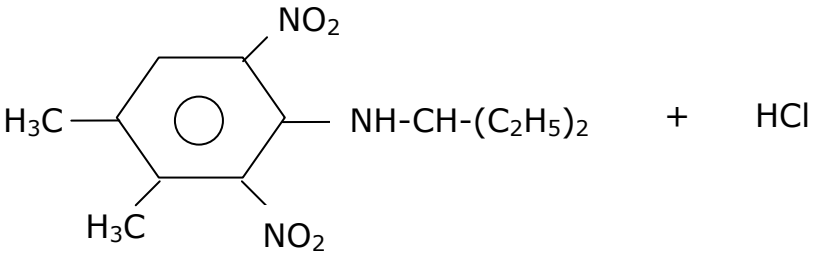
24. Pendimethalin

Manufacturing process:

1-Chloro 2, 6 Di nitro 3, 4 Xylidine reacts with 3-Pentaneamine in presence of Solvent and Catalyst to get the finished product Pendimethalin. On cooling, crystals form which are filtered out and solvent is distilled out and recycled.

Chemical Reaction:





Pendimethalin

Mass Balance

MASS BALANCE OF PENDIMETHALIN						
INPUT	**KG**				**OUTPUT**	**KG**
1-Chloro 2,6 Dinitro 3,4 xylidine	825	→	**Preparation**			
3-Pentane amine	315	→				
Toluene	800	→		→	30 % HCl mixture	130
Catalyst	5	→				
			↓			
			Filtration & Solvent recovery	→	**Pendimethalin**	**1000**
				→	Solvent recoverd	760
				→	Residue	55
Total	**1945**					**1945**

25. PROFENOFOS

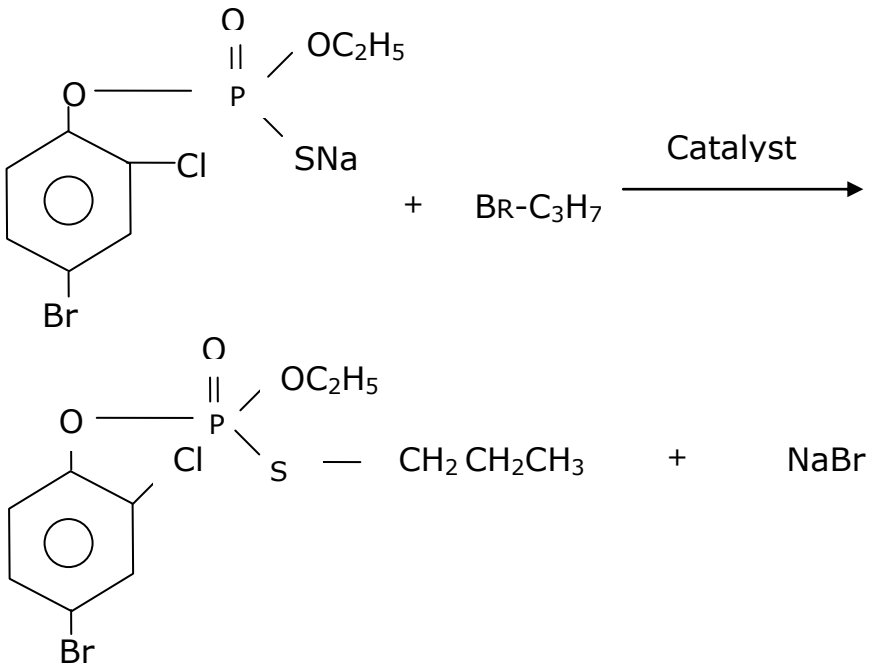
Manufacturing process:

Na-PFA Preparation: 4-bromo -2-chlorophenyl diethyl thiophosphate (PEA) is reacted with salt of dimethyldithiocarbamate (Na-DMDT) in presence of catalyst and solvent –Toluene to form Na-PEA. After solvent recovery and layer separation of Ethyl ester of dimethyldithiocarbamate (E-DMDT) taken to Incineration and crude Na-PFA directly taken to Profenofos preparation.

Profenofos Preparation: Crude Na-PFA is reacted with n-Propyl Bromide in presence of catalyst to give Profenofos Tech. The organic mixture of profenofos is washed to remove Sodium bromide salt in water. After n-Propyl bromide recovery, recycle it to get Profenofos Technical of 89% Purity.

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:



Mass Balance

MASS BALANCE OF PROFENPHOS						
INPUT	**KG**				**OUTPUT**	**KG**
PFA	950	→	**Preparation of NaPFA**	→	Recovered solvent	4340
Na-DMDT	360	→		→	Organic residue	375
Catalyst	9	→				
Toluene	4353	→				
			↓			
Catalyst	9	→	**Preparation of Technical**	→	**Profenofos Tech.**	1000
Water	435	→		→	n-Propyl bromide reco.	1175
n-Propyl bromide	1480	→		→	Residue	24
			↓			
C.S.lye 48%	44	→	**Detoxification**	→	Effluent	726
Total	**7640**					**7640**

26. 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.

Mass Balance:

Mass balance of Propiconazole

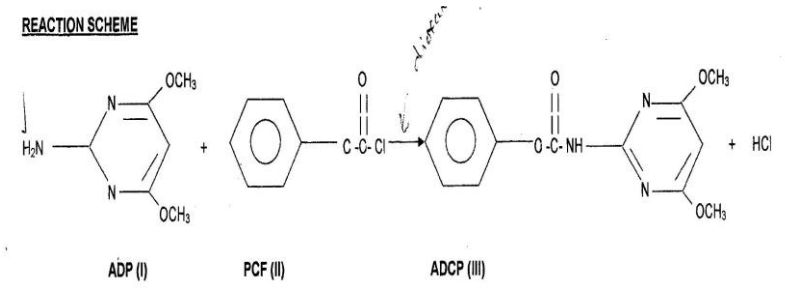
IN PUT	Kg		OUT PUT	Kg
2,4-dichloro benzyl chloride	545	→ Intermediate		
4-propyl-1, 3-dioxolane	305	→ Intermediate	Effluent	2020
Dimethyl sulphide	875	→ Intermediate		
KOH	675	→ Intermediate		
DMF	1780	→ Propiconazole		
1,2,4 Triazol	280	→ Propiconazole		
K_2CO_3	65	→ Propiconazole		
Iso Propanol	235	→ Propiconazole		
		DMF Recovery	DMF Recovery	1740
		Packing	**Propiconazole**	**1000**
Total	**4760**			**4760**

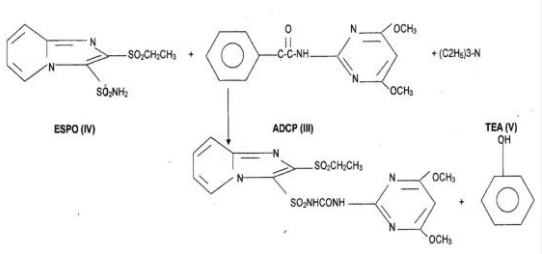
27. Sulfosulfuron

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:





Mass Balance

MASS BALANCE OF SULFOSULFURON							
INPUT	**KGS**					**OUTPUT**	**KGS**
Dichloromethane	3500	→	**Reaction**				
ESPO	480	→					
ADCP	450	→					
TEA	370	→	**Reaction**				
HCl	410	→					
Water	3000	→	**Filtration Washing**		→	Effluent	4410
			Distillation		→	Dichloromethane recovery	3350
					→	Organic residue	250
Sulfosulfuron wet	1150	→	**Drying**		→	drying loss	350
					→	**Sulfosulfuron technical**	**1000**
Total	**9360**						**9360**

28. Tebuconazole

Manufacturing Process:

Step: - 1 Process 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.

Step: - 2 Process 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.

Step: - 3 Condensation

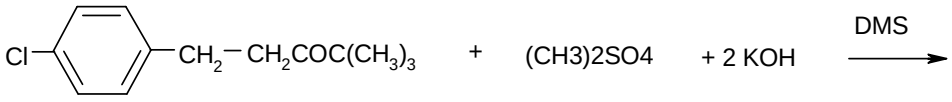
In dimethyl formamide, potassium carbonate, 1, 2, 4-triazole is added and then above prepared oxirane is added at reflux temperature. After completion of the reaction the mass is filtered and then solvent DMF is distilled out. Then the product Tebuconazole is isolated by adding water. The slurry is filtered, centrifuged and dried.

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

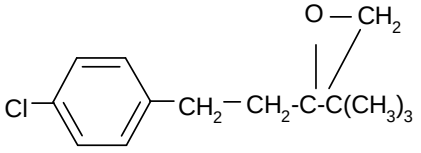
The mother liquor is transferred to ETP.

Chemical Reaction:

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

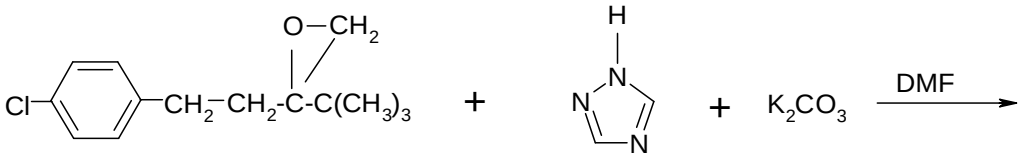


1-(4-CHLOROPHENYL)-4,4'-DIMETHYL-PENT-3-ONE (CPDP)



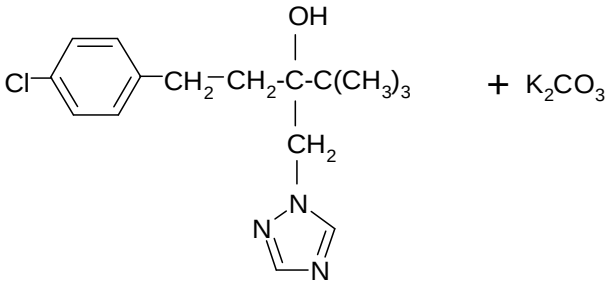
+ K_2SO_4 + H_2O

Oxirane



Oxirane

1H-1,2,4-
Triazole



Tebuconazole

Mass Balance

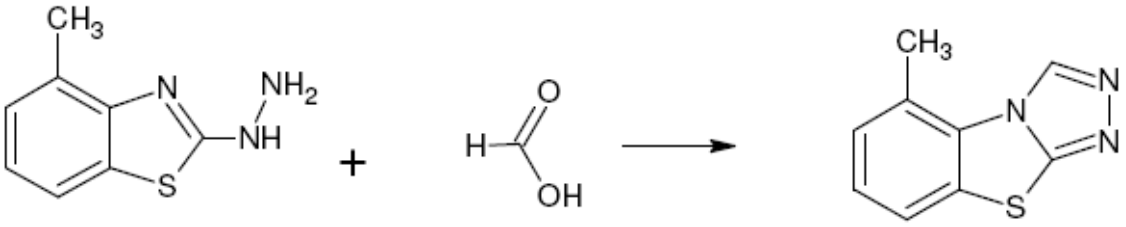
	Mass Balance of Tebuconazole							
INPUT	**KG**						**OUTPUT**	**KG**
Dimethyl Sulfate	502	→	**Reaction**			→		
Sodium sulfide	26	→				→	DMF Recovery	1395
KOH	323	→				→	Residue	185
1,2,4-triazole	255	→						
K2CO3	40	→						
DMF	1420	→						
Water	3050	→						
			↓					
			Filtration			→	Liquid effluent	2726
			↓					
			Drying			→	Drying Loss	310
						→	**Tebuconazole**	**1000**
Total	**5616**							**5616**

29. TRICYCLAZOLE

Manufacturing process:

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

Mass Balance

MASS BALANCE OF TRICYCLAZOLE							
IN PUT	**Kg**					**OUT PUT**	**Kg**
HMBT	980	→	**Reaction**		→	Formic acid recovery	260
Formic acid	550	→					
Caustic lye	50	→					
Water	3200	→					
			↓				
			Filtreation		→	Waste water	3260
			↓				
			Drying		→	Drying loss	260
					→	**Tricyclazole**	**1000**
Total	**4780**						**4780**

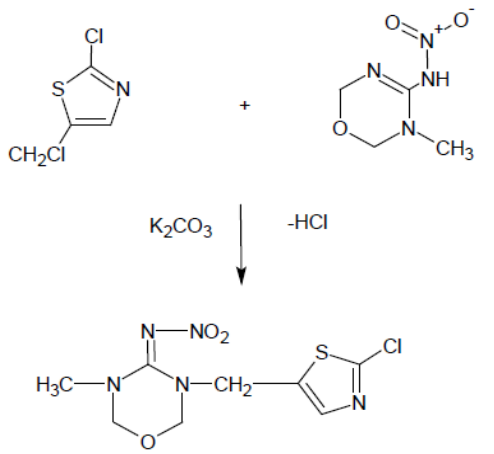
30.Thiamethoxam

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:

CHEMICAL REACTION OF THIAMETHOXAM



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

Mass balance

MASS BALANCE OF THIAMETHOXAM						
IN PUT	**KG**				**OUT PUT**	**KG**
CCMT	770	→	Reaction			
MNIO	735	→				
DMF	700	→				
K2CO3	450	→				
			↓			
			Filtration	→	Effluent	2645
Water	1600	→		→	Recovered Solvent	665
				→	Residue	35
			↓			
			Purification by Crystalization & Distillation	→	Methanol	1260
Methanol	1350	→		→	**Thiamethoxam Tech.**	**1000**
Total	**5605**					**5605**

31. Thiram

Manufacturing process:

Step-I: Formation of Adduct
Chilled carbon disulphide is taken in a reactor to which chilled dimethyl amine is added slowly maintain the temperature less than 15^0C with stirring. Deep yellow product is formed.

Step-II: Preparation of sodium salt
Caustic solution is slowly added to the above mixture maintain a temperature of below 15^0C and with vigorous stirring to form responding salt.

Step-III: oxidation of salt to form Thiram Technical
Hydrogen peroxide with sulphuric acid is slowly added to sodium salt to form the Thiram Technical.

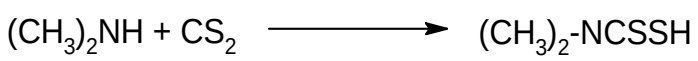
Step-IV: Centrifuging
A reaction mixture obtained in STEP-III is subjected to centrifuging to remove impurities.

Step-V: Washing
The product is repeatedly washed with water to remove inorganic impurities.

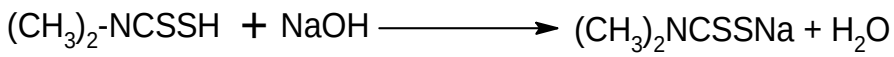
Step-VI: Drying
After washing, the product is dried in drier to form nearly colorless powder.

Chemical Reaction:

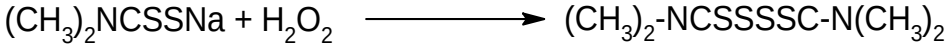
STEP-I Reaction of dimethyl amine with carbon disulphide to form adduct



STEP-II Reaction of sodium hydroxide with the adduct



STEP-III Formation of thiram crude



Mass Balance

MASS BALANCE OF THIRAM

INPUT	KG		OUTPUT	KG
CS2	400	Formation of adduct		
Dimethyl Amine	1000			
NaOH	330	Formation of sodium salt	Salt	870
H2O2	150			
H2SO4	200	Formation of thiram crude		
Water	850			
		washing	Effluent	1470
Water	1200			
		centrifuge	Effluent	475
		Drying & Packaging	Drying loss	315
			thiram tech	1000
Total	**4130**			**4130**

32. Thiophenate methyl

Manufacturing Process:

Step: 1

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

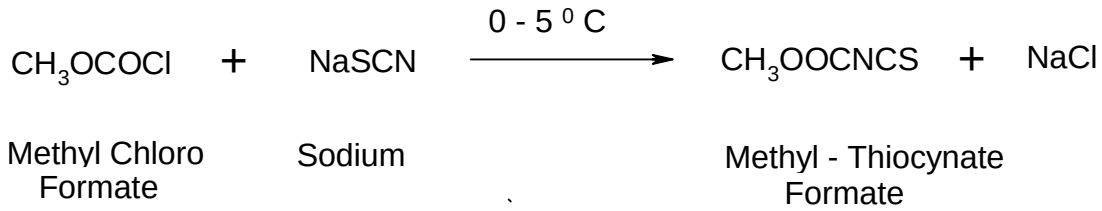
Sodium Thiocyanate is added in Ethylene dichloride. Then is reacted with Methyl chloro formate in the ratio of 1 mol: 1 mol at temp. $<5^0$C and Methyl Thiocyanateformate is formed.

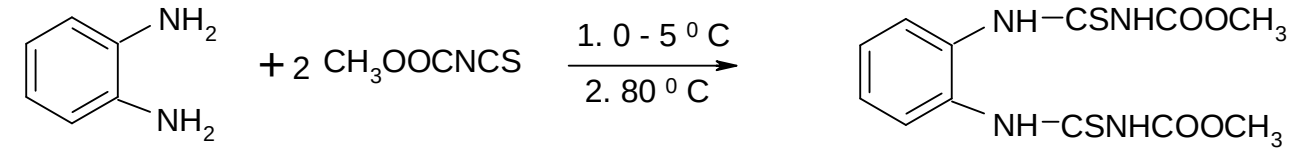
Step: 2

In above ethylene dichloride layer, solution of O-Phenylene Diamine 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 reaction:





O-Phynelene Diamine

Thio Phanate Methyl

Mass Balance

MASS BALANCE OF THIOPHENATE METHYL							
INPUT	**KG**					**OUTPUT**	**KG**
EDC	2000	→	**Reaction**		→	EDC Recovery	1920
Sodium Thio cyanate	526	→					
Methyl chloro formate	600	→					
OPDA	350	→					
Water	3100	→					
			↓				
			Filtration		→	Liquid effluent	3278
			↓				
			Separation		→	Solid waste	378
			↓				
			Packing		→	**Thiophenate methyl**	**1000**
Total	**6576**						**6576**

33. Ziram

Manufacturing process:

STEP-I: Chilled Dimethyl amine is reacted with carbon disulphide in a reactor marinating the temperature less than 15^0C. After the reaction is completed the contents are mixed with caustic soda maintain chilled temperature (below 10^0C).

STEP-II: The caustic soda is slowly added to the mixture in such a way temperature doesn't go above 10^0C with constant stirring the mixture.

STEP-III: Ziram Technical crude formation

Sodium salt obtained in STEP-III is reacted with stoic metric amount of chilled zinc sulphate solution under chilled condition with constant stirring while zinc sulphate solution under chilled condition with constant stirring while zinc sulphate solution is added slowly. The color of the mixture slowly faded from orange to pale yellow indication the completion of reaction.

STEP-IV: Product Separation

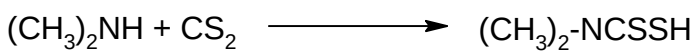
Reaction mixture obtained in above step is separated in a centrifuge and subjected to repeated washing with water to remove sodium sulphate and other impurities.

STEP-V: Removal of Moisture

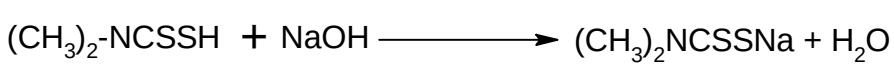
Ziram is subjected to drying in drier to produce Ziram technical almost Ziram technical is colorless powder.

Chemical Reaction:

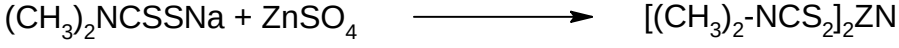
STEP-I Reaction of dimethyl amine with carbon disulphide to form adduct



STEP-II Reaction of sodium hydroxide with the adduct



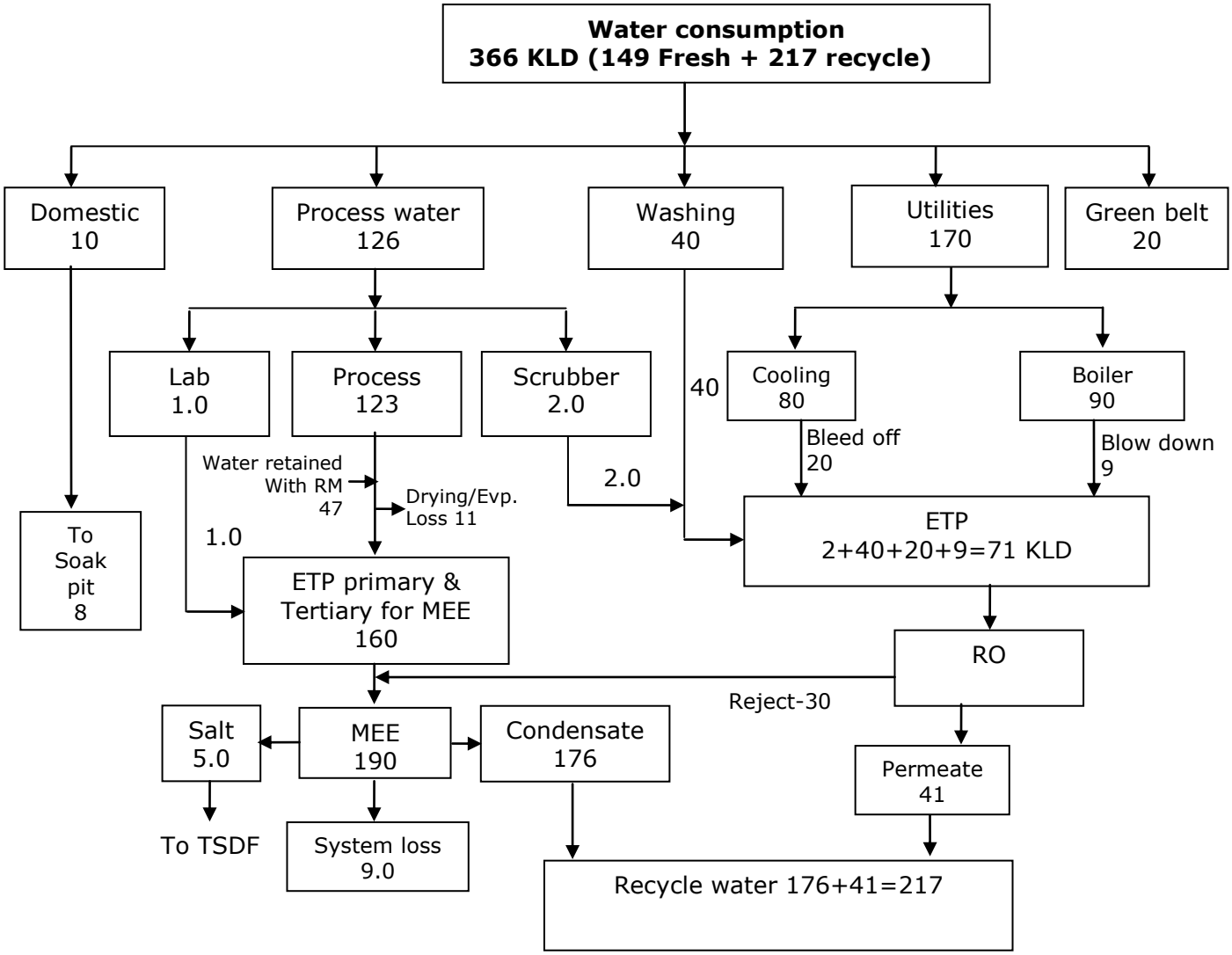
STEP-III Formation of ziram technical crude



Mass Balance

MASS BALANCE OF ZIRAM			
INPUT	**KG**	**OUTPUT**	**KG**
CS2	600		
Dimethyl Amine	900		
		Formation of adduct	
NaOH	320		
		Formation of sodium salt	
		Salt	820
ZnSO4	950		
Water	1200	**Formation of ziram crude**	
Water	1000	**washing**	
		Effluent	1950
		centrifuge	
		Effluent	860
		Drying & Packaging	
		Drying loss	340
		ziram tech	1000
Total	**4970**		**4970**

Annexure-III
Water Balance Diagram

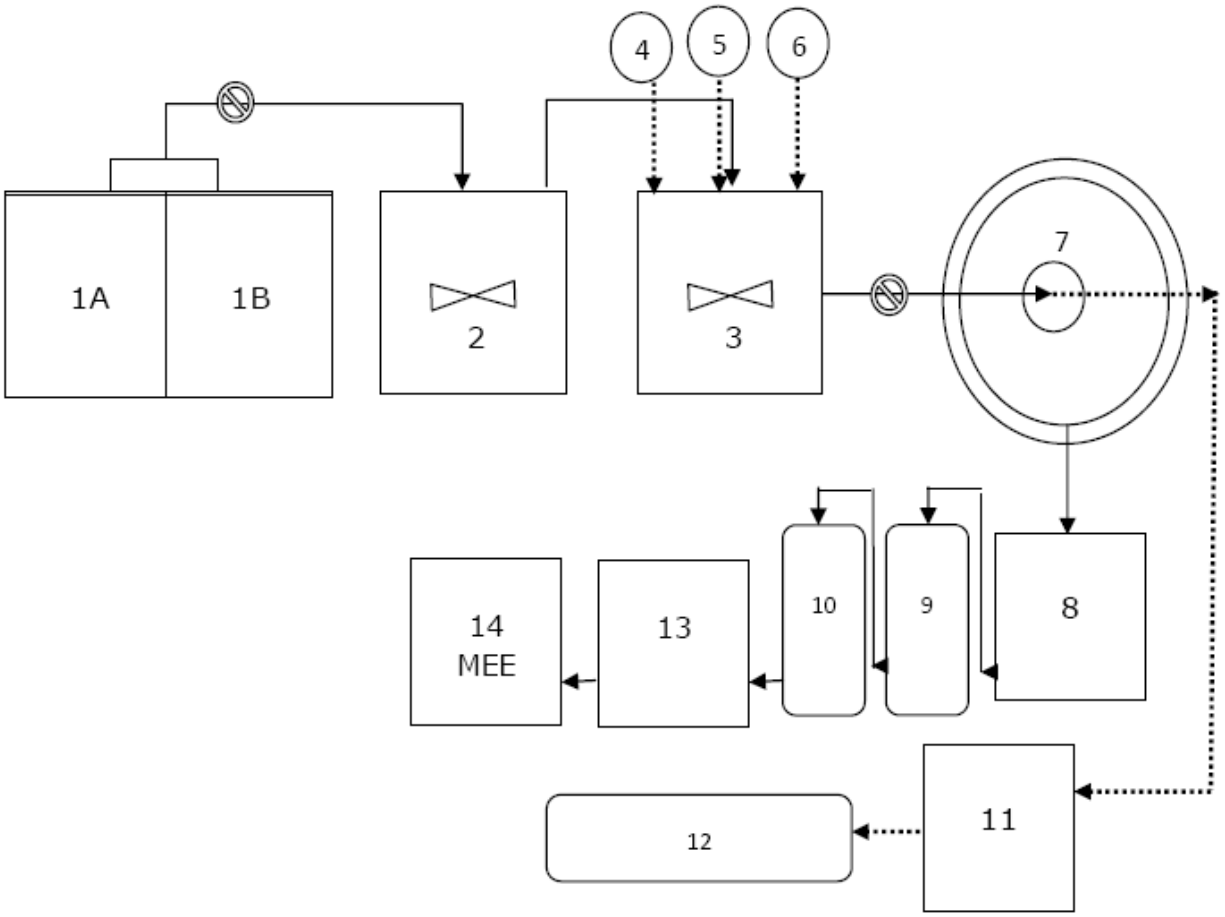


Annexure-III (a)

Break up of water consumption and waste water generation

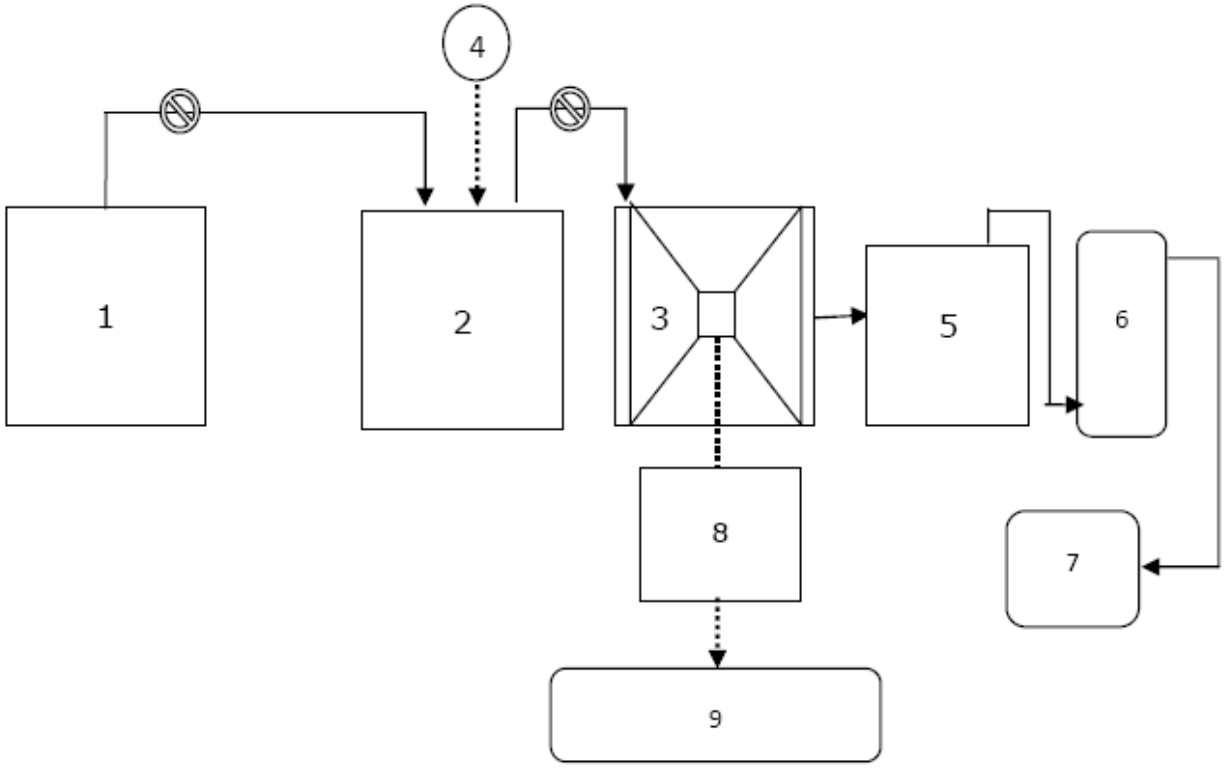
Sr. No.	Sources	Water consumption KLD	Waste water generation KLD
1.	Domestic	10.0	8.0
2.	Gardening	20.0	0.0
3.	**Industrial**		
(i	Process	123.0	159.0
(ii	Lab	1.0	1.0
(iii	Scrubber	2.0	2.0
(iv	Cooling	80.0	20.0
(v	Boiler	90.0	9.0
(vi	Washing	40.0	40.0
Total industrial		336	231
Total (1+2+3)		366	239
Less recycle		217	-
Actual w/c & w/w generation		**149**	**-**

Annexure IV
Flow Diagram of ETP - Process effluent



Sr.No.	Name of Unit
1.	Equalization/Neutralization Tank
2.	Flash Mixer
3.	Flocculator
4.	Lime Dosing Tank
5.	Alum Dosing Tank
6.	Poly Floc Dosing Tank
7.	Primary Clarifier
8.	Intermediates Holding Tank
9.	Pressure Sand Filter
10.	Activated Carbon Filter
11.	Sludge sump
12.	Filter press
13.	Holding Sump
14.	MEE

Flow Diagram of ETP - Utilities + washing



Sr.No.	Name of Unit
1.	Equalization Tank
2.	Neutralization tank
3.	Primary Settling tank
4.	Lime Dosing Tank
5.	Intermediates Holding Tank
6.	Pressure Sand Filter
7.	Holding Sump
8.	Sludge sump
9.	Filter press

Annexure V

Details of Hazardous waste

Sr. No.	Type of Waste	Sources	Category	Quantity in MTPM	Disposal facility
1.	ETP Sludge & MEE salt	ETP MEE	35.3	35 & 125	Collection, Storage, Transportation & Disposal at TSDF site approved by GPCB.
2.	Distillation Residue	Purification of Solvent	36.1	40	Collection, Storage, transportation and send to cement industry for co-processing or incinerated at CHWIF approved by GPCB.
3.	Process Reside (Inorganic Salt)	Process	29.1	50	Collection, Storage, Transportation & Disposal at TSDF site approved by GPCB.
4.	Spent Catalyst	Process	29.5	1.0	Collection, Storage and Send for regeneration to suppliers
5.	Off specific products	Process	29.3	As & when generated	Collection, Storage, transportation and send to cement industry for co-processing or incinerated at CHWIF approved by GPCB.
6.	Discarded containers/ liners	Process	33.1	Drum:800 Nos./month Liner:0.5 MT/month	Being used for packing of ETP sludge in case of excess it will be sold to approved recycler or traders.
7.	Used Lubricating Oil	Driving unit & D.G. set	5.1	1.0 Kl/Year	Collection, Storage, Transportation & disposal by selling to Registered Recyclers

Annexure-VI
Source of Air Emissions

Sr. No.	Stack attached to	Fuel Type	Stack Height (m)	APC measures	Probable emission
➢ **Flue Gas Stacks**					
1	Boiler Coal Base (4 T/hr.)	Coal-20 T/Day	30	Cyclone & Bag Filter	PM<150 mg/NM^3 SO_2<100 ppm NO_x<50 ppm
3	TFH (10 lakhs K Cal/hr.)	Coal-6.0 T/Day	21	Cyclone & Bag Filter	PM<150 mg/NM^3 SO_2<100 ppm NO_x<50 ppm
4	D.G. set – Stand by (500 KVA)	Diesel-110 lit/hr.	11	--	PM<150 mg/NM^3 SO_2<100 ppm NO_x<50 ppm
➢ **Process Gas stacks**					
1	Process Reactor of 2,4 D Acid	--	15	Venturi water scrubber followed by alkali scrubber	HCl< 20 mg/NM^3 SO_2<40 mg/NM^3
2	Process Reactor of Carbendazim	--	15	Water Scrubber followed by alkali scrubber	HCl< 20 mg/NM^3
3	Process Reactor of Captan	--	15	Water Scrubber followed by alkali scrubber	HCl< 20 mg/NM^3
4	Process Reactor of Deltamethrin	--	15	Venturi water scrubber followed by alkali scrubber	HCl< 20 mg/NM^3 SO_2<40 mg/NM^3
5	Process Reactor of Fipronil	--	15	Venturi water scrubber followed by alkali scrubber	HCl< 20 mg/NM^3 SO_2<40 mg/NM^3
6	Process Reactor of Permethrin	--	15	Water Scrubber followed by alkali scrubber	HCl< 20 mg/NM^3
7	Reactor of Metalaxyl	--	15	Water Scrubber followed by alkali scrubber	HCl< 20 mg/NM^3
8	Reactor of Pendimethalin	--	15	Water Scrubber followed by alkali scrubber	HCl< 20 mg/NM^3