Additional Documents

for

Proposed Project for manufacturing of Technical garde pesticide

By

M/s. Dhanuka Agritech Limited

Plot No.D-3/1/A, Dahej-III, Industrial Estate, Tal-Vagra,Dist-Bharuch-392130

INDEX

Annexure-1

List of Products and Production Capacity

Sr. No.	Product	CAS Number	Quantity (TPM)	TPA
A	**Insecticide/Fungicide**			
1	Fenvalarate	51630-58-1	200.00	2400.00
2	Fenpyroximate	134098-61-6	40.00	480.00
3	Bifenthrin	82657-04-3	100.00	1200.00
4	Cypermethrin	52315-07-8	300.00	3600.00
5	Permethrin	52645-53-1	100.00	1200.00
6	Alpha Cypermethrin	65731-84-2	50.00	600.00
7	Lambda-Cyhalothrin	91465-08-6	50.00	600.00
8	Flucythrinate	70124-77-5	20.00	240.00
9	Tefluthrin	79538-32-2	75.00	900.00
10	Pyriproxyfen	95737-68-1	75.00	900.00
11	Cyfluthrin and Beta cyfluthrin	68359-37-5	75.00	900.00
12	Isoprothiolane	50512-35-1	50.00	600.00
13	Allyl Isothiocyanate	57-06-7	150.00	1800.00
14	Veliphenalate	283159-90-0	30.00	360.00
15	Banalaxyl	71626-11-4	50.00	600.00
16	Banalaxyl-M	98243-83-5	50.00	600.00
17	Metalaxyl	57837-19-1	50.00	600.00
18	Acetamiprid	135410-20-7	100.00	1200.00
19	Imidacloprid	138261-41-3	100.00	1200.00
20	Thiamethaxom	153719-23-4	100.00	1200.00
21	Tebuconazole	107534-96-3	60.00	720.00
22	Propicanazole	60207-90-1	60.00	720.00
23	Hexaconazole	79983-71-4	60.00	720.00
24	Tetraconazole and intermediates	107534-96-3	75.00	900.00
25	Azoxystrobin	131860-33-8	20.00	240.00
		Total (A)	**2040.00**	**24480.00**
B	**Herbicide**			
1	Glyphosate tech	1071-83-6	300.00	3600.00
2	IPA salt of glyphosate	38641-94-0	200.00	2400.00
3	Ammonium salt of glyphosate	114370-14-8	50.00	600.00
4	Bispyribac Sodium	125401-92-5	100.00	1200.00
5	Clodinafop propargyl	105512-06-9	100.00	1200.00
6	Chlorimuron	99283-00-8	30.00	360.00
7	Sulfosulfuron	141776-32-1		
8	Nico Sulfuron	111991-09-4		
9	Clomazone	81777-89-1	200.00	2400.00
10	Pendimethalin	40487-42-1	300.00	3600.00
11	2,4-D acid	94-75-7	1500.00	18000.00

Sr. No.	Product	CAS Number	Quantity (TPM)	TPA
12	2,4-D Sodium	2709-72-9	200.00	2400.00
13	2,4-D Amine	94-75-7	1250.00	15000.00
14	2,4-D Ethyl ester	533-23-4	200.00	2400.00
15	2,4-D Butyl ester	94-80-4	200.00	2400.00
16	2,4-D Hexyl ester	1928-43-4	200.00	2400.00
17	Metribuzin	21087-64-9	200.00	2400.00
		Total(B)	**5030.00**	**60360.00**
C	**Intermediates**			
1	DHANSAFE (Methyl 2 -Methoxy -2,2-diphenyl acetate 74%)	41858-19-9	50.00	600.00
2	DVACl (CMAC)	52314-67-7	250.00	3000.00
3	MPBAD	39515-51-0	250.00	3000.00
4	Metaphenoxy benzyl Alcohol(MPBA)	13826-35-2	75.00	900.00
5	Phenyl Acetyl Chloride	103-80-0	100.00	1200.00
6	Lambda Cyhalothric Acid	72748-35-7	75.00	900.00
7	2, 6 Dichloro Phenol	87-65-0	100.00	1200.00
8	2, 4 Dichloro Phenol	120-83-2	1200.00	14400.00
9	Pilot Plant	-	20.00	240.00
		Total (C)	**2120.00**	**25440.00**
		Grand total (A+B+C)	**9190.00**	**110280.00**

Annexure-2

Land document of GIDC

GUJARAT INDUSTRIAL DEVELOPMENT CORPORATION
(A GOVT. OF GUJARAT UNDERTAKING)

Office of the Deputy Executive Engineer (Const. Division.),
1st FLOOR, NARMADA COMM. COMPLEX,
STATION ROAD, PANCHBATTI,
BHARUCH - 392 001
Ph- 02642-242432/244184 FAX – (02642)241902

1962-2012

NO.GIDC / DEE /Dahej-III / 206 DATE: 6 / 07/2013

Ref: (1) Offer cum Allotment No. : GIDC / RM /ANK /ALT/ 2061 Date :21/12/2012
(2) Handing Over Possession No. : GIDC / RM /ANK /1095 Date :06/04/2013
(3)Corrigendum Order No. : GIDC / DM/CG/ANK/1404 Date : 15/04/2013
(4) Deed of Ractification No. : GIDC / RM/ ANK/1621 Date : 20/06/2013

Possession Receipt

In pursuance of Offer-cum-allotment of Ind. Plot No./~~Comm. plot / Hsg. plot No. / Hsg.qtr No. /shed No.~~ D-3 /1/A admeasuring **151954.70 Sq.mt (tentative)** situated in the ~~housing~~ / industrial phase Dahej –III * As is Where is basis * consisting survey no 874/P,879/P,881/P,871/P,872/P,1039/P,1044/P,1043/P,1042,1041,1040/P Govt. C.T. 1036/P, 1037/P, 1038/P,1035/P,1034/P,476/P,1031/P,1032/P,1033/P, Govt. C.T. within the village limits of Dahej at GIDC Industrial estate Dahej ,Ta. Vagra , Dist Bharuch is handed over to day i.e on 6 -07 - 2013 in good condition.

The Said Premises Are Bounded As Follows :

Plot No: D- III /1/A

On towards North By	Dahej-Amod S.H. Road & 20mt U.T. corridor
On towards South By	30-00 mt wide U.T. corridor
On towards East By	30-00 mt wide corridor
On towards West By	Plot No. D-3/1/1

Possession Taken Over By :
M/s Dhanuka Agritech Limited
Sign :- For Dhanuka Agritech Limited
Managing Director
Desi :-

Possession Handed Over By:
Shri :- D.K.Pansara
sign :-
Desi :- Assistant Engineer,

Place:- GIDC / Dahej – III/ BRH
Date : 6 -07-2013

place :- GIDC / Dahej – III / BRH
Date : 6 -07-2013

Note : The plot is handed over on "As is where is basis ", as demarcated by the surveyor at site as per field book without any enchroachment.

Copy to :
M/s Dhanuka Agritech Limited
2nd Floor, Maha Shakti, Opp Loha Bhavan
Old High court Lane, Ahmedabad-380009

C.S.W.R.To :
(1) The R M GIDC / Ankleshwar.
(2) The A O GIDC / Ankleshwar.
(3) The Executive Engineer, Const. Div. GIDC, Dahej – II, Bharuch.
(4) The Dy.Ex Engineer, (W/s), GIDC Bharuch.
(5) The Dy.Ex Engineer (Drg). GIDC Bharuch.

For Dhanuka Agritech Limited
Managing Director

Sign Of Party

Deputy Executive Engineer
GIDC, Dahej- II, Bharuch.

GUJARAT INDUSTRIAL DEVELOPMENT CORPORATION
(A GOVT. OF GUJARAT UNDERTAKING)
Administrative Office Building,
Plot No. 624/B, GIDC, Ankleshwar, Dist. Bharuch
Phone: 02646-221351,221451,221403

No. GIDC/DM/ CG/ANK/ 1404 By RPAD Date: 15 /04/2013

Recd. on 24.4.13.

"Corrigendum order"

Sub :- Allotment of Plot No.**D-3/1/A** at Dahej -2 Industrial Estate.

Ref:- (1) This office offer cum allotment letter NO. GIDC/RM/ANK/2061 dtd:21/12/2012
(2) The Licensee Agreement executed on 02/04/2013

Corporation has allotted Part of Plot No. **D-3/1** area admeasuring 152271.78 sq. mtrs above reference no. 1 to M/s Dhanukas Agritech Limited at Dahej Industrial Estate.

As per the revised sketch it is order to read the Plot No, **D-3/1/A** area admeasuring **151954.70** Sq.mtrs (Tentative) instead of Part of Plot No. **D-3/1** area admeasuring 152271.78 Sq. mtrs in the offer cum allotment letter issued vide under reference. The revised calculation is as under.

Plot No	**D-3/1**
Area in M2 (Tentative)	**151954.70 sq. mt.**
Premium Price Rs. 1020/- per m2	Rs. 15,49,93,794/-
Frontage Charges	Rs. 40,79,321/-
Total Cost of Plot	Rs. 15,90,73,115/-
PCPIR Charges	Rs. 22,79,321/-
Fund for education and Innovation research@ Rs.5/- m2	Rs. 7,59,974/-
Amount to be paid by the party	Rs. 16,21,12,410/-
Amount paid by the party	Rs. 16,24,46,728/-
Execess Amount paid by the party	**Rs. 3,34,318/-**

To rectify the area discrepancy party shall have to execute the Deed of Rectification on Stamp paper of Rs. 100/- as per performa. Other terms and conditions of the offer cum allotment letter remain unchanged.

Divisional Mangaer(CG)
GIDC Ankleshwar

To,
M/s Dhanukas Agritech Limited
14th Floor, Building 5A, Cyber City,
DLF Phase – 3, Gurgaon – 122002
Haryana, (India)

Copy to:-
1) Executive Engineer GIDC Bharuch
2) Dy. CAO GIDC Ankleshwar
3) DEE GIDC Bharuch.

Gujarat Industrial Development Corporation
(A Govt. of Gujarat Undertaking)

Administrative office building,
Commercial Plot No.320/2, Near Asian Paints Chowkdi
GIDC Ankleshwar 393002. Dist. Bharuch.
Phone:+91-02646-221351, 221451, 221403
Fax: +91-02646-251451 Email-rmank2@gidcgujarat.org

15 YEARS OF CELEBRATING THE MAHATMA

No: GIDC/RM-II/ANK/ 2040 **Date:**

"Corrigendum Order" 27 MAY 2021

Sub: - Modification/Correction in area of Plot No. D-3/1/A at Dahej-III Industrial Estate.

Ref: - (1) T.O. OCA Letter No. GIDC/DM/CG/ANK/ALT/2061, dtd. 21/12/2012
(2) T.O. possession advise letter No. GIDC/RM/ANK/1095, dtd. 06/04/2013.
(3) T.O. Corrigendum Order No. GIDC/DM/CG/ANK/1404, dtd.15/04/2013
(4) T.O. Corrigendum Order No. GIDC/GM Gr.I/CG/ANK/935, dtd.20/12/2017
(5) T.O. Corrigendum Order No. GIDC/RM-II/ANK/DHJ/ALT/DHJ-III, dtd.22/03/2018

The Corporation has allotted Industrial part of Plot No. D-3/1 area admeasuring 152271.78 Sq.mt. (T) to M/s. Dhanuka Agritech Limited at Dahej-3 Industrial Estate vide OCA letter referred at (1) above. Thereafter, this office has issued corrigendum order for Plot No. D-3/1/A area admeasuring 151954.70sq.mt. (T) instead of part of Plot No. D-3/1 area admeasuring 152271.78 sq.mt. (T) vide order referred at (3) above and also issued corrigendum order for Plot No.D-3/1/A area as per approved field book admeasuring 153607.02 (T) instead of area admeasuring 151954.70 sq.mt. (T) vide order referred at (4) above. However, this office has again issued corrigendum order for the excluding of Government (Cart Tract) land area admeasuring 5374.11 sq.mt. (T) & Survey No.872/p (Pond) area 3908.65 sq.mt. (T) passing through the plot, Hence, area turned out of the plot was 144324.26 sq.mt. (T) vide order referred at (5) above.

As per the approved field book of the said plot, area of the Plot No. D-3/1/A has been turning out to be 153607.02 sq.mt. out of which Government land / Cart Tract area admeasuring 5374.11 sq.mt.(T) of Village Dahej which was not in possession with Corporation and falling under said plot. The advance possession of said land is handed over by the Government to GIDC.

In view of the above, it is hereby ordered to read the Plot No. D-3/1/A area admeasuring 149698.37 sq.mt. (T) instead area admeasuring 144324.26 sq.mt. (T) at Dahej-III Industrial Estate. The revised calculation is as under.

	Plot No	D-3/1/A
A)	Area of the plot as per approved FB	153607.02 sq.mt.
B)	Area of the Government Cart Tract Land advance possession handed over by Government	5374.11 sq.mt.
C)	Area of the Survey No.872/p (Pond) (N.P)	3908.65 sq.mt. (T)
D)	Cost of the Government Cart Tract Land @ Rs.2240/- (T) per sq.mt.	Rs.1,20,38,006 /-
E)	Frontage Charge @ Rs.15/- per sq.mt. above area of the plot 50000.00 sq.mt.	Rs.80,612/-
	Total amount to be paid within 30 days from the issuance of this order	**Rs.1,21,18,618/-** (T)

Further, the allottee shall have to obtain statement of accounts for payment / adjustment/refund/recovery to be made from the office to Senior Accounts Officer, GIDC, Ankleshwar within 30 days from the issuance of this order. To, rectify it; allottee shall have to execute deed of rectification on stamp paper of Rs.300/- as per enclosed proforma herewith.

Further, to the above, allottee shall have to execute notarized undertaking on stamp paper of Rs.300/- stating that in case of difference / increase in price of Government Land, allottee is liable to pay as per decision / approval from Government / Competent Authority.

All other terms and conditions of the offer cum allotment letter, license agreement & corrigendum order above shall remain unchanged.

Regional Manager-II
GIDC Ankleshwar

O/C Savaliya.L 20/05/2021

To,
M/s. Dhanuka Agritech Limited
2nd Floor, Maha Shakti Complex,
Opp. Loha Bhavan,
Old High court lane, Asharm Road,
Ahmedabad – 380 009

Encl: - As above.

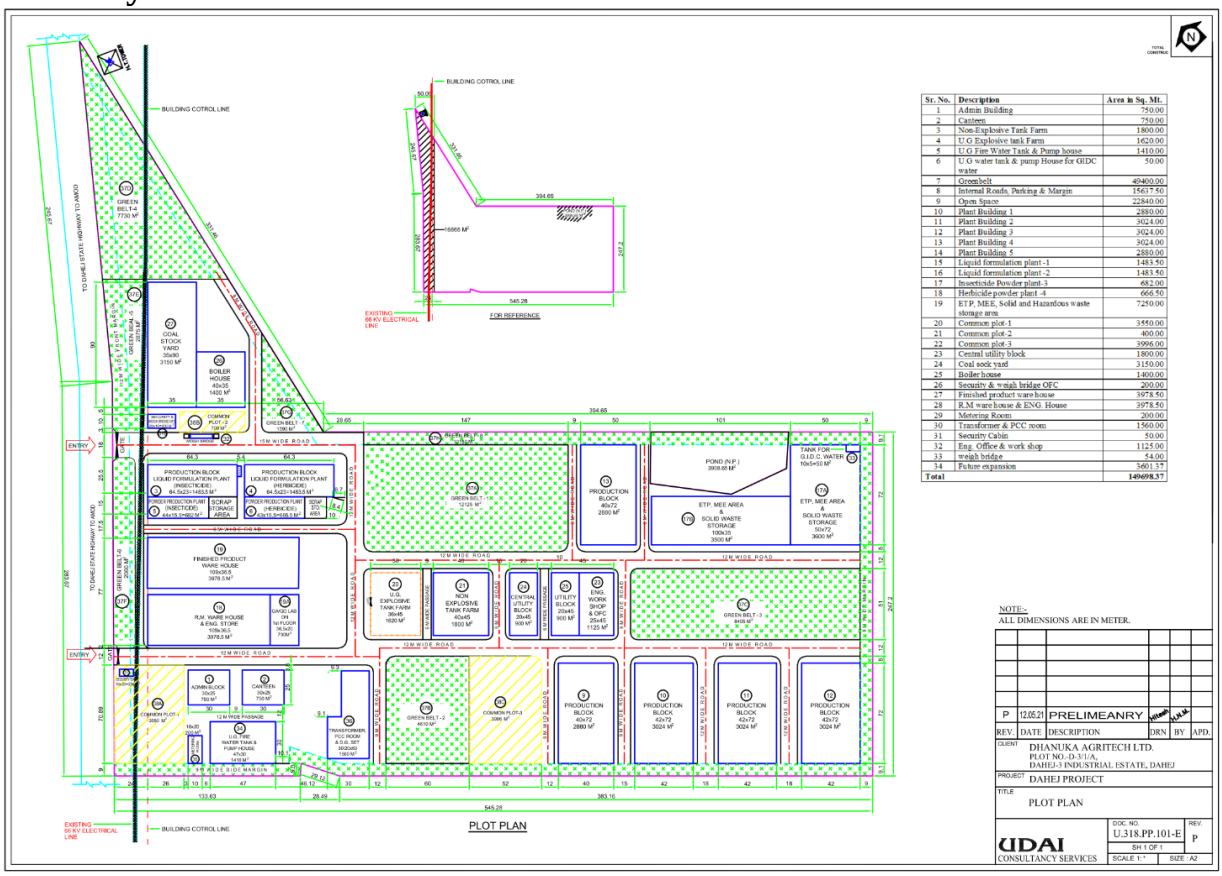
Copy to: -

1) XEN GIDC Bharuch.
2) SAO GIDC Ankleshwar.
3) DEE GIDC Dahej.
4) DEO GIDC Ankleshwar.

For information and further N.A. please.

Annexure-3

Plant layout



Sr. No.	Description	Area in Sq. Mt.
1	Admin Building	750.00
2	Canteen	750.00
3	Non-Explosive Tank Farm	1800.00
4	U.G Explosive tank Farm	1620.00
5	U.G Fire Water Tank & Pump house	1410.00
6	U.G water tank & pump House for GIDC water	50.00
7	Greenbelt	49400.00
8	Internal Roads, Parking & Margin	15637.50
9	Open Space	22840.00
10	Plant Building 1	2880.00
11	Plant Building 2	3024.00
12	Plant Building 3	3024.00
13	Plant Building 4	3024.00
14	Plant Building 5	2880.00
15	Liquid formulation plant -1	1483.50
16	Liquid formulation plant -2	1483.50
17	Insecticide Powder plant-3	682.00
18	Herbicide powder plant -4	666.50
19	ETP, MEE, Solid and Hazardous waste storage area	7250.00
20	Common plot-1	3450.00
21	Common plot-2	400.00
22	Common plot-3	3996.00
23	Central utility block	1800.00
24	Coal sock yard	3150.00
25	Boiler house	1400.00
26	Security & weigh bridge OFC	200.00
27	Finished product ware house	3978.50
28	R.M ware house & ENG. House	3978.50
29	Metering Room	200.00
30	Transformer & PCC room	1560.00
31	Security Cabin	50.00
32	Eng. Office & work shop	1125.00
33	weigh bridge	54.00
34	Future expansion	3401.37
Total		149698.37

Land Break up

Sr. No.	Description	Area in Sq. Mt.
1	Admin Building	750.00
2	Canteen	750.00
3	Non Explosive Tank Farm	1800.00
4	U.G Explosive tank Farm	1620.00
5	U.G Fire Water Tank & Pump house	1410.00
6	U.G water tank & pump House for GIDC water	50.00
7	Greenbelt	49400.00
8	Internal Roads, Parking & Margin	15637.50
9	Open Space	22840.00
10	Plant Building 1	2880.00
11	Plant Building 2	3024.00
12	Plant Building 3	3024.00
13	Plant Building 4	3024.00
14	Plant Building 5	2880.00
15	Liquid formulation plant -1	1483.50
16	Liquid formulation plant -2	1483.50
17	Insecticide Powder plant-3	682.00
18	Herbicide powder plant -4	666.50
19	Hazardous waste storage area	7250.00
20	Common plot-1	3550.00
21	Common plot-2	400.00
22	Common plot-3	3996.00
23	Central utility block	1800.00
24	Coal sock yard	3150.00
25	Boiler house	1400.00
26	Security & weigh bridge OFC	200.00
27	Finished product ware house	3978.50
28	R.M ware house & ENG. House	3978.50
29	Metering Room	200.00
30	Transformer & PCC room	1560.00
31	Security	50.00
32	Eng. Office & work shop	1125.00
33	weigh bridge	54.00
34	Future expansion	3601.37
Total		**149698.37**

Annexure-4

Raw material Details

Sr. No.	Product Name	Raw Material	Quantity (TPM)
1	Fenvalarate	Parachloro toluene	116.4
		Chlorine	43.4
		Catalyst	1.2
		NaCN	72.4
		IPBr	105.2
		Caustic lye 48%	237.8
		Hexane	1649
		H2O2 solution	8
		Sulfuric acid 98%	191
		Thionyl Chloride	23.8
		Catalyst 1	3.4
		PTC	6.4
		MPBAD	106
2	Fenpyroximate	Methyl Hydrazine	7.36
		methyl aceto acetate	19.52
		POCl3	8
		DMF	12.28
		Toluene	153.08
		Phenol	15.04
		KOH	9.4
		Hydroxyl Amine	58.08
		HCl 30%	29.2
		Sulfuric acid	35.28
		p-toluic acid	21.8
		SOCl2	20.96
		Cat-1	1.08
		Cat-2	0.24
		t-Butyl Alcohol	14.72
		TEA	11.32
		Chlorine	23.28
		Caustic flakes	11.84
		Acetone	103.52
		Methanol	77.64
		Caustic lye	33.11264
3	Bifenthrin	Bifenthrin alcohol	54
		Lambda Cyhalothric acid	65
		30% HCl	209
		Potassium Carbonate	62.7
		Catalyst	5.2
		Sodium Bicarbonate	5.7
		n-Hexane	413.8
		Methanol	313.5
4	Cypermethrin	DVACl(CMAC)	177
		MPBAD	151.2
		NaCN	42
		PTC	1.8
		Hexane	531
		H2O2 50%	12.6
		Sodium Bicarbonate	6
5	Permethrin	DVACl(CMAC)	60
		MPBAL	53.5
		Hexane	200

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		Sodium Bicarbonate	5
6	Alpha Cypermethrin	high cis-Cypermethrin	87.5
		TEA	7.5
		IPA	87.5
		Sulfuric acid	1
		n-Hexane	70
		Sodium bicarbonate	0.5
7	Lambda-Cyhalothrin	LC Acid	32.05
		SOCl2	17.35
		Cat	0.5
		MPBAD	25.4
		NaCN	7.15
		Caustic Lye	26.1
		n-Hexane	128.2
		Na3CO3	9.65
		IPA	64.1
8	Flucythrinate	PCCN	32
		IPBr	26
		Caustic lye 48%	88.8
		Conc Sulfuric acid	53.4
		Hexane	312
		Methanol	80
		Acetone	100
		Catalyst (Cu)	0.4
		Freon gas	11.6
		KOH	6.5
		Alpha PEAHCl	10
		Thionyl Chloride	13.8
		Cat -1	0.7
		30% HCl	8.3
		MPBAD	9.6
		H2O2 50%	0.6
		Sodium Cyanide	2.66
		PTC	0.64
9	Tefluthrin (Technical):	Lambda cyhalothric acid	48.15
		SOCl2	24.75
		Cat	0.75
		Caustic lye	36.45
		TFBA	36.75
		Toluene	187.5
		Isopropyl aclcohol	150
		Sodium bicarbonate	11.85
10	Pyriproxyfen	4-Phenoxy phenol	48.9
		KOH	18.75
		Propylene oxide	15.6
		Toluene	375
		2-Chloro pyridine	29.775
		Methanol	187.5
11	Cyfluthrin (Technical):	CMAC	44.25
		CPFBA	46.875
		Hexane	187.5
		Sodium bicarbonate	17.25
12	Isoprothiolane –Technical	CS2	21.25
		DIPM	39.5
		EDC	32

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		Caustic Lye	28.75
		catalyst	4.5
		n-Hexane	100
13	Allyl Isothiocyanate	Allyl Chloride (L)	132
		Sodium Thio cyanate (S)	139.5
		Catalyst (S)	13.5
		Caustic Lye (L)	7.5
		Acetone (L)	375
14	Valiphenalate	Methanol	462
		Malonic acid	12.15
		Ammonium Acetate	30
		Para chloro benzaldehyde	15.3
		98% H2SO4 kg	28.74
		MDC	324
		Soda Ash	27
		L-Valine	4.5
		C.lye 48%	41.25
		IPCF	15.75
		TEA	21
		Methyl sulfonyl chloride	12.75
		Intermediate 1	28.38
		Intermediate 2	63
		HCl 30%	10.5
15	BENALAXYL	2,6 Xylidine	50
		2 CP	32.5
		Cat-1	7.5
		Cat-2	1.5
		Cat-3	1.25
		Cat-4	0.5
		Sod bicarbonate	39.55
		Hexane	300
		sulfuric acid 98%	12.5
		Caustic lye	66.25
		Phenyl acetic acid	35
		Thionyl Chloride	32.5
16	BENALAXYL-M	2 Methyl-S- Lactate	22.5
		Methan Sulfonyl Chloride	24.7
		TEA	27.5
		Toluene	75
		HCl 30%	6.5
		Caustic Lye	79.85
		2,6-Xylidine	36.5
		Sulfuric acid 98%	9.5
		Hexane	160
		Phenyl Acetic Acid	28.9
		Thionyl Chloride	26.8
		Sodium Bicarbonate	2.5
17	METALAXYL	2,6 Xylidine	50
		2 BP	33.5
		Cat-1	5
		Sod bicarbonate	20
		Toluene	100
		Hexane	150
		sulfuric acid 98%	21.25
		Caustic lye	19.5

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		MAC	20.5
18	Acetamiprid	2-chloro-5-chloromethyl pyridine (CCMP).	80
		Methyl amine 40%	191.4
		toluene	200
		Caustic lye	49
		Ethyl N-cyano-acetimidate	52.6
19	Imidacloprid	2-chloro-5-chloromethyl pyridine (CCMP).	70.4
		2-(Nitroimino) imidazolidine	56.5
		DMF	200
		Soda Ash	25.3
		Methanol	200
20	Thiamethoxam (Technical)	N-Methyl -Nitro Guanidine	53.9
		Para formaldehyde	37.5
		Formic Acid	150
		Caustic Lye	10
		Methane Sulfonic Acid	2.6
		2-Chloro-5-Chloro Methyl Thiazole	71
		DMF	175
		Potassium Iodide	1
		Potassium Carbonate	31
		Methanol	200
21	Tebuconazole	1-(4-Chlorophenyl)-4,4-Dimethyl-3-Pentenone	48.6
		Sodium methoxide	12
		DMS	10.2
		Toluene	108
		1,2,4- Triazole	14.4
		KOH	8.4
		Heptane	150
		DMF	120
22	Propiconazole	1,3-Dichloro benzene	31.8
		Acetyl Chloride	16.98
		EDC	120
		AlCl3	31.5
		Bromine	32.7
		Catalyst	0.48
		1,2-Pentanediol	20.4
		Toluene	120
		DMF	120
		1,2,4- Triazole	12.6
		Potassium Hydroxide	7.44
		Caustic lye	3
23	Hexaconazole	1,3-Dichloro benzene	35.04
		Pentanoyl Chloride	28.74
		EDC	240
		AlCl3	31.5
		DMS	120
		Dimethyl sulfate	33.12
		Catalyst	0.48
		Potassium Hydroxide	36
		DMF	120
		1,2,4- Triazole	14.52
		Potassium Carbonate	8.4

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		Heptane	150
24	Tetraconazole and intermediates	Ethyl chloro acetate (ECA)	55.125
		Methanol	16.875
		2,4-Di Chloro Benzyldehyde	79.875
		Sodium Methoxide 30%	76.875
		Cuastic lye	94.5
		Toluene	553.125
		Phosphric acid	365.625
		N-Methyl Pyrrolidone (NMP)	25.5
		1,2,4-Triazole(TRE)	25.5
		para formaldehyde	11.25
		Acetic Acid	25.125
		Sodium borohydrite	3.45
		NaOH flakes	0.75
		HCl 30%	9
		Sodium Bicarbonate	28.125
		Tetra fluoro Ethane	21.75
25	Azoxystrobin	2,6 Diachloro Pyrimidine	8.22
		DMF	108.1
		MHPMP	11.46
		Potassium Carbonate	18.38
		Cyno phenol	6.56
		Cuprus Chloride	0.22
		Caustic soda	0.44
		Hexane	86.48
		Dichloro Methane	43.24
26	Glyphosate And It's Ammonium And Ipa Salts	DEA	249
		Catalyst -Cu	13.5
		Caustic Lye	484.5
		PCl3	291
		HCHO 40%	90
		Cat-01	1.5
		H2O2 50%	147
		Vanadyl Sulphite	1.5
27	Bispyribac Sodium	2,6-Hydroxy Benzoic Acid	38
		4,6 Di methoxy 2 Methoxy Sulfonyl Pyrimidine	96
		Toluene	200
		NaOH	27
		TBAB	4
		n-Butyl alcohol	450
		Ethyl Acetate	150
28	Clodinafop Propargyl	Hydroquinone	60
		2-CPA	45
		DMF	300
		Potassium Carbonate	48.8
		2,3-Difluro-5-chloro pyridine	50.2
		Propargyl chloride	22.5
		Ethyl Alcohol	200
		Caustic lye	34
		30% HCl solution	55
		MEK	50
29	Chlorimuron	Sec ethyl ester	23.4
		PCF	16.77
		TEA	20.28

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		Acetonitril	58.5
		Methan Sulfonic Aciid	9.57
		ACMP	12.87
		Methanol	39
		Caustic lye	7.5
30	Sulfosulfuron	Sulfon (ESPS)	19.95
		PCF	12.3
		TEA	14.4
		Acetonitril	51
		Methan Sulfonic Acid	6.9
		ADMP	10.95
		Caustic lye	10.5
		High flow(inerts)	5.4
		Methanol	30
31	NICO SULFURON	ADMP	18.75
		PCF	18
		Acetonitrilr	120
		Cat -1	1.5
		DMA	2.25
		30%HCl	4.5
		SNA	18.75
		DBU	12
32	Clomazone	NH2OH.HCl	93
		Caustic lye	337.8
		3-CPC	166
		Cat-01	2
		OCBC	146.6
		Dry HCl	36.6
		EDC	400
33	Pendimethalin	DEK	108
		3,4-Xylidine	151.8
		C/Pd cat	1.5
		Hydrogen	4.2
		EDC	1500
		Sulfuric Acid	276
		Nitric acid 70%	132
		sodium bi carbonate	30
		Heptane	600
34	(2,4-D ACID)	Phenol	825
		chlorine	1272
		MCA	876
		Caustic Lye	1104
		HCl30% solution	1440
35	SODIUM SALT OF 2,4-DI CHLORO PHENOXY ACETIC ACID (2,4-D SODIUM) :	Phenol	94
		chlorine	144.8
		MCA	91.6
		Caustic Lye	109.6
36	2,4-D AMINE	2,4-D Acid	775
		DMA 40% Solution	393.75
37	2,4-D ETHYL ESTER	2,4-D Acid	171
		Ethyl alcohol	60.6
		Benzene	400
		Sodium bi-carbonate	3
		PTSA	8.4
38	2,4-D Butyl Ester	2,4-D Acid	168

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		Butyl alcohol	59
		Toluene	400
		Sodium bi-carbonate	3
		PTSA	10
39	2,4-D Ethyl Hexyl Ester	2,4-D Acid	137
		Ethyl hexanol	82
		Toluene	400
		Sodium bi-carbonate	3
		PTSA	8
40	Metribuzin (Stream-1)	Triazinone	206
		Water	1200
		Caustic Lye	99
		Methanol	99
		Bromine	82.2
		Cat-1	2
		Cat-2	2.8
	Metribuzin (Stream-2)	Triazinone	206
		Caustic Lye	20
		Di methyl sulfate	146
		Soda bicarbonate	400
		Sulfuric Acid	250
		Cat-1	2
		Cat-2	2
41	DHANSAFE	Glycolic Acid 70%	20
		Sulfuric acid	1
		methanol	80
		sodium bicarbonate	2
		EDC	150
		Benzahydrol	30.5
		ZnCl2	2
		Soda Ash	1.25
		O-Xylene	12
42	DVACL (INTERMEDIATE)	Acrylonitril	120
		Carbon tetrachloride	366.25
		Acetonitrile	7.5
		Sulfuric Acid	422.5
		Thionyl Chloride	393.75
		Iso Butylene	195
		n-Hexane	1750
		TEA	177.5
		Caustic lye	1368.75
		Soda Ash	18.75
		Cat-1	2.5
		Cat-2	1.25
		Cat-3	2.5
		Cat-4	2.5
		Cat-5	3
		HCl 30%	200
43	Meta Phenoxy Benzaldehyde (MPBAD)	Benzaldehyd	170
		Bromine	130.5
		EDC	750
		AlCl3	287.5
		Chlorine	58.5
		HCl 30%	125
		Sodium Thio sulfate	25

Sr. No.	Product Name	Raw Material	Quantity (TPM)
		MEG	236.25
		Phenol	142.5
		KOH	87.5
		Toluene	750
		Formic Acid	5
		Cat	2.5
		Sulfuric Acid	15
44	Meta Phenoxy Benzyl Alcohol (MPBA):	MPBAD	75.75
		Hydrogen	1.125
		Catalyst Raney Ni	3.75
		IPA	75
45	Phenyl Acetyl Chloride	Phenyl Acetic Acid	90.5
		Thionyl Chloride	81
		Caustic Lye	57
46	Lambda Cyhalothric Acid	R-113a gas	75.75
		Methyl 3, 3-dimethylpent-4-enoate	53.7
		t-Butanol	450
		Dimethyl formamide	90
		Sodium t-butaxide	33
		KOH	42.75
		HCl 30%	75

Annexure-5

Water requirement and Waste Water generation

Water

Total water requirement for the proposed project would be around 4294 KLD. Total water will be sourced from Dahej GIDC.

Water requirement

Sr. No.	Particulars	Water consumption Quantity (KLD)	Remark
1	**Domestic**	30	
2	**Gardening**	190	(FW 165 +TW 25)
3	**Industrial**		
	(a) Process	2214	(1487.00 FW + 727.00 TW)
	b) Washing	123	(123 TW)
	c) Cooling (Make-up)	613	(613 TW)
	d) Boiler	1324	(947 FW + 377 TW)
	e) scrubber	50	(23 FW + 27 TW)
	Sub Total (a + b + c + d)	**4324**	**(2457 FW + 1867 TW)**
	Total (1 +2+3)	**4544**	**(2652 FW + 1892 TW)**

Note: * One time requirement.

Waste Water Generation

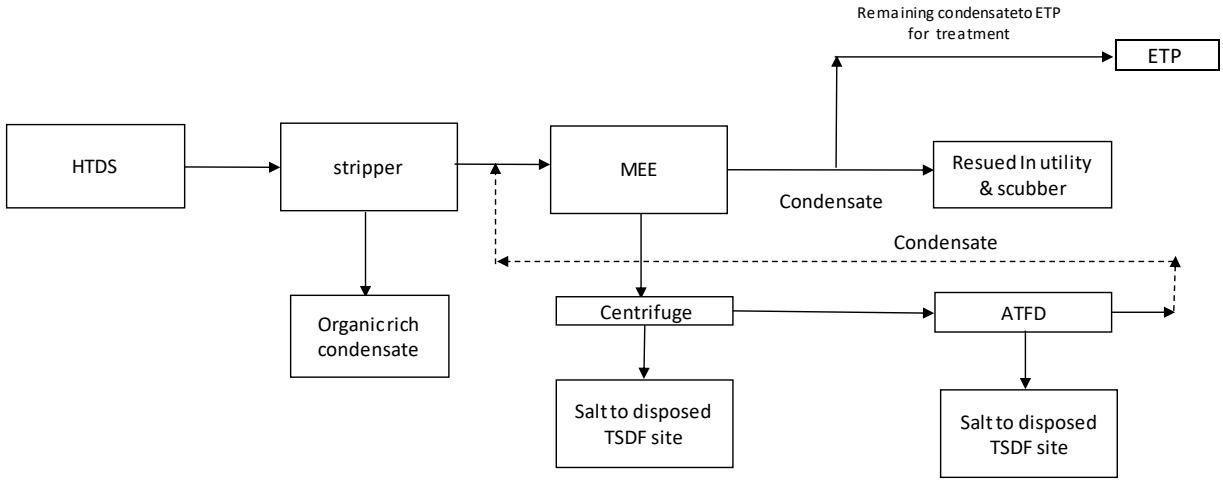
Sr. No.	Particulars	Waste Water Generation KLD)
1	**Domestic**	25.00
2	**Industrial**	
	a) Process	2341.00
	b) Washing	123.00
	c) Cooling	264.00
	d) Boiler	503.14
	e) Scrubber	50.00
	Sub Total (a + b + c + d +e)	**3281.14**
	Total (1 +2)	**3306.14**

Industrial effluent:

A. High TDS effluent:

1761 KLD HTDS process waste water shall be sent to Stripper followed by MEE for further treatment. Condensate collected from stripper shall be sold to actual users. MEE condensate shall be recycled in utility, process & scrubber. Remaining MEE condensate will be sent to ETP for treatment. ATFD condensate will be sent to first stage of MEE. Solid collected from MEE plant shall be disposed to TSDF site. The proposed MEE will have 4 Stage evaporation system along with ATFD. The entire treatment scheme will be implemented in Phase wise manner.

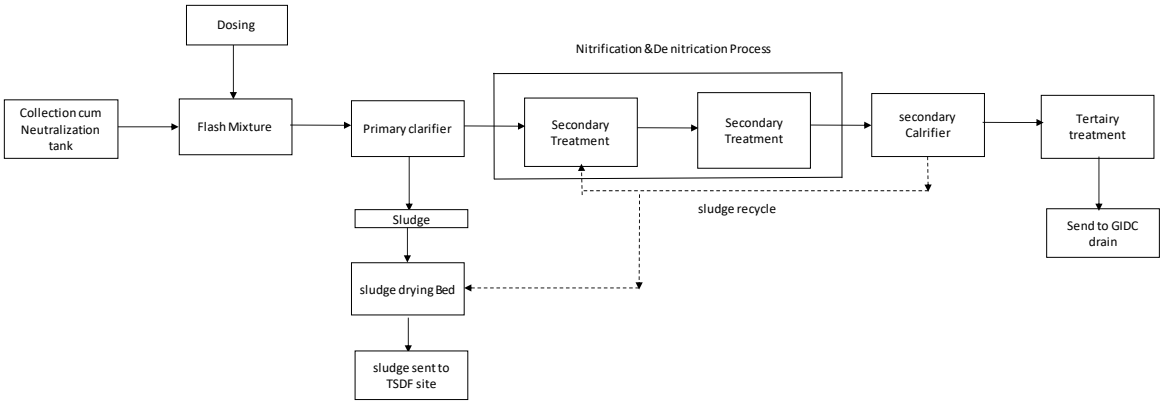
Effluent scheme for HTDS:



B. Low TDS effluent:

2023.14 KLD Low TDS effluent (Process 580 KLD + Boiler 503.14 KLD +Washing 123 KLD +Cooling 264 KLD+ Scrubber 50 KLD) will be treated in in house ETP along with MEE Condensate 503 KLD. Treated waste water from ETP, meeting the norms as per GIDC drain shall be sent for final disposal into GIDC underground drainage-Dahej vilayet pipeline/common disposal system up to the sea.

Effluent Scheme for LTDS:



Domestic effluent:

Domestic effluent shall be treated in STP and treated waste water will be reused for gardening purpose.

Annexure-6

Details of Solid/Hazardous waste details

Sr. No.	Type of Waste	Source	Category No.	Quantity MT/M	Mode of Disposal
1	ETP sludge	ETP Plant	I -35.3	2500	Collection, Storage, Transportation and final disposal at common TSDF site
2.	MEE Salt	MEE	I -35.3	5500	Collection, Storage, Transportation and final disposal at common TSDF site
3.	Discarded containers / drums / Barrels/ Bags	Storage Facility	I 33.1	120	Collection, Storage, Decontamination, Transportation, by sent to authorized vendor.
4	Spent Oil/Used Oil	Process Unit	I 5.1	0.4	Collection, Storage, Transportation, disposal by selling to GPCB authorized & registered recyclers or reuse as lubricants in Plant machinery within unit.
5	Process residue	Chemical Plant	I-29.1	550	Collection, Storage, Transportation and final disposal at common TSDF site or incineration at common incineration facility.
6	Date-expired and off-specification pesticides/ Products / RMs	Process Unit	I -29.3	10	Collection, Storage, Transportation, Disposal by incineration at common incineration facility or Co-Processing for cement industries
8	Bromate, (Hypo-Bromates)	Manufacturing process	II-B6	196	Aq. & solid Sodium Bromide sol./ Aq. HBr Sol. Recovery: Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
9	Bromate, (Hypo-Bromates)	Manufacturing process	II-B6	1171.8	Aq. KBr Solution: Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
10	Di Sodium sulphite (Aq. Solution)	Manufacturing process	I-29.1	3153.20	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
11	Inorganic Salts (Spent Acids)	Manufacturing process	B-15	1425.7	Spent Sulphuric Acid (inorganic acid): Collection, Disposal, Reuse, Storage, Transportation, Disposal by reused within plant.
12	Spent HCl	Manufacturing process	I-29.6	3945	Collection, Disposal, Recovery, Storage, Transportation, Disposal by

Sr. No.	Type of Waste	Source	Category No.	Quantity MT/M	Mode of Disposal
					sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
13	Spent Solvent	Manufacturing process	I 29.4	184.34	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
14	Aq. $AlCl_3$ Solution	Manufacturing process	I-29.1	2455	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
15	Process Solid waste	Manufacturing process	I-29.1	100	Collection, Storage, Transportation and final disposal at common TSDF site
16	Sodium acetate (Solid & Liquid Solution)	Manufacturing process	I-29.1	192	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
17	Sodium sulphate	Manufacturing process	I-29.1	300.4	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
18	Crude $POCl_3$	Manufacturing process	I-29.1	1.35	Collection, Disposal, Recovery, Storage, Transportation, Disposal by sell out to authorized users who is having authorization with valid CCA and rule 9 permission to receive this waste.
19	Fly ash	From Boiler	--	2555	Collection, storage, transportation & disposal by send to Brick manufacturing /cement industry.
20	Clinker	From moving bed Boiler	-	1095	Collection, storage, transportation & disposal by send to TSDF site

Details of Air Emission Details

Flue Gas Emission

Sr. No.	Particulars	Fuel	Stack height (m)	Emission Norms	APCM
1	Steam Boiler- 1 (5 TPH)	Coal 26 Ton/day	35 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
2	Steam Boiler- 2 (15 TPH)	Coal 77 Ton/day	50 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
3	Steam Boiler- 3 (20 TPH)	Coal 103 Ton/day	55 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
4	Steam Boiler- 4 (30 TPH)	Coal 155 Ton/day	60 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
5	Thermic Fluid Heater-1 (2 Lac Kcal/hr)	Coal 1.6 Ton/day	30 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
6	Thermic Fluid Heater-2 (4 Lac Kcal/hr)	Coal 3.2 Ton/day	30 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	ESP & water scrubber
7.	D. G. Set (1250 kVA)	Diesel 100 lit/hr	11 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	Adequate Stack Height
8.	D. G. Set (1250 kVA)	Diesel 100 lit/hr	11 m	PM <150 mg/Nm³ SO_2 < 100 ppm NO_x < 50 ppm	Adequate Stack Height

Note: DG set only for emergency purpose.

Process Gas Emission

Sr. No.	Plant	Stack Height in meter	APCM	Parameters	Permissible limit
1.	MPP 1 (2 Nos.)	15	Two stage Alkali scrubber	HCl SO_2	20 mg/Nm^3 100 ppm
2.	MPP 1 A	15	Two stage Alkali scrubber	HCl SO_2	20 mg/Nm^3 100 ppm
3.	MPP 2 (2 Nos.)	15	Two stage Alkali scrubber	HCl SO_2	20 mg/Nm^3 100 ppm
4.	MPP 4	20	Two stage Alkali scrubber	Br_2	16 mg/Nm^3
5.	MPP 5	20	Two stage	HCl	20 mg/Nm^3

			Alkali scrubber		
6.	MPP 6	20	Two stage Alkali scrubber	HCl	20 mg/Nm^3
7.	MPP 8	15	Two stage Alkali scrubber	HCl	20 mg/Nm^3
8.	MPP 10	21	NO_X scrubber	NOx	50ppm
9.	MPP-11 A	25	Two stage Alkali scrubber	HCl Cl_2	20 mg/Nm^3 09 mg/Nm^3
10.	MPP-11 B	25	Two stage Alkali scrubber	HCl	20 mg/Nm^3
11.	MPP- 12	25	Two stage Alkali scrubber	Br_2 CO_2	16 mg/Nm^3 -
12.	MPP-13 (2 Nos.)	15	Two stage Alkali scrubber	HCl SO_2	20 mg/Nm^3 100 ppm
13.	MPP-14	15	Two stage Alkali scrubber	HCl Cl_2	20 mg/Nm^3 09 mg/Nm^3
14.	Amine formulation	15	Water scrubber	NH_3	175 mg/Nm^3

Annexure-8

Details of Manufacturing Process, Chemical Reaction and Flow Diagram

A. INSECTICIDES

1. Fenvalarate Technical

Process description

Step-1

Para chloro Toluene is reacted with Chlorine in the presence of a catalyst in MSGL reactors to form para chloro benzyl chloride. It is further reacted with sodium cyanide (dissolved in water) and Hexane as solvent. Solvent is distilled and used in the next batch. Intermediate Para Chloro Benzyl Cyanide is collected for the next step. The aqueous solution is discarded after de-toxification with Hydrogen Paraoxide or Sodium hypo chlorite.

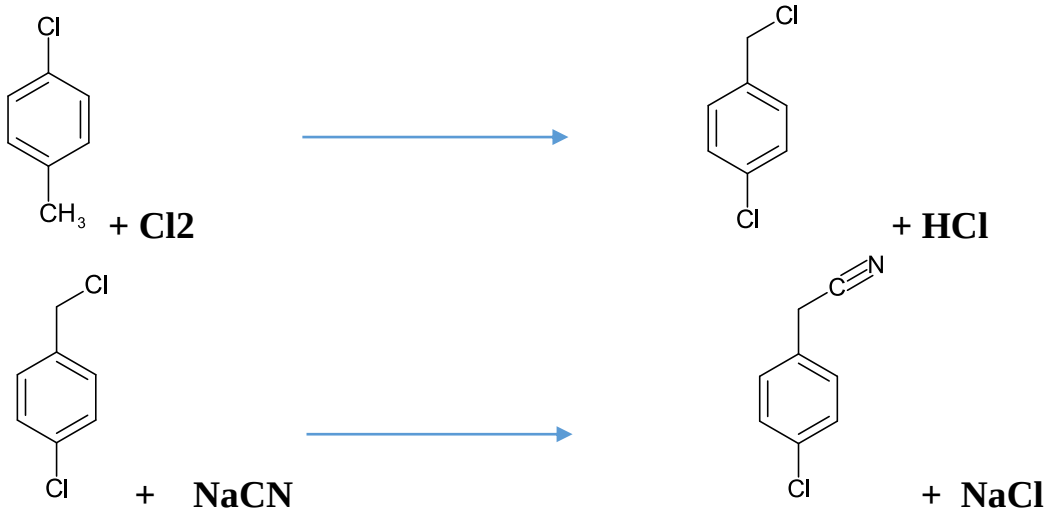
Step-2

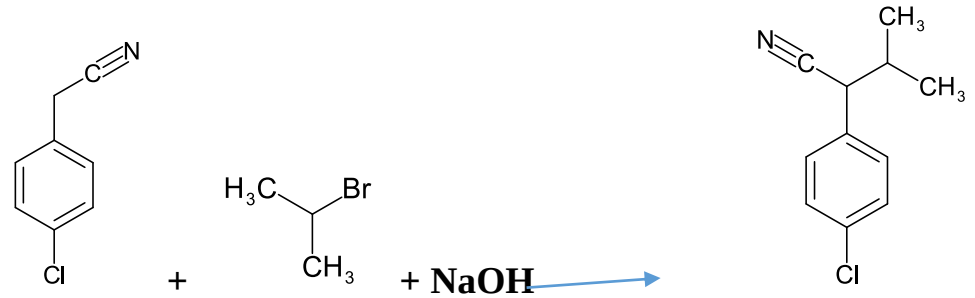
Para chloro benzyl cyanide is reacted with Isopropyl bromide (IPBr), caustic soda and a phase transfer catalyst and produced 2-(4-Chlorophenyl)-3-methylbutanenitrile (CMBN).Aqueous layer contains Sodium Bromide. It is disposed to authorized vendors.

Step – 3

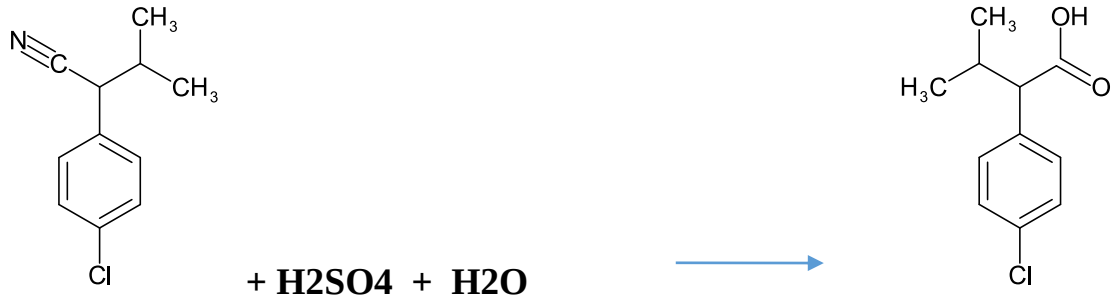
CMBN is hydrolysed in dilute sulphuric acid to get CMB Acid. It is reacted with Thionyl chloride in presence of a catalyst and n-Hexane as solvent. The intermediate, thus formed is CMB Chloride . It is reacted with meta phenoxy Benzaldehyde (MPBAD) and sodium cyanide (dissolved in water) in hexane Aqueous layer is discarded after de-toxification with Hydrogen paraoxide/ Sodium Hypo chlorite. Organic layer is washed with water and soda bicarb solution. The solvent is recovered and recycled. The product is filled in drums as FG.

Chemical reaction

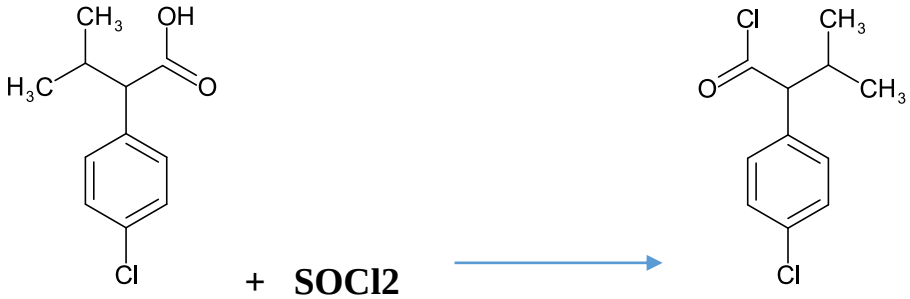


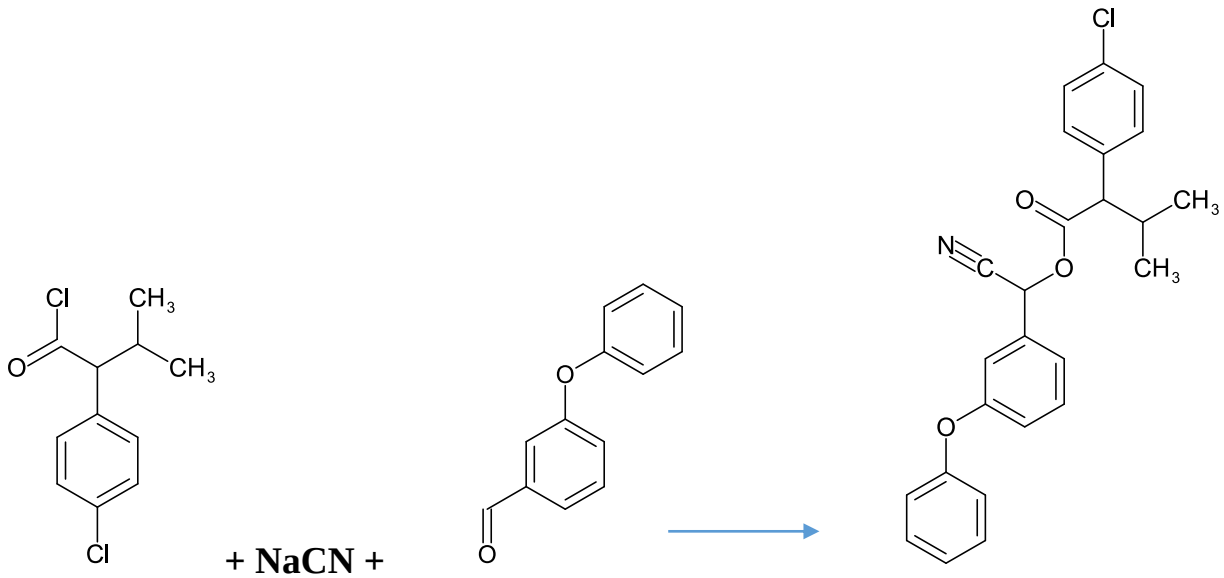


PCBN **IPBr** **CMBN**

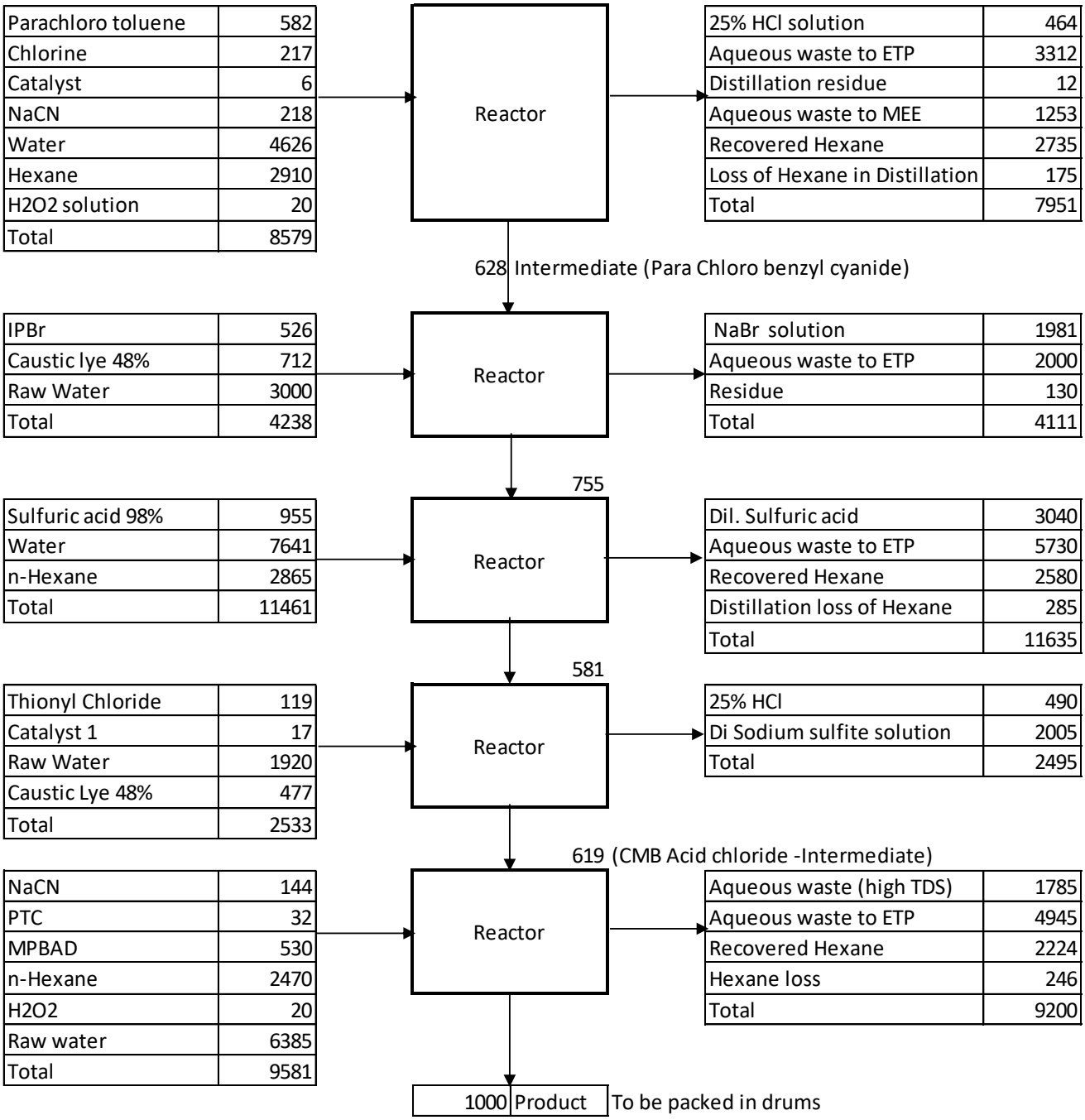


CMBN **CMB Acid**





Process flow diagram



Material balance

Input kg		Output kg	
Parachloro toluene	582	Product	1000
Chlorine	217	25% Spent HCl	954
Catalyst	6	Disodium sulfide solution	2005
NaCN	362	Aq layer to CN detoxification	3038
IPBr	526	Dil. Sulfuric acid	3040
Caustic lye 48%	1189	Aqueous layer to ETP	15987
Hexane	8245	NaBr Solution(waste)	1981
H2O2 solution	40	Recovered Hexane	7539
Raw Water	23572	Distillation loss Hexane	706
Sulfuric acid 98%	955		
Thionyl Chloride	119		
Catalyst 1	17	Residue (incineration)	142
PTC	32		
MPBAD	530		
Total	**36392**	**Total**	**36392**

2. Fenpyroximate (Technical) And Intermediates:

Process Description

Step 01 -Intermediate 1: Oxime

Methyl hydrazine and methyl aceto acetate are reacted and chlorinated further with POCl3 . It is further reacted with di methyl formamide. The product from this step is reacted with potassium salt of phenol in solvent (toluene) . The oxime is formed by reacting it with hydroxyl amine HCl. The intermediate is crystallized, filtered and dried. It is Intermediate-1,Pyrazole-1,3-dimethyl-5-phenoxy-4-carboxaldehyde oxime (PDPC-Oxime)

Step 02 -Intermediate 2 : (Chloro Ester)

p-Toluic acid is converted in p-Toluic chloride with SOCl2. The gases evolved are scrubbed with water and caustic solution. P-Toluic acid chloride is reacted with t-butyl alcohol to form ester. The ester is further chlorinated with chlorine to get chloro ester. It is intermediate-2, tert-Butyl 4-(chloromethyl)benzoate (t-BCMB).

Step 03.

Intermediate-1 and Intermediate-2 are condensed in solvent acetone. Mass is continuously neutralized with sodium hydroxide. The salt are removed. The product is crystallized in methanol. Product is filter and dried. Solvents are recovered from the mother liquor which are recycled after purification process.

Chemical Reactions:

Step-1

$$CH_3NHNH_2 + CH_3COCH_2COOCH_3 + POCl_3 + (CH_3)_2NCHO \rightarrow C_6H_7ClN_2O$$

Methyl Hydrazine | Methyl Aceto Acetate | DMF | DMCF

$$C_6H_7ClN_2O + C_6H_5OH + KOH \rightarrow C_{12}H_{12}O_2N_2$$

DMCF | Phenol | DMPF

$$C_{12}H_{12}O_2N + NH_2OH.HCl \rightarrow C_{12}H_{13}N_3O_2$$

DMPF | Hydroxylamine hydrochloride | PDPC Oxime

Step-2

$$C_8H_8O_2 + SOCl_2 \rightarrow C_8H_7O_2Cl$$

p-toluic acid | Thyonyl chloride | p-Toluic acid chloride

$$C_8H_7O_2Cl + (CH_3)_3OH + (CH_3)_3N \rightarrow C_{10}H_{16}O_2 + TEA.HCl$$

p-Toluic Acid chloride t-Butyl Alcohol TEA

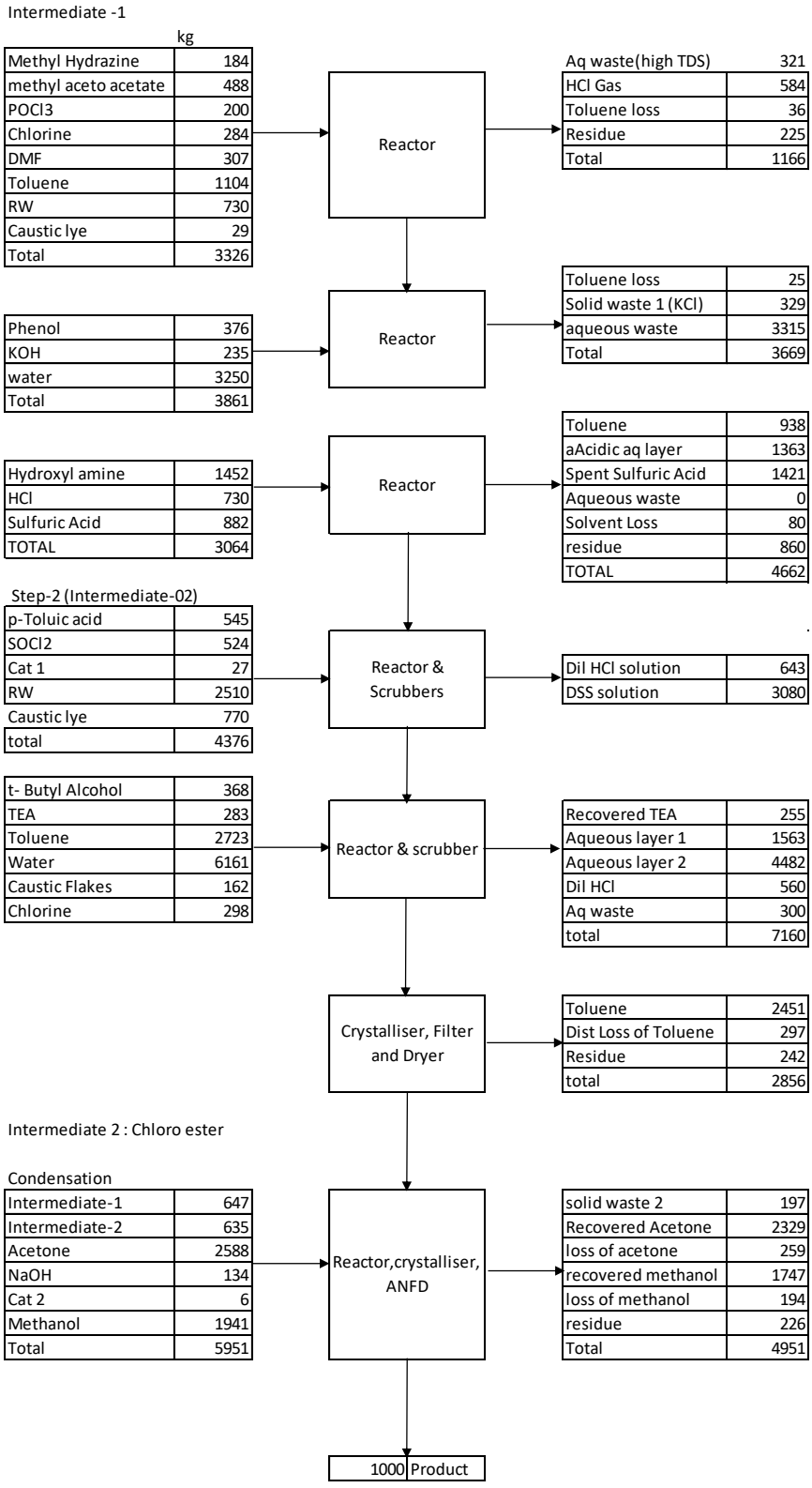
$$C_{10}H_{16}O_2 + Cl_2 \rightarrow C_{10}H_{15}O_2Cl + HCl$$

Step-3

$$C_{12}H_{13}N_3O_2 + C_{10}H_{15}O_2Cl + NaOH \rightarrow C_{22}H_{27}O_4N_3 + NaCl$$

Fenpyroximate

Process Flow diagram:



Material Balance

InputKg/MT		**Output Kg/MT**	
Methyl Hydrazine	184	Solid Waste 1 (KCl)	329
methyl aceto acetate	488	Solid Waste 2 (NaCl)	196.56
POCl3	200	Recovered POCl3	0
DMF	307	Residue-POCl3	225
Toluene	3827	Dil HCl solution	1787
Phenol	376	DSS solution	3080
KOH	235	Aq Waste (High TDS)	3547
Hydroxyl amine	1452	Aq Waste (ETP)	7797
HCl 30%	730	Spent sulfuric acid	1421
Sulfuric Acid	882	Recovered Toluene	3389
p-Toluic acid	545	Loss of Toluene	438
SOCl2	524	Residue	1328
Cat 1	27	Recovered TEA	255
Cat 2	6	Recovered Acetone	2329
t- Butyl Alcohol	368	Recovered Methanol	1747
TEA	283	Loss of Acetone	259
Water	12651	Loss of Methanol	194
Chlorine	582	Product	1000
Caustic flakes	296		
Acetone	2588		
Methanol	1941		
Caustic lye	827.816		
Total	**29321**		**29321**

3. Bifenthrin (Technical)

Process Description

Step 1. Take Bifenthrin alcohol (Powder), n-hexane in a reactor and add 30% HCL in reflux conditions. After completion of reaction, separate layers. Aqueous layer is spent HCl.

Step 2. Add Lambda Cyhalothric acid , Potassium carbonate and catalyst and reflux the mass. Give water and soda ash solution wash after completion of reaction. Remove solvent completely under vacuum. Crystallise the ,mass n methanol and filter and dry. The solvent is recovered from mother liquor and recycled. Residue is disposed by incineration.

Chemical Reaction:

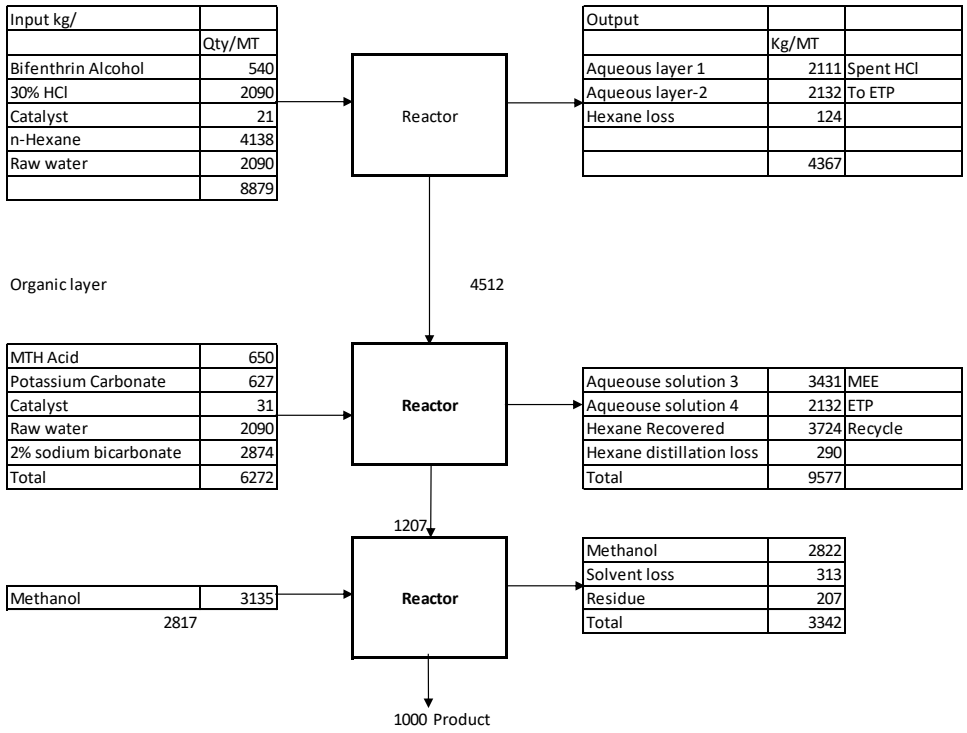
$$C_{14}H_{14}O \quad + \quad HCl \quad \rightarrow \quad C_{14}H_{13}Cl$$

Bifenthrin Alcohol

$$C_{14}H_{13}Cl \quad + \quad C_9H_{10}OClF_3O_2 \quad \rightarrow \quad C_{23}H_{22}ClF_3O_2$$

Lambda Cyhalothric Acid Bifenthrin tech

Process Flow diagram:



Material Balance

Input Kg		Output Kg	
Bifenthrin Alcohol	540	Hexane recovered	3724
Lambda Cyhalothric acid	650	Recovered Methanol	2822
30% HCl	2090	Spent HCl acid	2111
Potassium Carbonate	627	To ETP	4264
Catalyst	52	Hexane loss in Dist	414
Sodium Bi carbonate	57	Methanol loss in Dist	313
Raw Water	6997	Incineration Residue	207
n-Hexane	4138	Aqueous layer 1	3431
Methanol	3135	Solid waste	0
		Product	1000
Total	**18286**	**Total**	**18286**

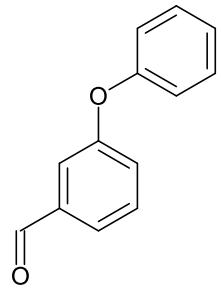
4. Cypermethrin (Technical)

Process Description:

Meta Phenoxy Benzaldehyde (MPBAD) is reacted with Sodium Cyanide to form Meta Phenoxy Benzaldehyde Cyanohydrin as an intermediate. This on reaction with Cypermethric Acid Chloride forms Cypermethrin. n-Hexane is used as solvent along with a phase transfer Catalyst. Layers are separated. Aqueous layer is treated with Hydrogen peroxide to decompose cyanide traces.

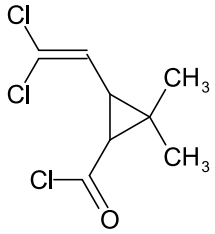
The organic mass of Cypermethrin is washed with Sodium bicarbonate solution & Water to remove acidity. Finally n-Hexane is distilled under vacuum to get Cypermethrin. It is filled in drums as per requirement.

Chemical Reaction :

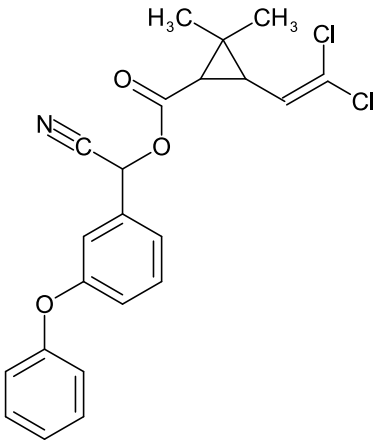


MPBAD

\+ NaCN +

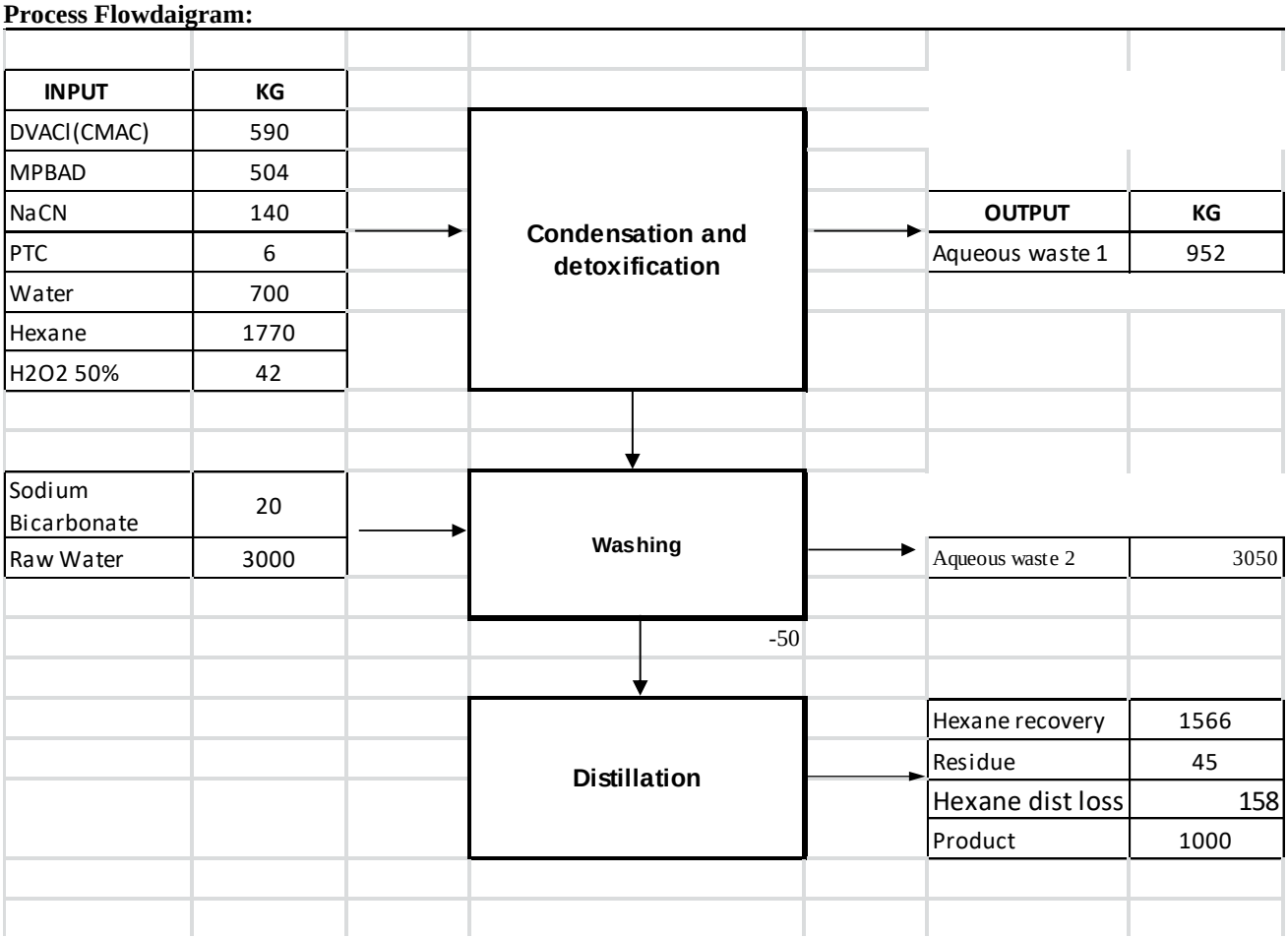


DVACl



Cypermethrin technical

Process Flowdaigram:



Material Balance

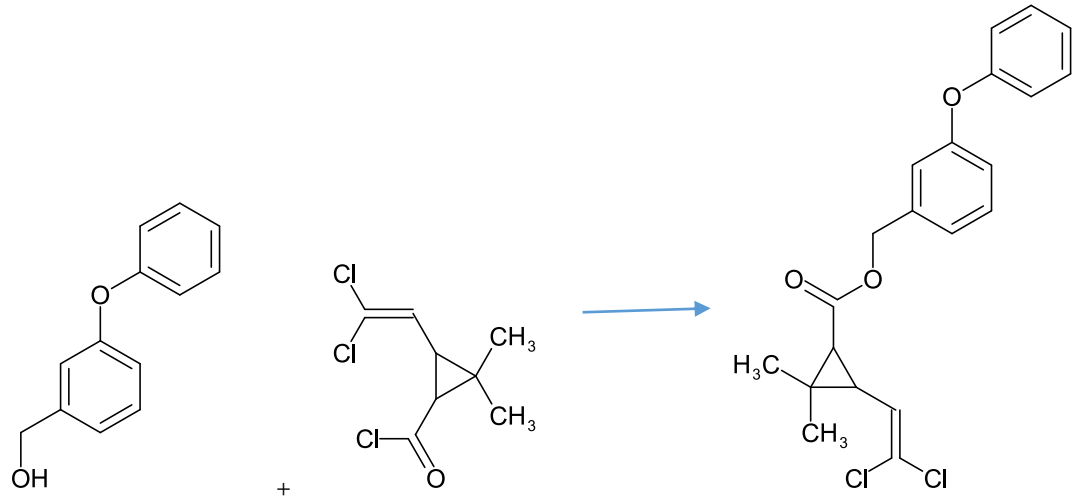
Input Kg/MT		Output kg/MT	
DVACl(CMAC)	590	Aqueous waste (High TDS)	952
MPBAD	504	Aqueous waste (to ETP)	3050
NaCN	140	Recovered hexane	1566
PTC	6	Hexane Distillation loss	158
Water	3700	Residue	46
Hexane	1770	Cypermethrin (tech)	1000
H2O2 50%	42		
Sodium Bicarbonate	20		
Total	**6772**	**Total**	**6772**

5. Permethrin (Technical):

Process Description:

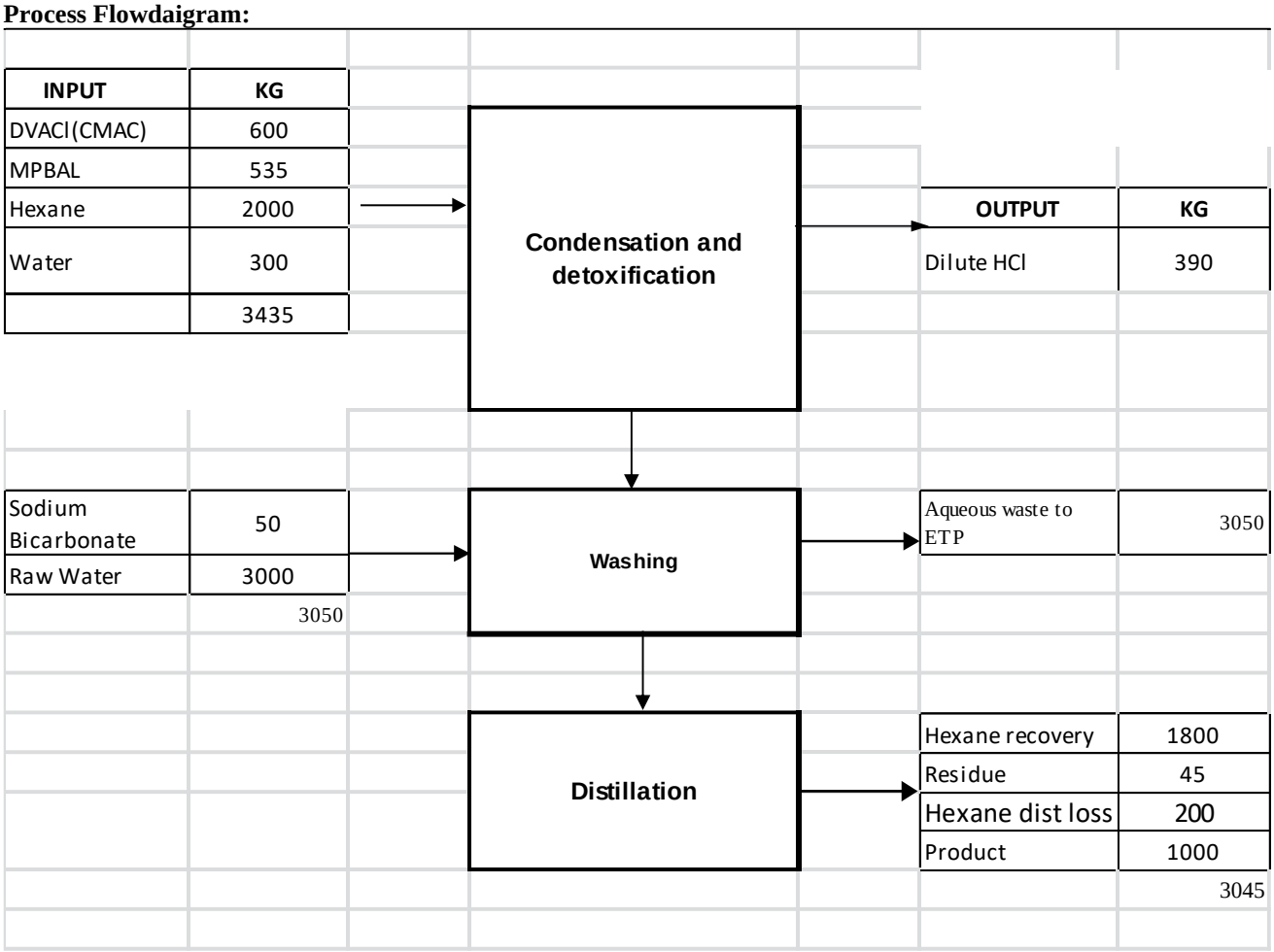
Meta Phenoxy Benzyl Alcohol is reacted with Cypermethric Acid Chloride (CMAC) in presence of solvent n-Hexane to give the Permethrin . Hydrochloric acid gas is generated during the reaction which is scrubbed in water to get dilute hydrochloric acid. The organic mass is then washed with soda ash solutions and water to remove acidity. Hexane is recovered to get Permethrin as a product.

Chemical Reaction



MPBAD DVACl Permethrin

Process Flowdaigram:



Material Balance

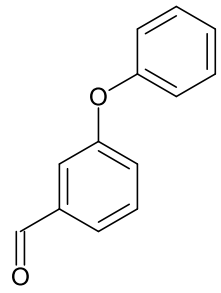
Input kg/MT		Output kg/MT	
DVACl(CMAC)	600	Dil. HCl	390
MPBAL	535	Aq waste to ETP	3050
Hexane	2000	Recovered Hexane	1800
Water	3300	Loss of Hexane	200
Sodium Bicarbonate	50	Residue	45
		Product	1000
Total	**6485**	**Total**	**6485**

6. Alpha Cypermethrin (Technical):

Process Description:

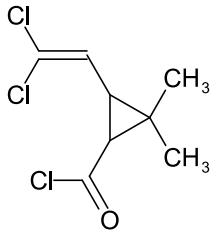
High cis-Cypermethrin technical is obtained by the same process of cypermethrin by using high cis CMAC instead of CMAC. It is epimerized with TEA in IPA. It is chilled to desired temperature very slowly and product is filtered. The cake is dissolved in hexane and washed with dil sulphuric acid and water. Product is crystallised and filtered. Product is dried at very low temperature and high vacuum. Hexane is recovered from mother liquor and residue is sent for incineration.

Chemical Reaction

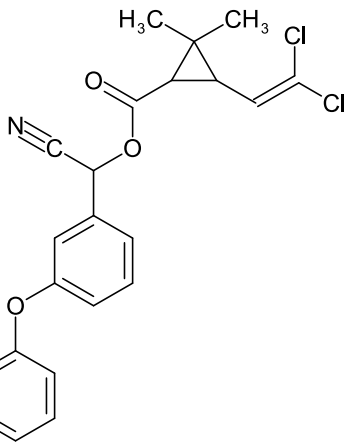


MPBAD

\+ NaCN +

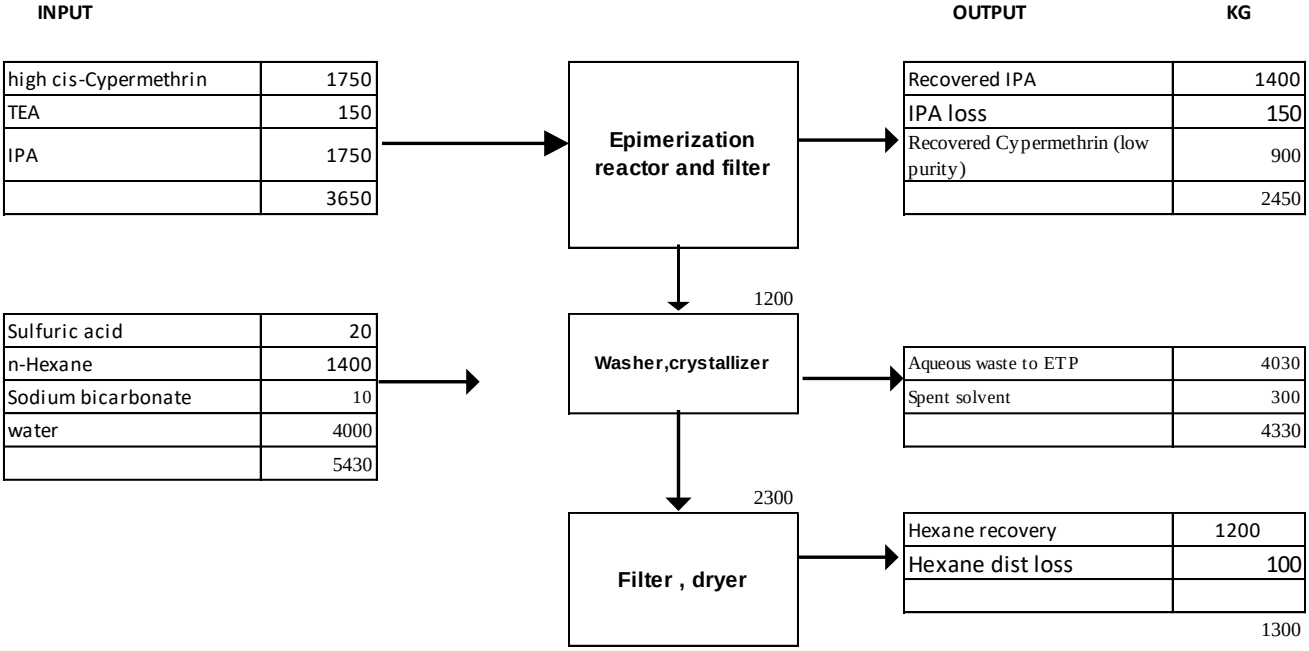


DVACl



Cypermethrin technical

Process Flowdaigram:



Material balance:

Input Kg/MT		**Output kg/MT**	
high cis-Cypermethrin	1750	Recovered IPA	1400
TEA	150	IPA loss	150
IPA	1750	Recovered Cypermethrin (low purity)	900
Sulfuric acid	20	Spent solvent	300
n-Hexane	1400	Aqueous waste to ETP	4030
Sodium bicarbonate	10	Hexane recovery	1200
water	4000	Hexane dist loss	100
		Product	1000
Total	**9080**	**Total**	**9080**

7. Lambda Cyhalothrin Technical:

Process Description:

LC Acid is reacted with thionyl chloride to make LC Acid chloride. Meta Phenoxy Benzaldehyde is reacted with Sodium Cyanide to form Meta Phenoxy Benzaldehyde Cyanhydrin as an intermediate. It is further reacted with LC Acid chloride to get Lambda Cyhalothric acid. The mass is washed with sodium bicarbonate solution and water to remove acidity and make organic mass cyanide free. The aqueous layer is treated for de-toxification with hydrogen peroxide. The organic mass after distilling hexane is epimerized in isopropyl alcohol. The mass is filtered in ANF. Solvent is recovered from the mother liquor.

Chemical Reaction:

$$C_9H_{10}ClF_3O_2 + SOCl_2 \rightarrow C_9H_9Cl_2F_3O + SO_2 + HCl$$

Lambda Cyhalothric acid

$$C_9H_9Cl_2F_3O + C_{13}H_{10}O_2 \rightarrow C_{23}H_{19}F_3ClNO_3$$

MPBAD **Lambda Cyhalothrin**

Material Balance

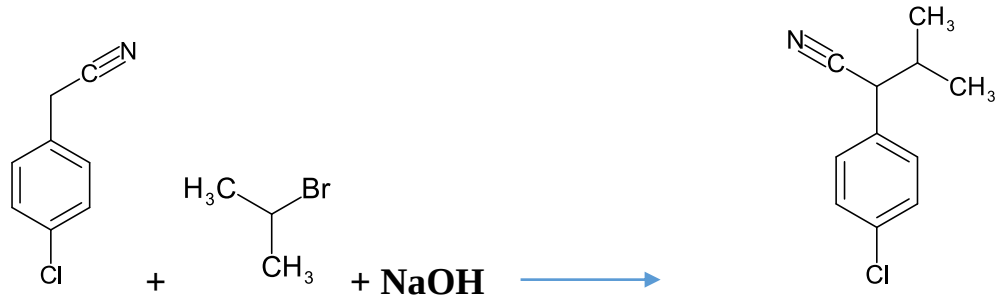
Input kg		Output kg	
LC Acid	641	Product	1000
SOCl2	347	25% Spent HCl	425
Cat	10	Disodium sulfide solution	2034
MPBAD	508	Aqueous layer to CN destruction	4016
NaCN	143	Aqueous layer to MEE	2116
Caustic Lye	522	Aqueous layer to ETP	1923
n-Hexane	2564	Recovered Hexane	2308
Raw Water	9356	Recovered IPA	1026
Sodium bicarbonate	193	Dist loss IPA	256
Isopropyl alcohol	1282	Distillation loss Hexane	256
		Residue (incineration)	206
Total	**15566**	**Total**	**15566**

8. Flucythrinate

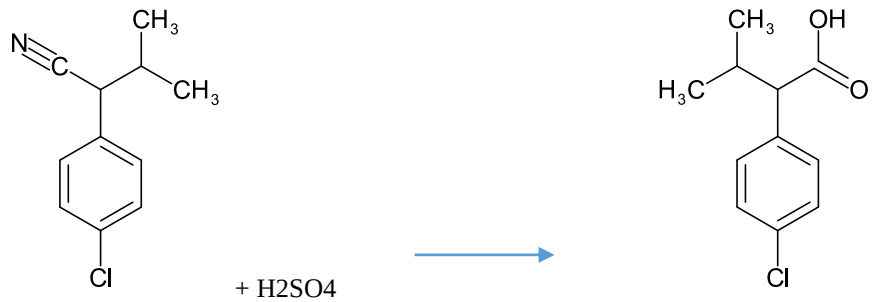
Process Description

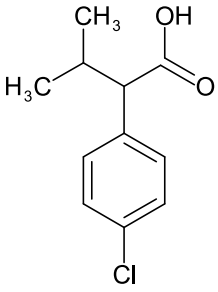
- Para Chloro Benzyl Cyanide is reacted with Isopropyl bromide (IPBr), caustic soda and a phase transfer catalyst and produced 2-(4-Chlorophenyl)-3-ethylbutanenitrile (CMBN). Aqueous layer contains Sodium Bromide. It is disposed to authorized vendors. CMBN is hydrolysed in dilute sulphuric acid to get CMB Acid.
- CMB Acid is reacted with caustic lye at high temperature and elevated pressure in the presence of an activated metal catalyst to get 2-(4-hydroxyphenyl)-3_methylbutanoic acid (HPMB Acid).
- HPMB Acid is reacted with methanol to get HPMB Ester.
- HPMB ester is reacted with R22 gas at elevated pressure and temperature in solvent acetone and neutralised with caustic lye. Solvent is recovered and Fluorinated ester is recovered in hexane by aqueous layer separation.
- Fluorinated ester is reacted with KOH in the presence of Methanol as solvent and further with Alpha Phenylethyl amine HCl (Alpha PEA. HCl). The F Acid is taken forwarded and Alpha PEA.HCl is recovered from the aqueous layer.
- F Acid is converted in acid chloride by reacting with thionyl chloride in the presence of one catalyst,. Gases are scrubbed in scrubber.
- Acid chloride is reacted with Meta Phenoxy Benzaldehyde by adding NaCN solution. Hexane is the solvent. Layers are separated and water wash is given to organic layer. Recover hexane and product Flucythrinate is collected as a product.

Chemical reaction

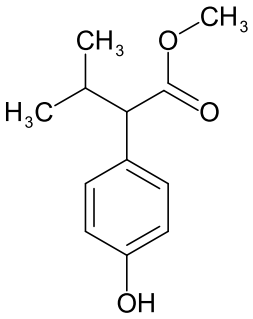


PCBN CMBN

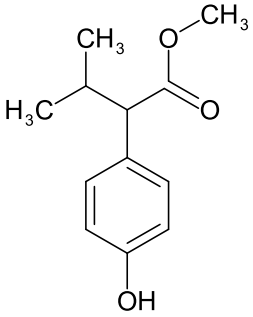




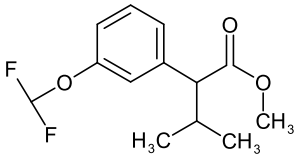
+ NaOH +Catalyst +CH3OH



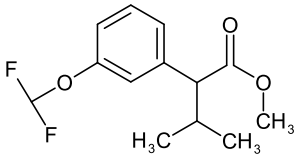
HPMB Ester



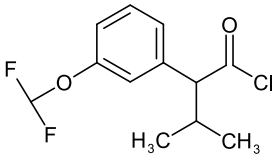
+ CHClF2

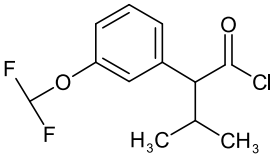


S-F Ester



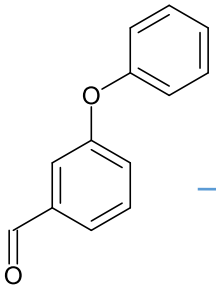
+KOH + SOCl2



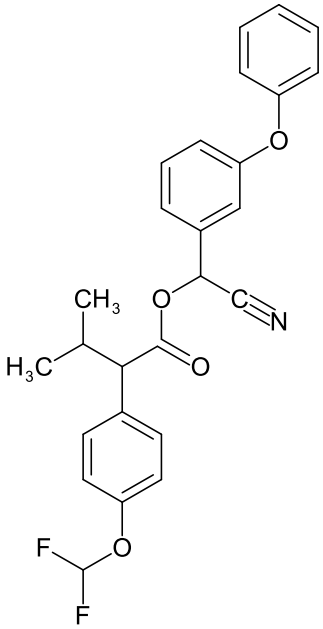


S-Acid Chloride

+ NaCN+

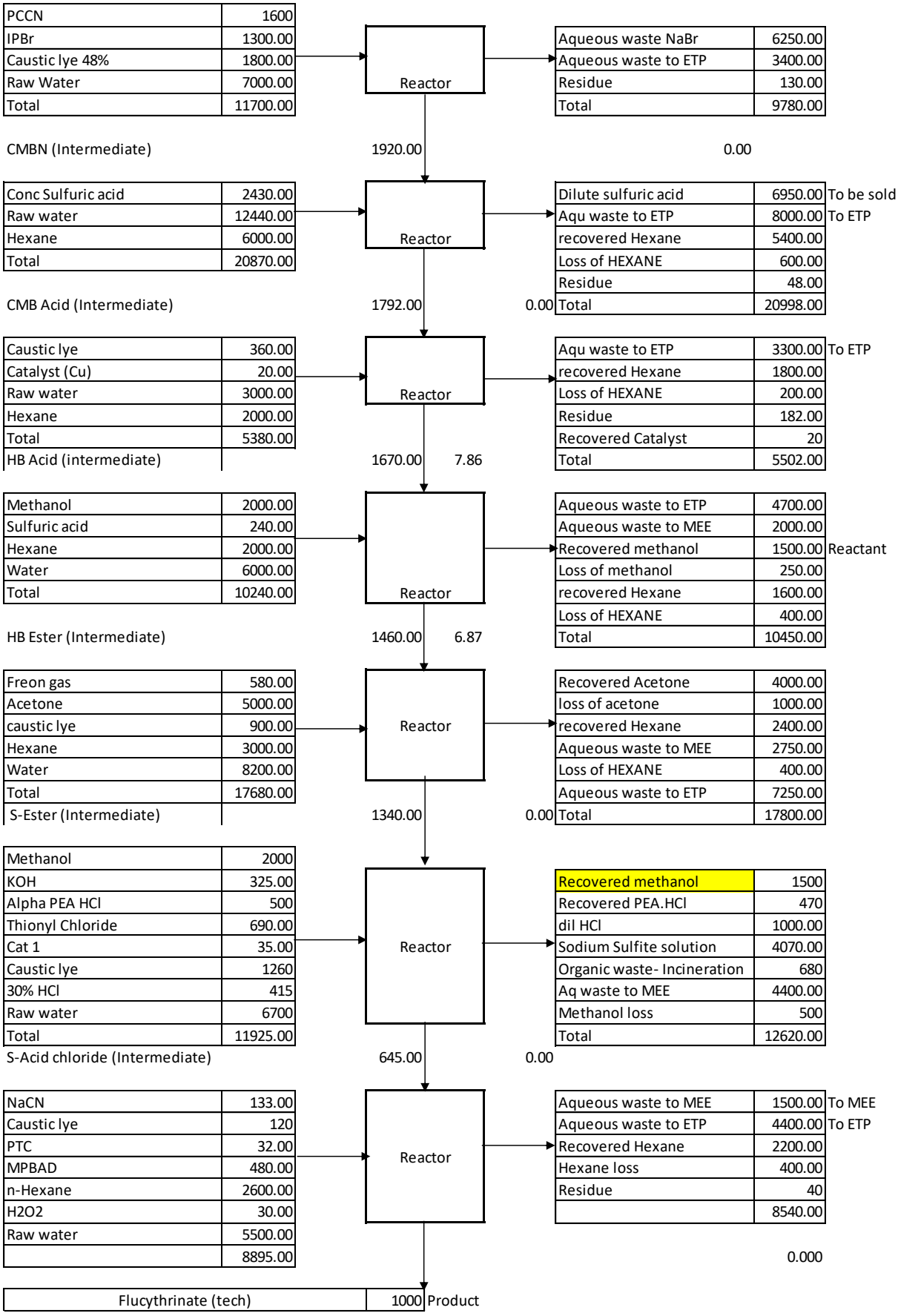


MPBAD



Flucythrinate

Process Flowdaigram :



Material Balance

Input kg/MT		Output kg/MT	
PCCN	1600	Aqueous waste NaBr	6250
IPBr	1300	Dilute sulfuric acid	6950
Caustic lye 48%	4440	recovered Hexane	13400
Conc Sulfuric acid	2670	Loss of HEXANE	2000
Hexane	15600	Recovered methanol	3000
Methanol	4000	Loss of methanol	750
Acetone	5000	Recovered Acetone	4000
Catalyst (Cu)	20	loss of acetone	1000
Freon gas	580	Recovered PEA.HCl	470
KOH	325	dil HCl	1000
Alpha PEAHCl	500	Sodium Sulfite solution	4070
Thionyl Chloride	690	Aqueous waste to MEE	10650
Cat -1	35	Aqueous waste to ETP	31050
30% HCl	415	Residue for incineration	1080
Sodium Cyanide	133	Recovered Catalyst	20
PTC	32	Product	1000
MPBAD	480		
H2O2 50% Solution	30		
Raw Water	48840		
Total	**86690**	**Total**	**86690.00**

9. Tefluthrin (Technical):

Process Description

Step-1: Preparation of TFP acid chloride

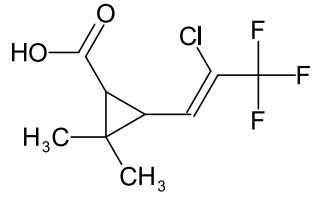
TFP Acid (Lambda cyhalothric acid) and Toluene(solvent) are taken in a MSGL reactor and Thionyl chloride is added slowly at reaction temperature. HCl and SO2 gases are scrubbed in scrubber. After completion of reaction, recover solvent and get TFP Acid Chloride.

Step 2: Preparation of Tefluthrin

Take TFP acid chloride was added 4-methyl-2, 3,5,6- tetrafluorobenzyl alcohol (TFBA) and toluene in a MSGL reactor and add TFP Acid chloride slowly and maintain the reaction temperature to complete the reaction. Cool the mass and adjust alkalinity with sodium carbonate solution. Separate the layer. Give water wash to remove any dissolved salt. Distil solvent completely and add IPA. Crystallise the mass and filter it . Product is dried at low temperature under high vacuum. IPA is recovered from Mother liquor. It is recycled after purification. Residue is incinerated.

Chemical Reaction

01.

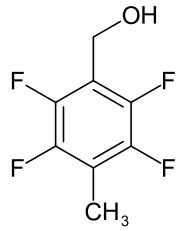


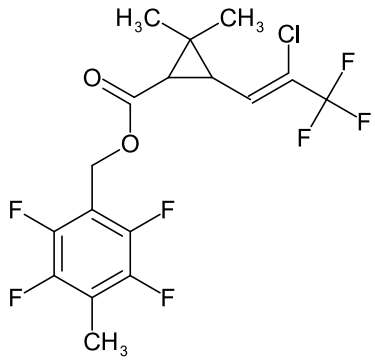
+


→ $C_9H_{10}Cl_2F_3O$

Lambda Cyhalothric acid Thionyl Chloride Lambda cyhalothric Acid Chloride

02.





$C_9H_{10}Cl_2F_3O$ + →

Lambda cyhalothric Acid chloride TFBA Tefluthrin

Material balance:

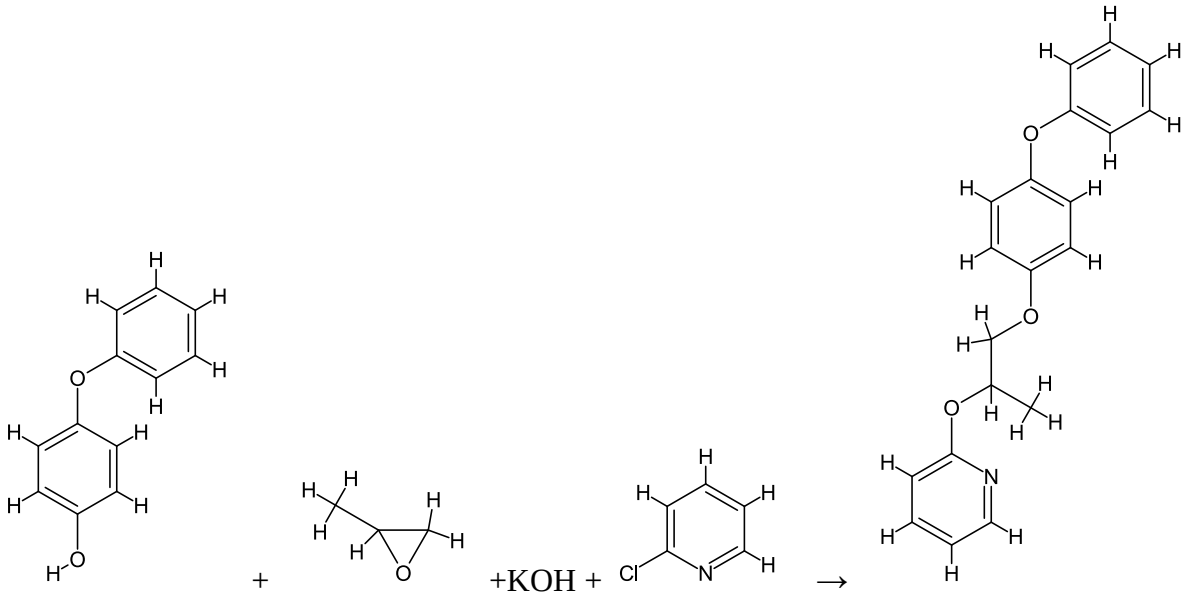
Input kg		Output kg	
Lambda cyhalothric acid	642	Product	1000
SOCl2	330	`	765
Cat	10	Di Sodium Sulfide solution	1945
Caustic lye	486	Aq layer 1 to MEE	1418
Raw water	7890	Aq layer to ETP	5040
TFBA	490	Recovered Toluene	2230
Toluene	2500	Spent solvent	200
Isopropyl aclcohol	2000	Recovered IPA	1600
Sodium bicarbonate	158	Process Residue	108
		Loss	200
Total	**14506**	**Total**	**14506**

10. Pyriproxyfen

Process Description

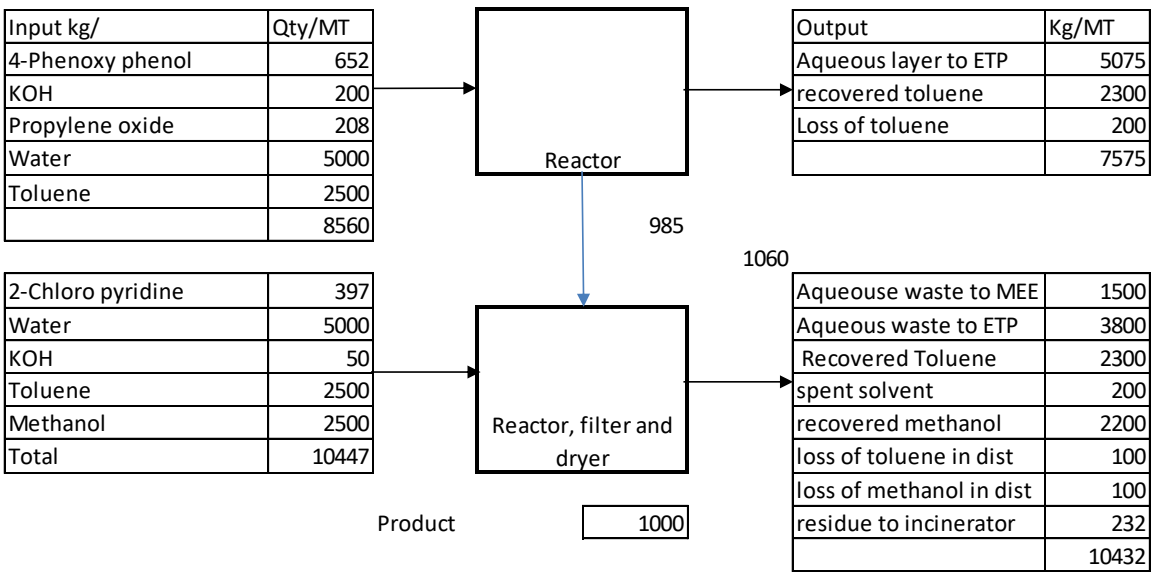
Take water and potassium hydroxide. 4-phenoxyphenol and add propylene oxide. After completion of reaction, organic mass is extracted in solvent – toluene. Aqueous layer is sent to MEE. 4-Chloro pyridine is added in organic mass by maintaining alkalinity. Mass is washed with water. Solvent is distilled. Bottom product Is crude pyriproxifen. Add methanol and crystallise the mass. Filter the product and dry it at low temperature. Solvent is distilled from mother liquor and residue is incinerated.

Chemical Reaction:



4-Phenoxy Phenol PO 2-Chloro pyridine Pyriproxyfen

Process Flowdiagram:



Input kg/	Qty/MT
4-Phenoxy phenol	652
KOH	200
Propylene oxide	208
Water	5000
Toluene	2500
	8560

Output	Kg/MT
Aqueous layer to ETP	5075
recovered toluene	2300
Loss of toluene	200
	7575

2-Chloro pyridine	397
Water	5000
KOH	50
Toluene	2500
Methanol	2500
Total	10447

Aqueouse waste to MEE	1500
Aqueous waste to ETP	3800
Recovered Toluene	2300
spent solvent	200
recovered methanol	2200
loss of toluene in dist	100
loss of methanol in dist	100
residue to incinerator	232
	10432

Material balance:

Input Kg/MT		**Out put Kg/MT**	
4-Phenoxy phenol	652	Aqueous layer to ETP	8875
KOH	250	recovered toluene	4600
Propylene oxide	208	Loss of toluene	300
Water	10000	spent solvent	200
Toluene	5000	recovered methanol	2200
2-Chloro pyridine	397	Aqueouse waste to MEE	1500
Methanol	2500	loss of methanol in dist	100
		residue to incinerator	232
		Product	1000
Total	**19007**	**Total**	**19007**

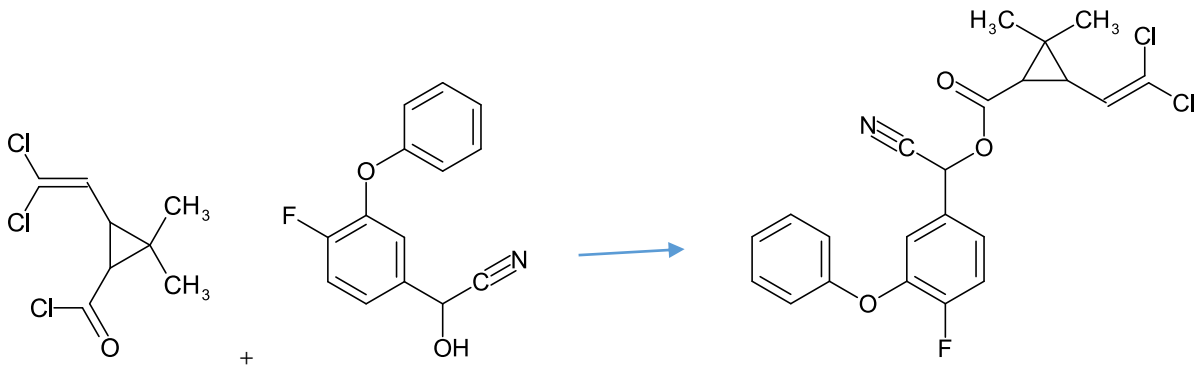
11. Cyfluthrin (Technical):

Process Description:

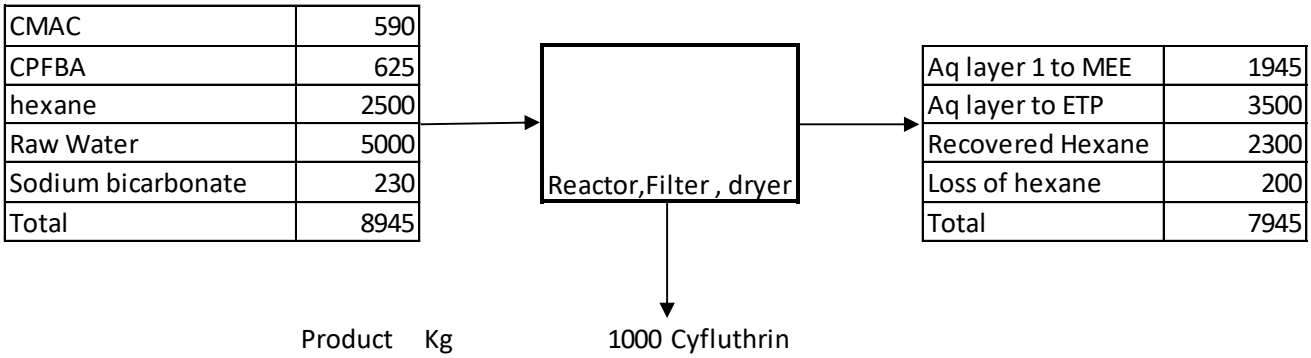
Add cypermethric acid chloride is added in mixture of hexane and in a MSGL reactor. Reaction mass is washed with water and sodium bicarbonate solution to remove acidity. Solvent is recovered under vacuum. The product is filled in drums.

This is epimerized in IPA and TEA to get Beta cyfluthrin. Which is crystallized in hexane and filtered

Chemical Reaction



Process Flow diagram:



Material Balance

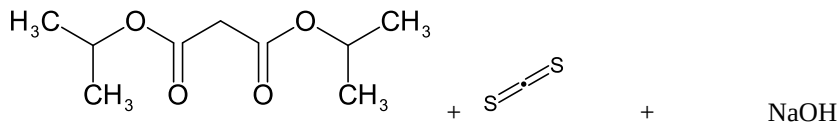
Input kg		Output kg	
CMAC	590	Product	1000
CPFBA	625	Aq layer 1 to MEE	1945
Hexane	2500	Aq layer to ETP	3500
Raw Water	5000	Recovered Hexane	2300
Sodium bicarbonate	230	Loss of hexane	200
Total	**8945**	**Total**	**8945**

12. Isoprothiolane –Technical

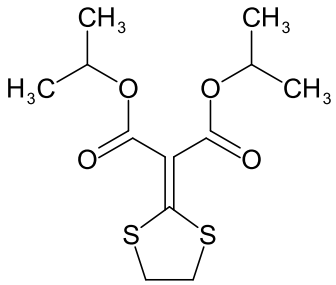
Process Description:

Carbon Di sulfide, EDC, DIPM and catalyst are taken in a reactor and caustic lye is added slowly at a controlled temperature. Product is extracted in EDC and aqueous layer is discarded. Finally, product is crystallised in n-Hexane and Heptane. Product is dried and packed in Fibre drums. Solvent is recovered and recycled. The residue is sent for incineration.

Chemical Reaction



Diisopropyl malonate + Carbon do sulphide + NaOH



Isoprothiolane

Process flowdaigram:

Input

	Qty/MT
CS2	425
DIPM	790
Catalyst	90
Caustic Lye	575
EDC	640
Water	2000
n-Hexane	2000
	6520

Reactor

Output

Aqueous waste to MEE	1481
Aqueous waste to ETP	2025
	3506

Organic layer 3014

Crystallizer

recovered n-Hexane	1700
Solvent loss	100
Residue to Incinerator	214
	2014

6520

Product 1000

Material Balance

Input		Output	
CS2	425	Aqueous layer 1	1481
DIPM	790	Aqueous layer 2	2025
EDC	640	n-Haxane(Recovered)	1700
Caustic Lye	575	Distillation loss	100
catalyst	90	Residue	214
n-Hexane	2000	Isporothiolane (Product)	1000
Raw water	2000		
Total	**6520**	**Total**	**6520**

13. Allyl Isothiocyanate

Process Description

Allyl chloride is added in the mix of sodium thio cyanate, catalyst and solvent. are reacted in presence of solvent, by maintaining temperature under reflux. After the completion of reaction mass is filtered to separate salt as solid waste. Solvent is recovered to get crude product which is distilled completely as finished goods. The residue is disposed by incineration. Cool to room temperature, separate and distil desire product under vacuum.

Chemical Reaction

Allyl Chloride Sodium Thiocyanate Allyl Isothiocyanate

Material Balance

Input Kg			**Output Kg**		
1	Allyl Chloride (L)	880	Acetone recovered	2250	90% recovery
2	Sodium Thio cyanate (S)	930	AITC (Product)	1000	FG
3	Catalyst (S)	90			
4	Caustic Lye (L)	50	Distillation loss	175	
5	Acetone (L)	2500	Residue	304	Incineration
6	Raw Water	1000	Aqueous layer 1	1021	To MEE
			Solid waste	700	solid waste
	Total	**5450**	**Total**	**5450**	

14. VALIPHENALATE

Process Description

Step-1 –Intermediate -1 manufacturing

Malonic acid, ammonium acetate and 4-Chlorobenzaldehyde are reacted in solvent –Methanol at low temperature. The intermediate (ammonium salt) is filtered and esterified with methanol in the presence of sulfuric acid. It is methyl ester.

Step -2: Intermediate-2 manufacturing

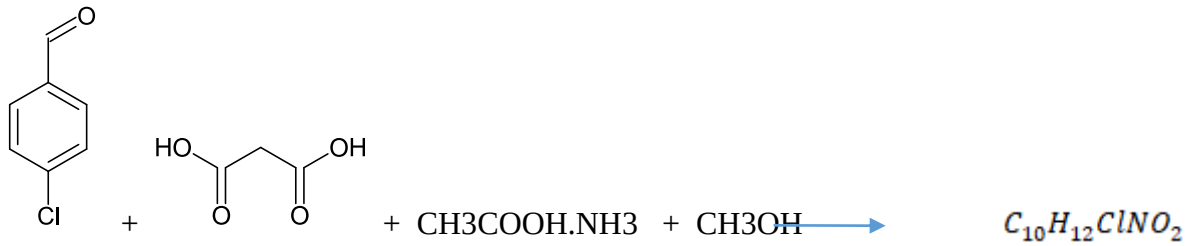
(L) Valine is reacted with caustic lye and further reacted with Iso propyl chloro formate in MDC . It is further reacted with methane sulfonyl chloride to form second intermediate.

Step-3 : Final product manufacturing

Intermediate 1 and 2 are reacted at low temperature. After water wash and sodium bicarbonate solution wash, solvent MDC is recovered and product is crystallised in methanol. It is filtered and dried. Product is in powder form and packed in drums as per requirement.

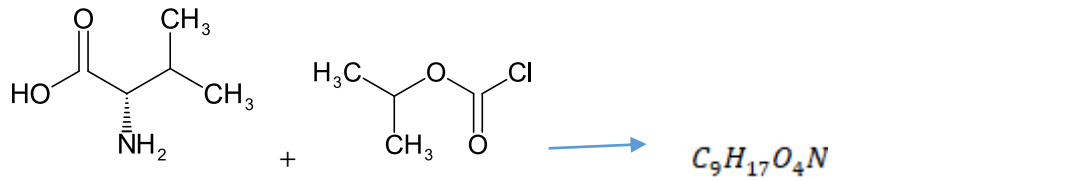
Chemical Reaction :

Step-1

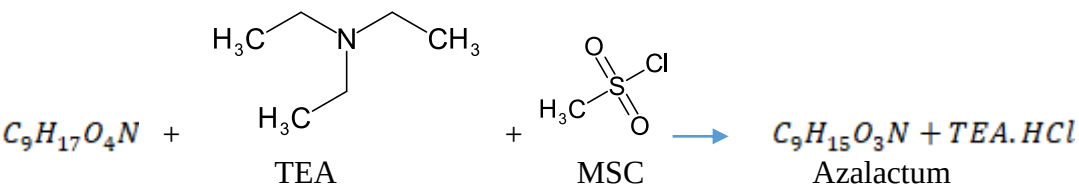


PCB Malonic acid Ammonium Acetate Methyl ester

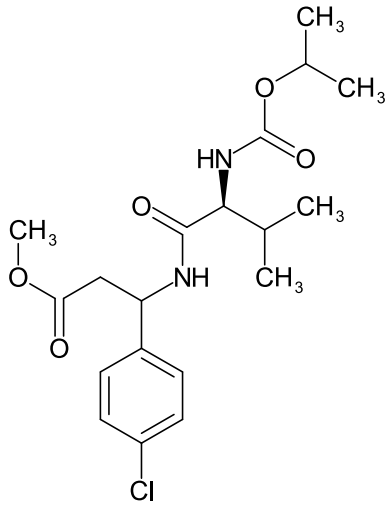
Step-2



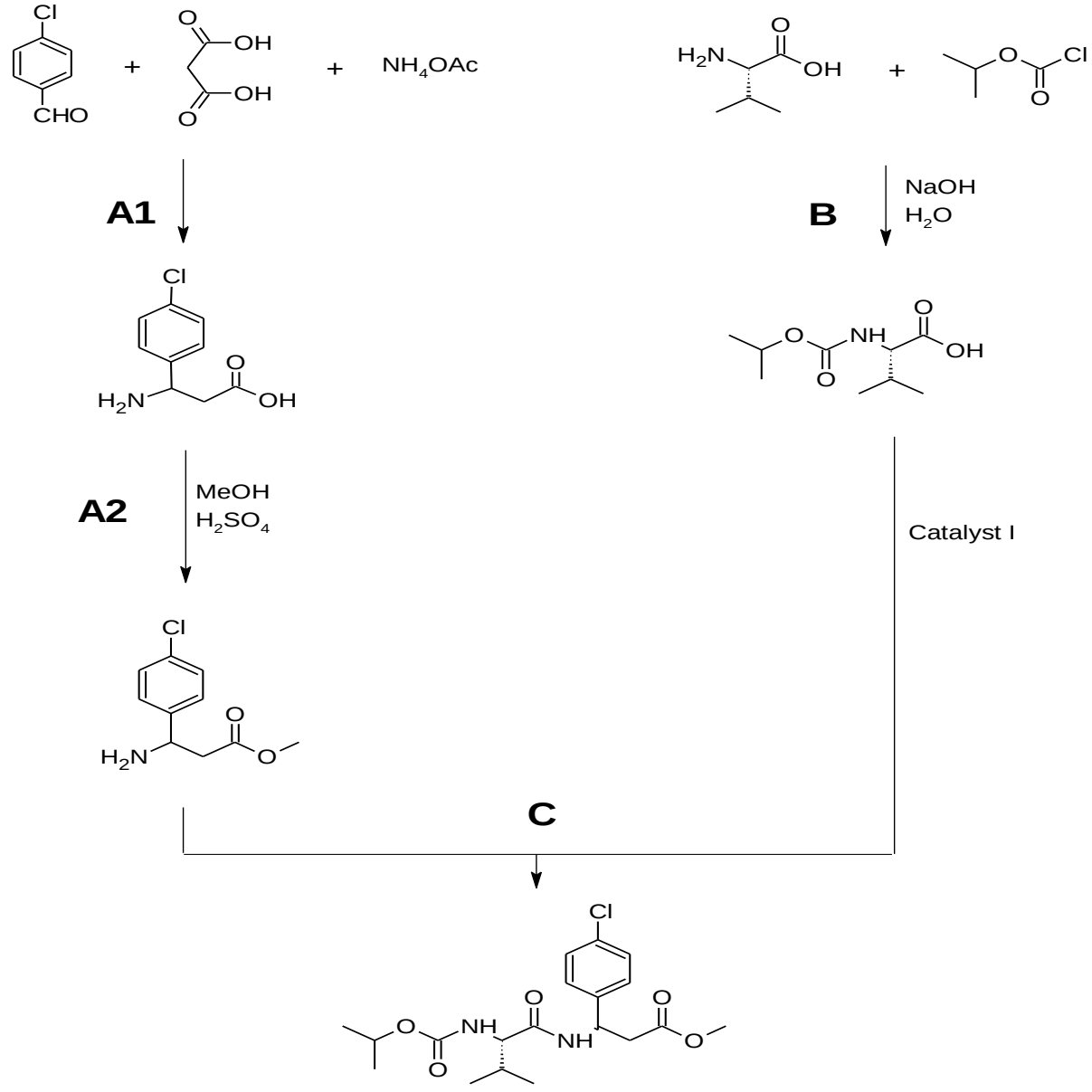
L-Valine IPCF IP-L-Valine



TEA MSC Azalactum



$$C_{10}H_{12}ClNO_2 + C_9H_{15}O_3N \rightarrow$$



Material Balance

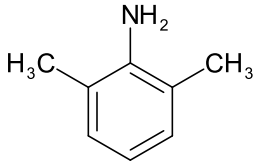
Input kg /MT		**Output kg**	
Methanol	15400	Product	1000
Malonic acid	405	Spent Solvent	3952
Ammonium Acetate	1000	Recovered Methanol	11028
Para chloro benzaldehyde	510	Recovered MDC	10345
98% H2SO4 kg	958	Intermediate 1	946.00
MDC	10800	Intermediate 2	2100
Soda Ash	900	Recovered TEA	680
L-Valine	150	Methanol Loss	1323
C.lye 48%	1375	MDC loss	505
IPCF	525	Aqueous waste to MEE	16544
TEA	700	Aqueous waste to ETP	22426
Methyl sulfonyl chloride	425	Distillation Residue	695
Intermediate 1	946		
Intermediate 2	2100		
HCl 30%	350		
Water	35000		
Total	**71544**	**Total**	**71544**

15. BENALAXYL

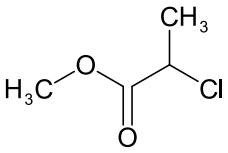
Process Description

- 2,6 Xylidine , Methyl 2 chloro Propionate and sodium bicarbonate are reacted at 90-95 deg C in the presence of three catalysts . All the RM are charged at a time. After reaction, organic mass is taken in Hexane and salts are removed in water layer. Unreacted 2,6-Xylidine is recovered from organic layer by sulphuric acid treatment and further reacting with caustic lye. Organic mass free from 2,6-Xylidine is called MEDA solution.
- Phenyl acetic acid is reacted with thionyl chloride to prepare Phenyl Acetyl chloride .
- MEDA and PAC are reacted in hexane to form Benalaxyl. It is crystallised and filtered in ANF. The product is dried in RVD under high vacuum and low temperature.

Chemical Reaction

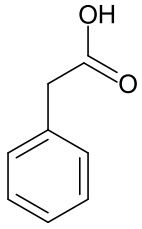


+



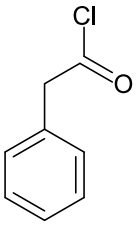
+ NHCO3 → $C_{12}H_{16}NO_2$ + NaCl

2,6 xylidine 2-CP MEDA

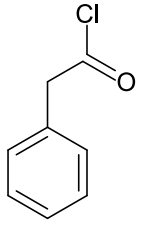


+

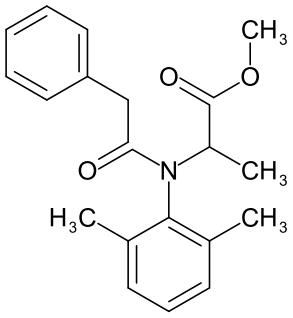
→



PAA Thionyl Chloride PAC

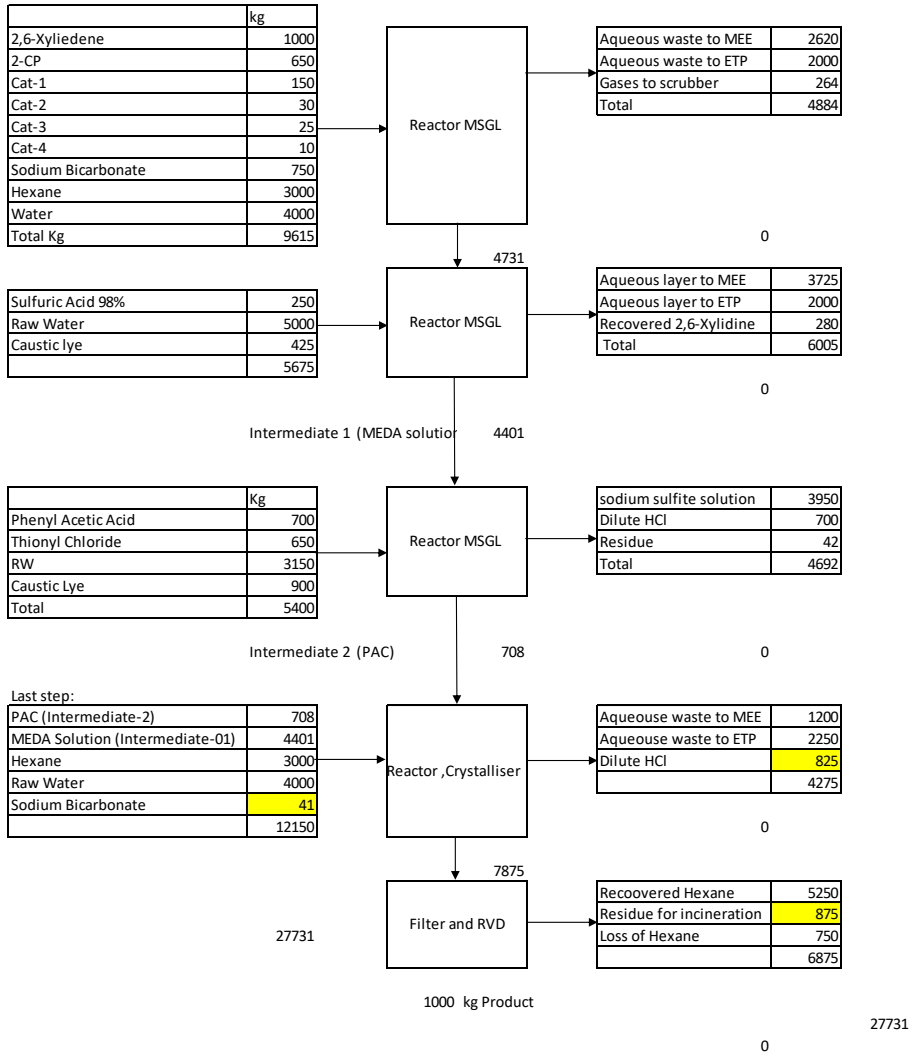


+ $C_{12}H_{16}NO_2$ →



PAC MEDA BENALAXYL

Process Flowdiagram



Material Balance

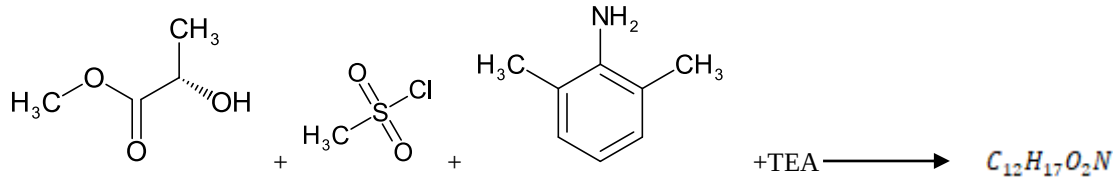
Input kg/MT		Out put kg/MT	
2,6 Xylidine	1000	Aqueous waste to MEE	7545
2 CP	650	Aqueous waste to ETP	6250
Cat-1	150	Gases to scrubber	264
Cat-2	30	Residue	917
Cat-3	25	Recovered 2,6-Xylidine	280
Cat-4	10	sodium sulfite solution	3950
Sod bicarbonate	791	Dilute HCl	1525
Hexane	6000	Hexane loss	750
sulfuric acid 98%	250	Recovered Hexane	5250
Caustic lye	1325	Product	1000
Phenyl acetic acid	700		
Thionyl Chloride	650		
RW	16150		
Total	**27731**	**Total**	**27731**

16. BENALAXYL-M

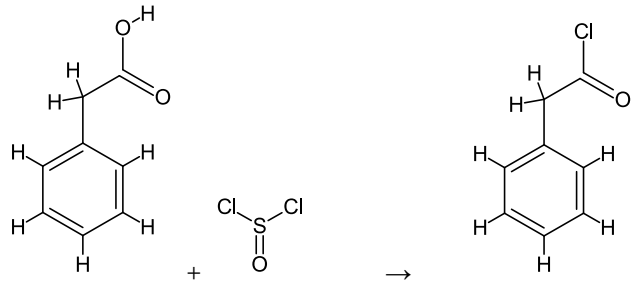
Process Description:

- Methyl-S-Lactate and Methane sulfonyl chloride (MSC) are reacted in toluene under reflux conditions to form MLMS TEA is used as scavenger. Solvent is distilled to get MLMS.
- MLMS is reacted with 2,6-Xylidine in solvent-Hexane. Organic layer is washed with water and reacted with sulphuric acid to get unreacted 2,6Xylidine.
- Organic mass , free from 2,6-Xylidine is the solution of R-MEDA in Hexane.
- Phenyl acetic acid is reacted with Thionyl chloride to get PAC.
- PAC and R-MEDA are reacted to get Benalaxyl-M which is crystallised, filtered and dried. Solvent is recovered from mother liquor. Residue is incinerated.

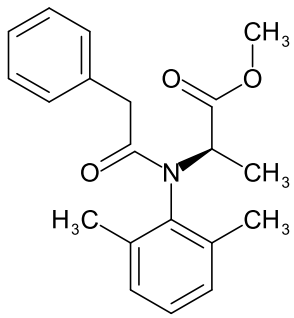
Chemical Reaction



Methyl-S-Lactate MSC 2,6-Xylidine R-MEDA



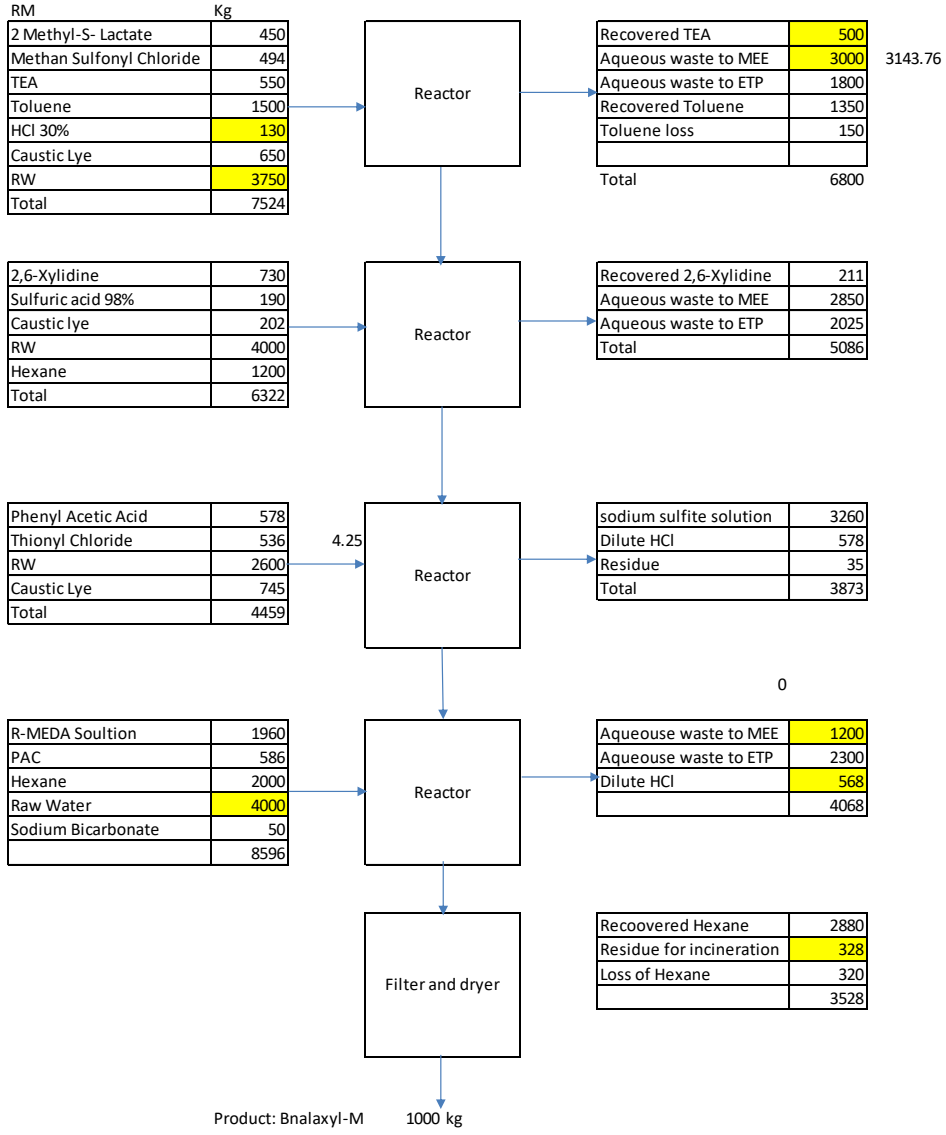
PAA Thionyl Chloride PAC



$C_8H_7ClO + C_{12}H_{17}O_2N \rightarrow$

PAC R-MEDA BENALAXYL-M

Process Flow diagram:



Material Balance

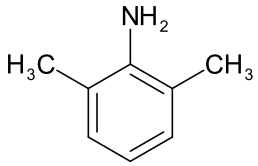
Input kg/MT		Output kg/MT	
2 Methyl-S- Lactate	450	Recovered TEA	500
Methan Sulfonyl Chloride	494	Aqueous waste to MEE	7050
TEA	550	Aqueous waste to ETP	6125
Toluene	1500	Recovered Toluene	1350
HCl 30%	130	Toluene loss	150
Caustic Lye	1597	Recovered 2,6-Xylidine	211
2,6-Xylidine	730	sodium sulfite solution	3260
Sulfuric acid 98%	190	Dilute HCl	1146
Hexane	3200	Recovered Hexane	2880
Phenyl Acetic Acid	578	Residue for incineration	363
Thionyl Chloride	536	Loss of Hexane	320
Raw Water	14350	Product	1000
Sodium Bicarbonate	50		
Total	**24355**	**Total**	**24355**

17. METALAXYL

Process Description:

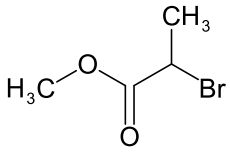
1. 2,6-Dimethylaniline (2,6-Xylidine) ,methyl bromo propionate ,toluene and sodium bicarbonate are heated to reflux in a reactor
2. Filter Sodium Bromide after completion of reaction at room temperature. Mother liquor is washed with water to remove traces of salt. Solvent is recovered under vacuum and N-(1-methoxycarbonylethyl)-2,6-dimethyl aniline (MEDA) is obtained.
3. Add MEDA, toluene and DMF in reactor and Methoxy acetal chloride is added slowly. HCl gas is scrubbed in scrubber. The reacted mass is washed with water. Solvent is completely recovered and hexane is added as second solvent. Product is crystallized in it.
4. Product is filtered and dried. Solvent is recovered from mother liquor, residue is incinerated.

Chemical Reaction



2,6 xylidine

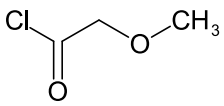
\+



2-CP

+ NaHCO3 → $C_{12}H_{16}NO_2$ + NaBr

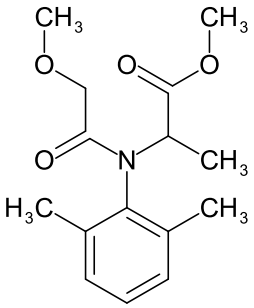
MEDA



PAC

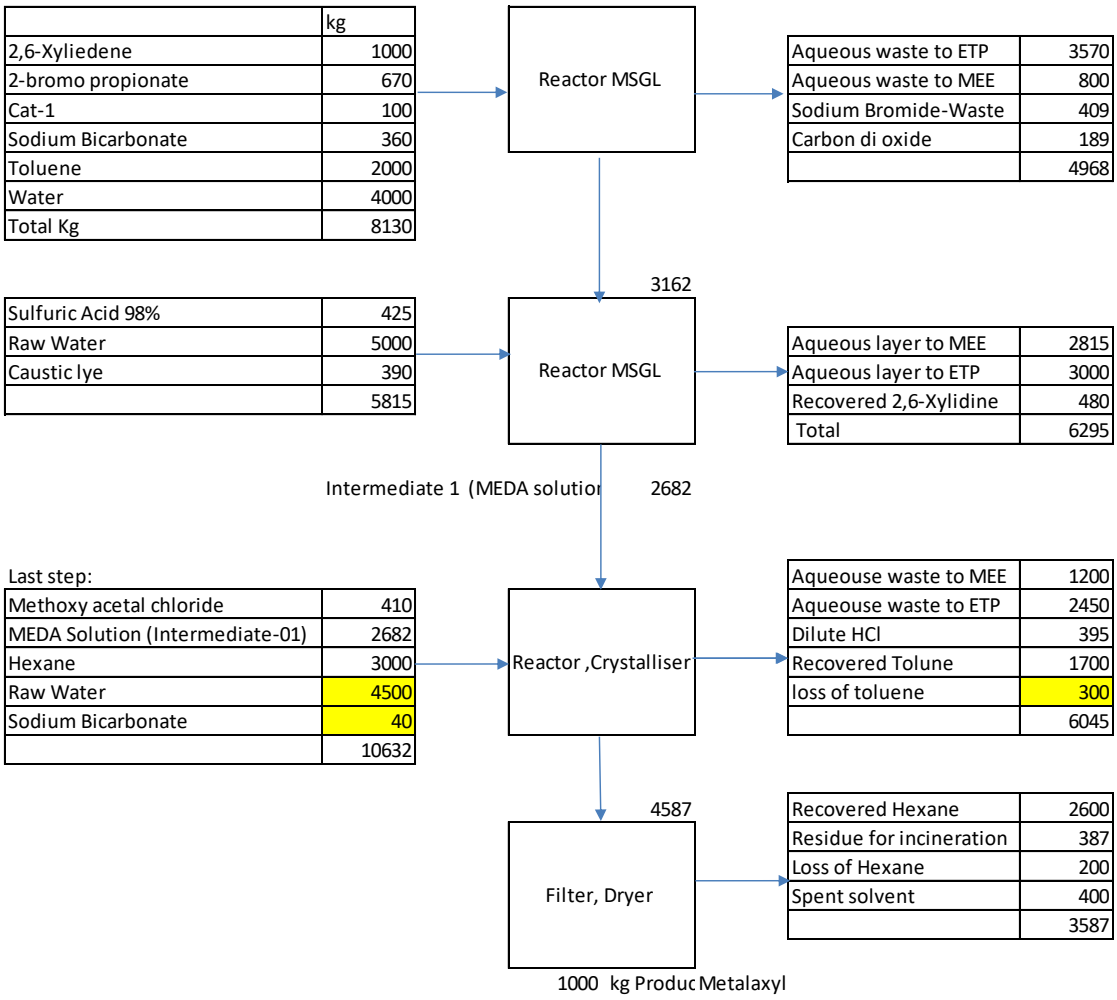
\+ $C_{12}H_{16}NO_2$ →

MEDA



Metalaxyl

Process Flowdaigram



Material Balance:

Input kg/MT		**Output kg/MT**	
2,6 Xylidine	1000	Aqueous waste to MEE	4815
2 BP	670	Aqueous waste to ETP	9020
Cat-1	100	Gases to scrubber	189
Sod bicarbonate	400	Sodium Bromide Waste	409
Toluene	2000	Residue	387
Hexane	3000	Recovered 2,6-Xylidine	480
sulfuric acid 98%	425	Dilute HCl	395
Caustic lye	390	Hexane loss	200
MAC	410	Recovered Hexane	2600
RW	13500	Recovered Toluene	1700
		Loss of toluene	300
		Spent solvent	400
		Product	1000
Total	**21895**	**Total**	**21895**

18. Acetamiprid

Manufacturing Process

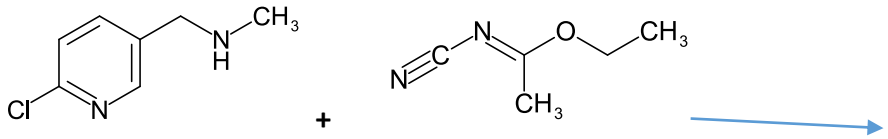
Process Description:

01. Take 40% methyl amine and toluene. Add solution of 2-chloro-5-chloromethyl pyridine (CCMP). Separate layers after completion of reaction. Organic layer contains 2-chloro-5-methylaminomethyl pyridine (CMAMP). Excess methyl amine is recovered from aqueous layer and recycled.

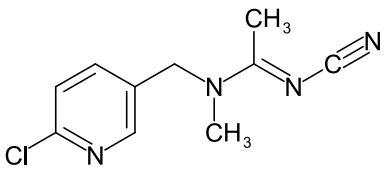
02. CMAMP in toluene is taken in a reactor and Ethyl N-cyano-acetimidate (ECAI) is added slowly. Mass is filtered. Cake is washed and dried. Solvent is recovered from the mother liquor.

Chemical Reaction

CCMP Methyl amine CMAMP

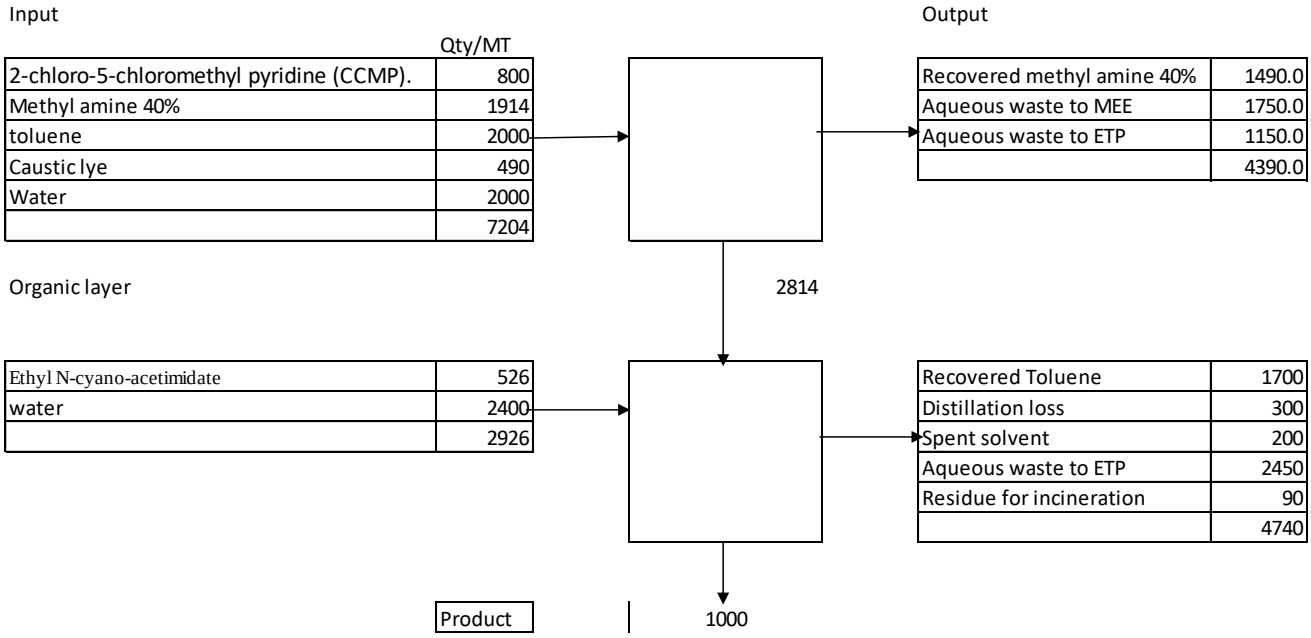


CMAMP Ethyl N-cyano-acetimidate



Acetamiprid

Process flowdaigram:



Material Balance:

Input kg/MT		Output kg/MT	
2-chloro-5-chloromethyl pyridine (CCMP).	800	Recovered methyl amine 40%	1490.0
Methyl amine 40%	1914	Aqueous waste to MEE	1750.0
toluene	2000	Aqueous waste to ETP	3600.0
Caustic lye	490	Recovered Toluene	1700
Ethyl N-cyano-acetimidate	526	Distillation loss	300
Water	4400	Spent solvent	200
		Residue for incineration	90
		Product	1000
Total	**10130**	**Total**	**10130**

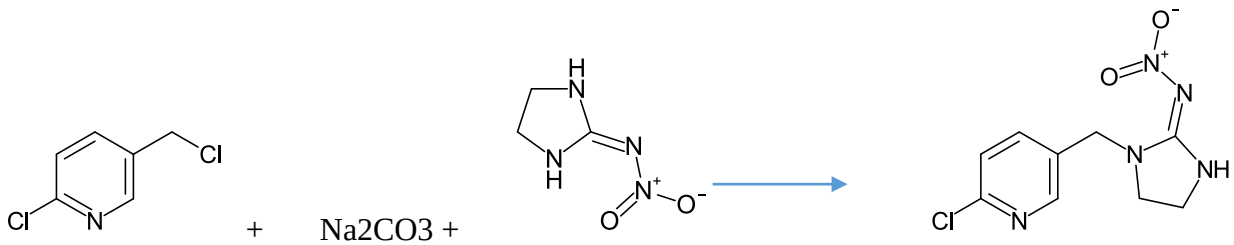
19. Imidacloprid

Manufacturing Process

Process Description

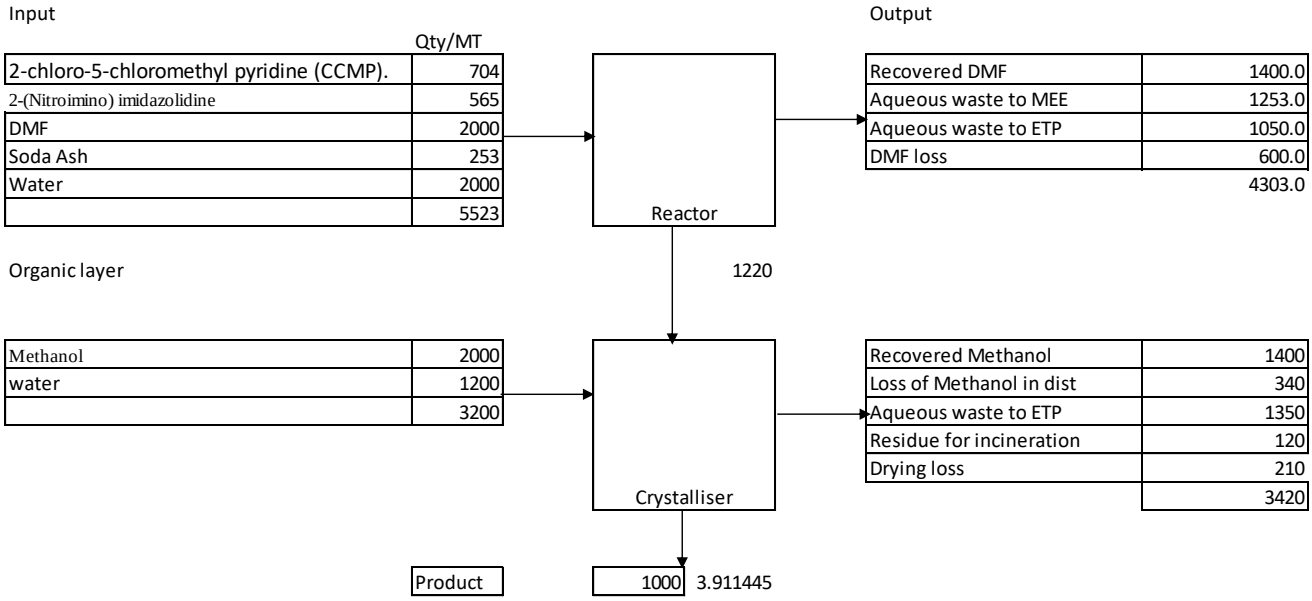
2,5 – Chloro methyl Pyridine (CCMP) is reacted with 2-(Nitroimino) imidazolidine (N-Nll) in solvent DMF and a catalyst . Generated HCl is scavenged with sodium carbonate. The resulting mass is filtered to remove salts . Water is add in mother liquor. Recover DMF and filter the mass to get crude Imidacloprid. Wet Cake is recrystallized in methanol to get pure material. Methanol is recovered from mother liquor and recycled.

Chemical Reaction



CCMP 2-(Nitroimino) imidazolidine Imidacloprid

Process flow diagram:



Material balance:

Input kg/MT		**Output kg/MT**	
2-chloro-5-chloromethyl pyridine (CCMP).	704	Recovered DMF	1400.0
2-(Nitroimino) imidazolidine	565	Aqueous waste to MEE	1253.4
DMF	2000	Aqueous waste to ETP	2400.0
Soda Ash	253	DMF loss	600
Methanol	2000	Recovered Methanol	1400
Water	3200	Loss of Methanol in dist	340
		Residue for incineration	120
		Drying loss	210
		Product	1000
Total	**8723**	**Total**	**8723**

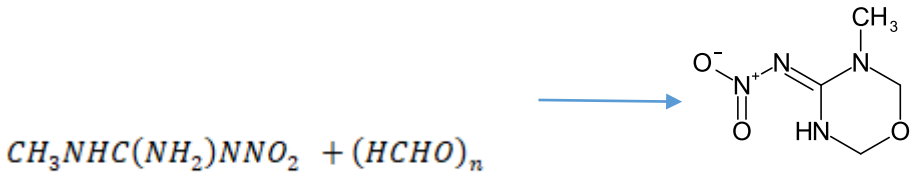
20. Thiamethoxam (Technical)

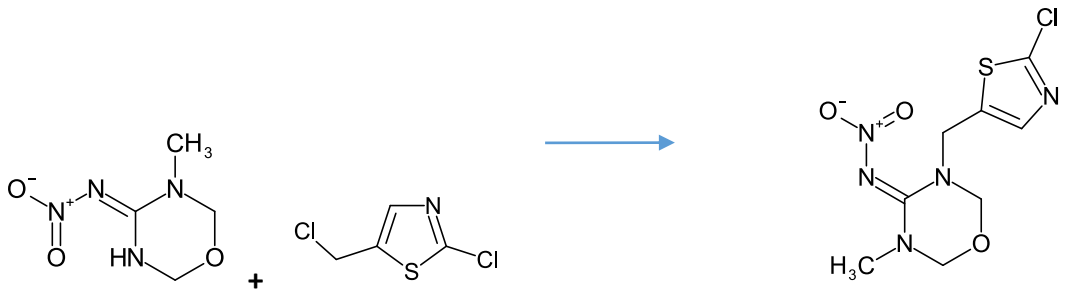
Process Description

Take formic acid as solvent and add N-Methyl -Nitro Guanidine (NMG) and Para Formaldehyde (PFA). It cyclizes NMG to form 3 – Methyl - N-nitro –4H-4-imino- 1,3,5- oxadiazine . The solvent formic acid is distilled and water is added. Neutralize the mass with caustic lye. Cool and crystalize the mass. Filter intermediate Oxadiazine. Concentrated Formic acid is recycled after concentration. Dilute formic acid is discarded as spent solvent.

The intermediate product of step 1 (Oxadiazine) is condensed with 2-Chloro-5-Chloro Methyl Thiazole in solvent Di Methyl Formamide. Solvent Di Methyl Formamide is distilled and mass is diluted with water and neutralised with 30% HCl/Caustic lye as per requirement. Crystallize the product by slow cooling & filtered the product. It is crude product. It is recrystallized in methanol. The product is filtered and dried.

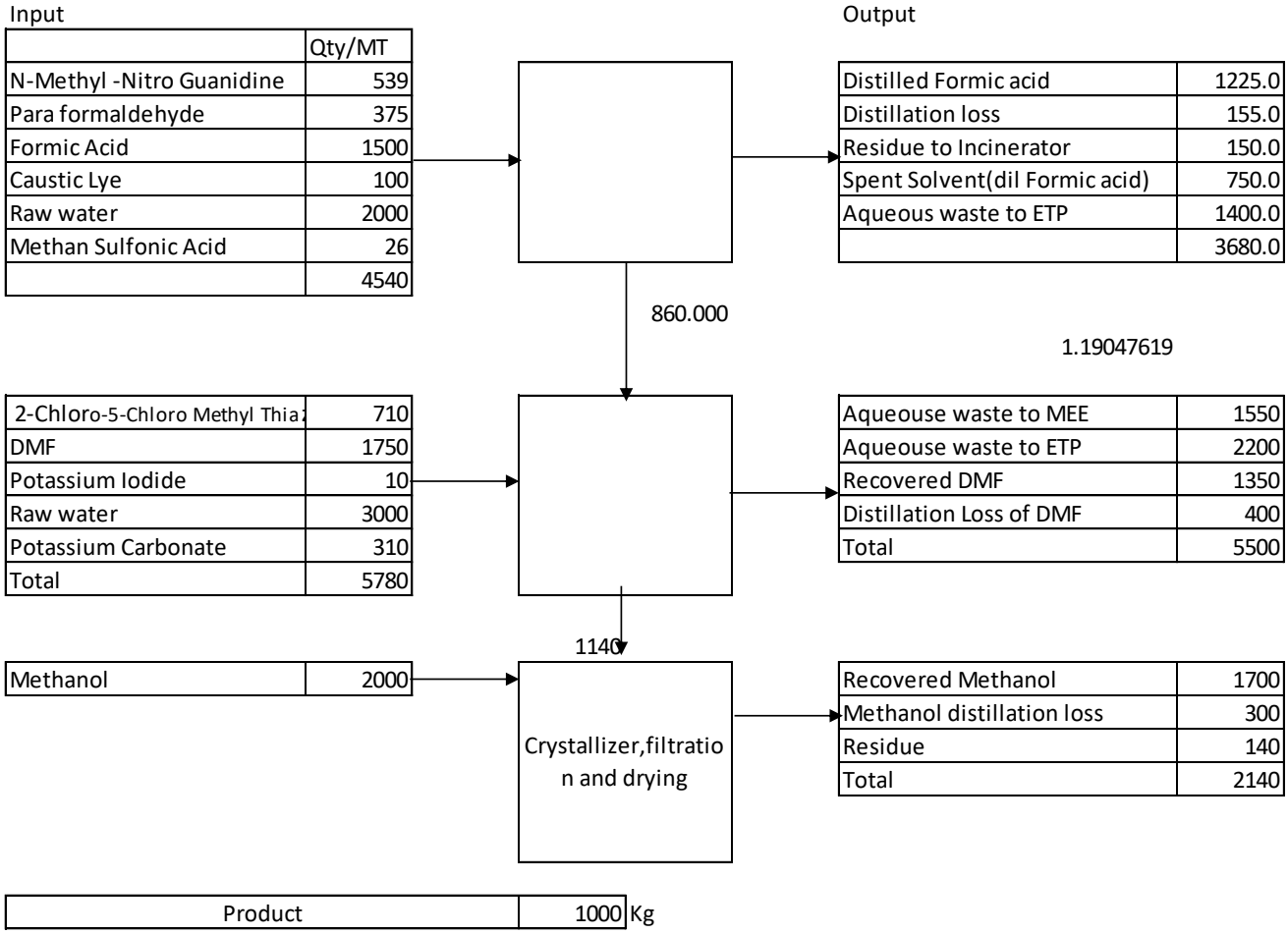
Chemical reaction:





with 2-Chloro-5-Chloro Methyl Thiazole Thiamethoxam

Process Flowdiagram:



Material Balance

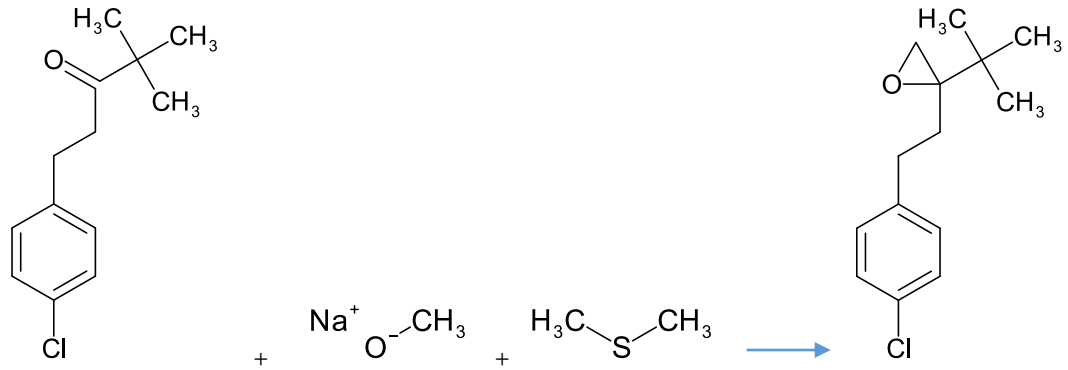
Input kg/MT		**Output kg/MT**	
N-Methyl -Nitro Guanidine	539	Distilled Formic acid	1225.0
Para formaldehyde	375	Distillation loss	155.0
Formic Acid	1500	Residue to Incinerator	150.0
Caustic Lye	100	Spent Solvent (dil. Formic acid)	750.0
Raw water	5000	Aqueous waste to ETP	3600.0
Methane Sulfonic Acid	26	Aqueous waste to MEE	1550.0
2-Chloro-5-Chloro Methyl Thiazole	710	Recovered DMF	1350
DMF	1750	Distillation Loss of DMF	400
Potassium Iodide	10	Recovered Methanol	1700
Potassium Carbonate	310	Methanol distillation loss	300
Methanol	2000	Residue	140
		Product	1000
Total	**12320**	**Total**	**12320**

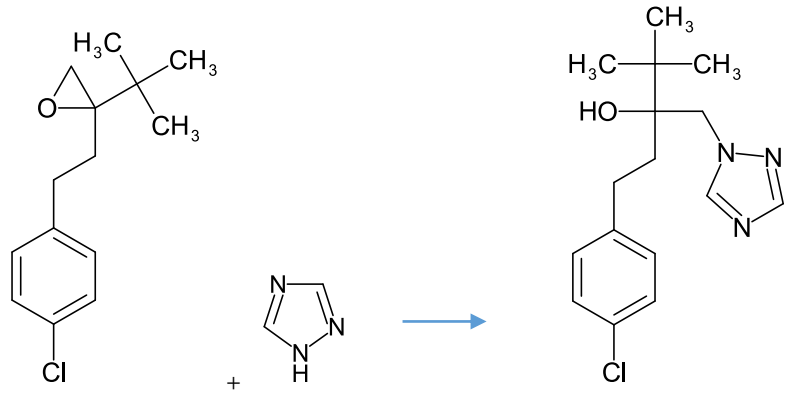
21. Tebuconazole

Process Description

React 1-(4-Chlorophenyl)-4,4-Dimethyl-3-Pentenone ,Sodium methoxide and DMS in solvent toluene. It produces 2-[2-(4-Chlorophenyl)ethyl]-2-(1,1- DiMethyl ethyl) Oxirane. It is separated in toluene.

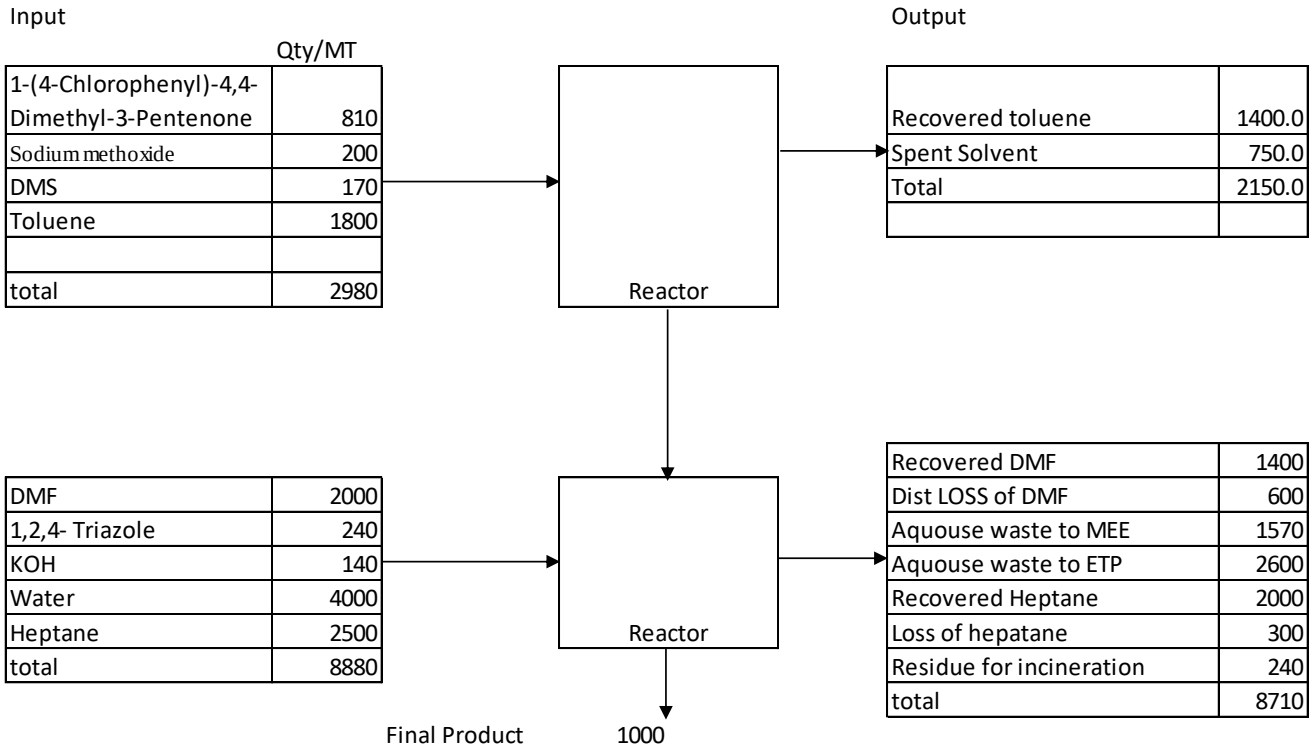
2-[2-(4-Chlorophenyl) ethyl]-2-(1,1-DiMethyl ethyl) Oxirane is reacted with 1,2,4-Triazole in solvent DMF to get final product Tebuconazole. It is crystallised, filtered and dried.





Oxirane 1,2,4-Triazole Tebuconazole

Process Flow diagram:



Material balance:

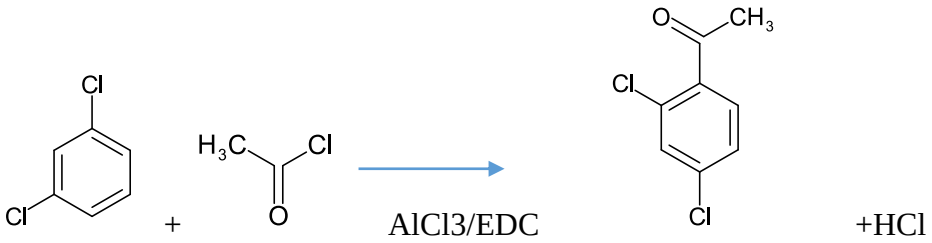
Input kg/MT		**Out put kg/MT**	
1-(4-Chlorophenyl)-4,4-Dimethyl-3-Pentenone	810	Recovered toluene	1400
Sodium methoxide	200	Spent Solvent	750
DMS	170	Recovered DMF	1400
Toluene	1800	Dist LOSS of DMF	600
1,2,4- Triazole	240	Aqueous waste to MEE	1570
KOH	140	Aqueous waste to ETP	2600
Heptane	2500	Recovered Heptane	2000
DMF	2000	Loss of heptane	300
Water	4000	Residue for incineration	240
		Product	1000
Total	**11860**	**Total**	**11860**

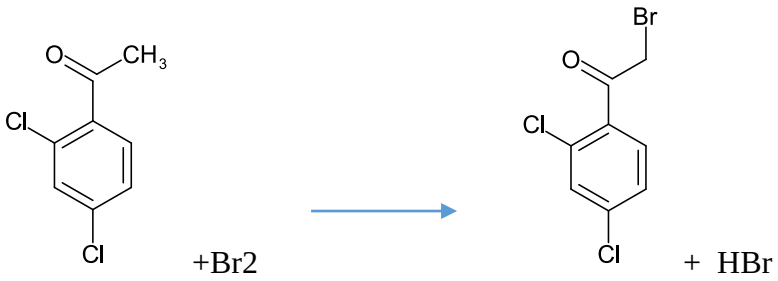
22. Propiconazole

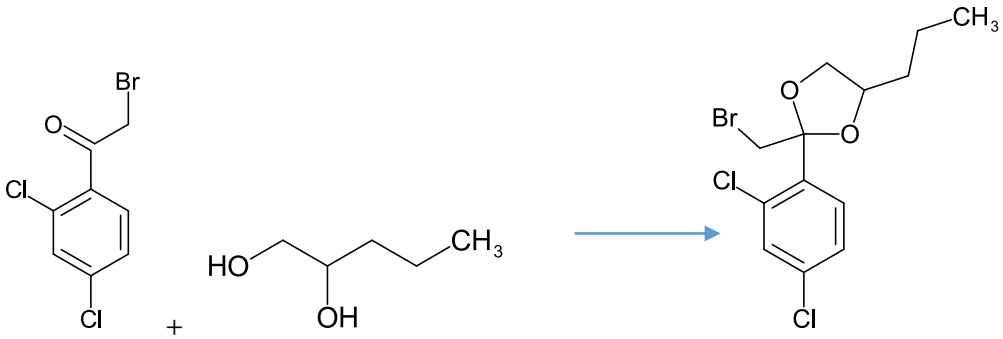
Process Description

- Charge 1,3-Dichloro benzene, Aluminium chloride in solvent EDC and add Acetyl chloride slowly. HCl gas is scrubbed with water. At the end reaction, solvent EDC contains 2,4-Dichloro acetophenone. Layers are separated after drowning the mass.
- Add bromine slowly in the solution of step-1 to get 2,4-Dichloro Phenacyl Bromide.
- Recover solvent add toluene and add 1,2-Pentanediol to get 4-(2-Bromomethyl-4-Propyl-1,3-Dioxolane-2-yl)-1,3-Dichlorobenzene.
- Add KOH and 1,2,4-Triazole in the solution of DMF and 4-(2-Bromomethyl-4-Propyl-1,3-Dioxolane-2-yl)-1,3-Dichlorobenzene to get final product Propiconazole.

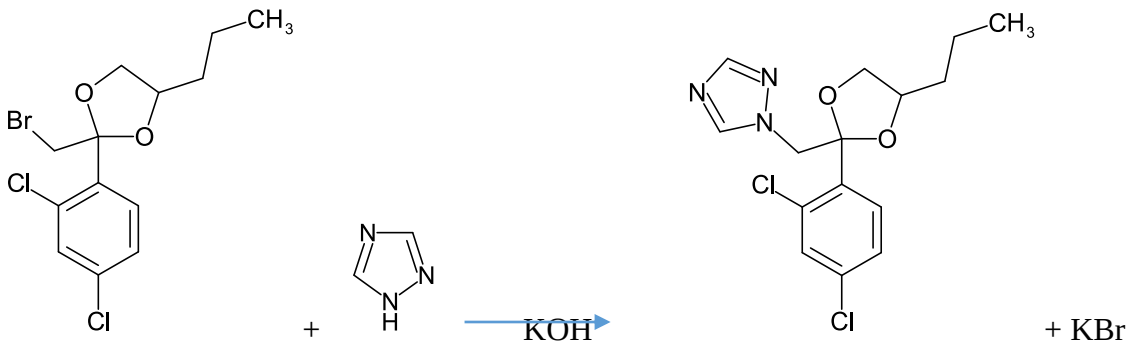
Chemical Reaction







CAS No. 60207-89-8.



1,2,4-Triazole Propiconazole

Process flowdiagram

Input

	Qty/MT
1,3-Dichloro benzene	530
Acetyl Chloride	283
EDC	2000
AlCl3	525
Water	3000
total	

Reactor

Output

AlCl3 solution	2810.0
Aqueous waste to ETP	1100.0
	3910.0

Organic layer

Bromine	545
water	1750
Catalyst	8
Caustic Lye	50

Reactor

Dilute HBr solution (20-25%)	1300
recovered EDC	1750
EDC loss	250
Aqueouse waste to MEE	550

1,2-Pentanediol	340
Toluene	2000
Water	1000

Reactor

Recovered Toluene	1600
Distillation loss of tolene	400
Aqueous waste to ETP	1080

DMF	2000
1,2,4- Triazole	210
Potassium Hydroxide	124
Water	1500

Reactor

Recovered DMF	1400
Dist LOSS of DMF	600
Aquouse solution of KBr	1450
Aquouse waste to ETP	500
Residue	75

Product	1000

Material Balance:

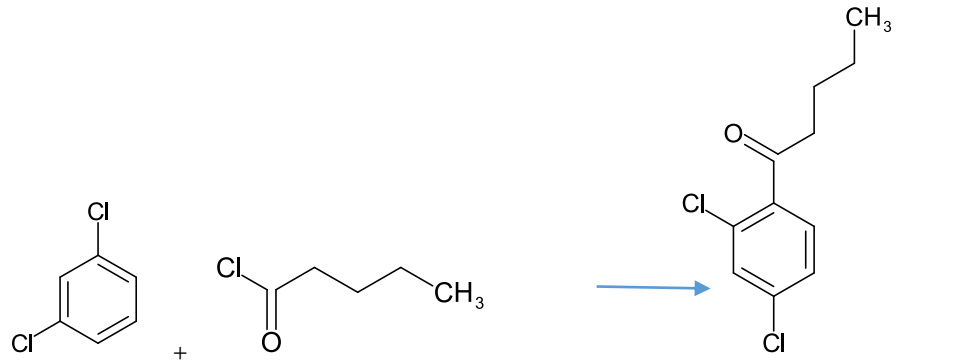
Input kg/MT		Output kg/MT	
1,3-Dichloro benzene	530	$AlCl_3$ solution	2810.0
Acetyl Chloride	283	Aqueous waste to ETP	2680.0
EDC	2000	Dilute HBr solution (20-25%)	1300.0
AlCl3	525	recovered EDC	1750
Bromine	545	EDC loss	250
Catalyst	8	Aqueous waste to MEE	550
1,2-Pentanediol	340	Recovered Toluene	1600
Toluene	2000	Distillation loss of toluene	400
DMF	2000	Recovered DMF	1400
1,2,4- Triazole	210	Dist LOSS of DMF	600
Potassium Hydroxide	124	Aqueous solution of KBr	1450
Caustic lye	50	Residue	75
Water	7250	Product	1000
Total	**15865**	**Total**	**15865**

23. Hexaconazole

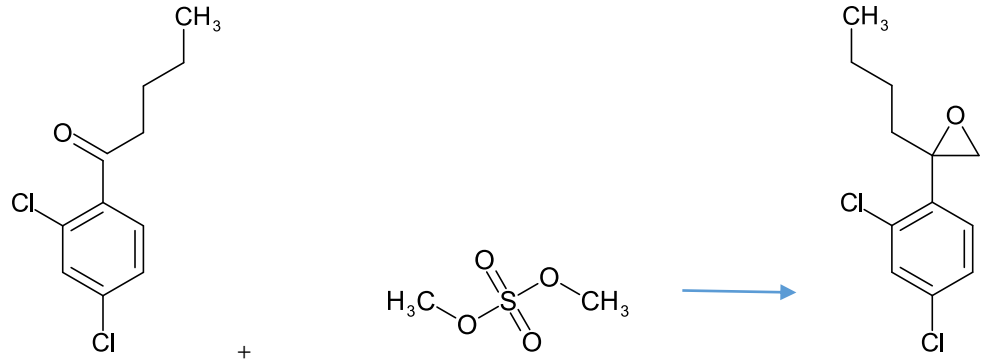
Process Description:

Charge 1,3-Dichloro Benzene (MDCB) in EDC. Add aluminium chloride, Pentanoyl Chloride. The reaction mass is quenched in chilled water. Layers are separated to get 2,4-Dichloro Velerophenone. EDC is distilled. 2,4-Dichloro Velerophenone, DMS, Catalyst and water. Add $DMSO_4$. Add KOH. Ensure completion of reaction. Recover DMS under vacuum and add EDC and water. Recover EDC to get Oxirane (intermediate). Take Oxirane ,1,2,4-Trizole and K_2CO_3 in DMF. DMF is distilled under vacuum add water and Heptane. Organic layer contains Hexaconazole. Crystallize and filter the product. Dry under vacuum.

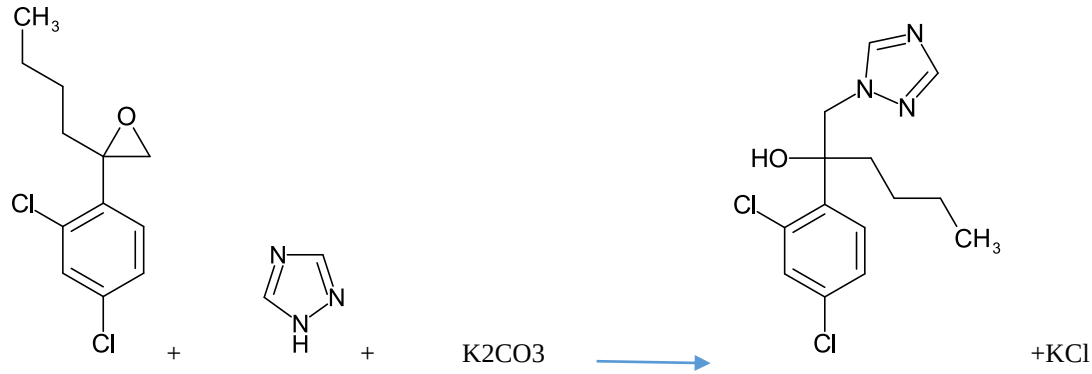
Chemical Reaction



MDCB + Pentanoyl chloride → 2.4-Dichloro Valerophenone



2,4-Dichloro Valerophenone + Dimethyl sulphate → Oxirane



Oxirane + 1,2,4-Triazole + K2CO3 → Hexaconazole +KCl

Material Balance

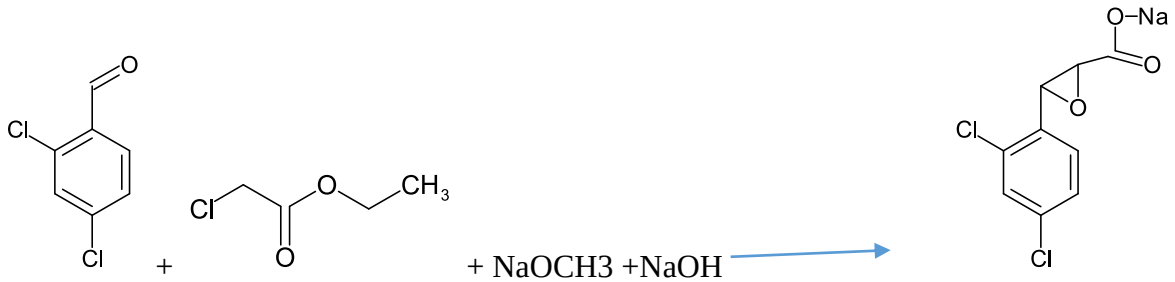
Input kg/MT		Output kg/MT	
1,3-Dichloro benzene	584	AlCl3 solution	2680.0
Pentanoyl Chloride	479	Aqueous waste to ETP	4700.0
EDC	4000	recovered EDC	3200
AlCl3	525	EDC loss	800
DMS	2000	Recovered DMS	1400
Dimethyl sulfate	552	Loss of DMS-Distillation	600
Catalyst	8	Aqueous waste to MEE	4650
Potassium Hydroxide	600	Recovered Heptane	2300
DMF	2000	Loss of heptane	200
1,2,4- Triazole	242	Recovered DMF	1400
Potassium Carbonate	140	Dist LOSS of DMF	600
Heptane	2500	Residue	100
Water	10000	Product	1000
Total	**23630**	**Total**	**23630**

24. Tetraconazole and intermediates

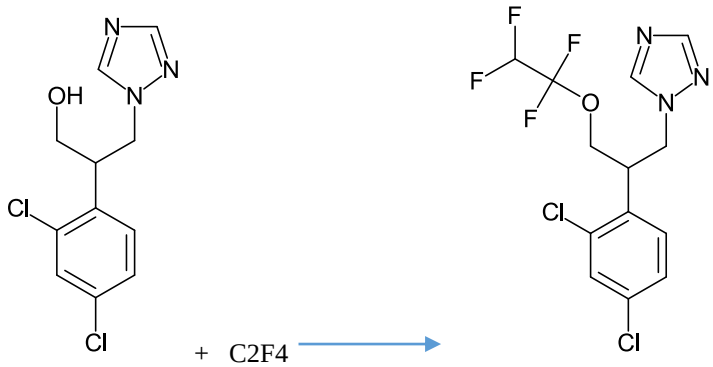
Manufacturing process:

Take ethyl chloro acetate and 2,4-Dichloro bezaldehyde in a reactor. Add 30% solution of sodium methoxide in methanol at reaction temperature. Recover methanol and add caustic lye and water. Filter the mass and dissolve cake in solvent toluene. The slurry in toluene is added in phosphoric acid and toluene solution and refluxed . Dilute phosphoric acid is separated and concentrated while Organic layer is taken to next step. Add N methyl -2-Pyrrolidone(NMP) in it and remove water by reflux. Add para Formaldehyde and 1,2,4-Triazen in it. The mass after reaction completion is drowned in acidic water. NMP comes in aqueous phase which is recovered and recycled. Aldehyde is converted to alcohol by adding sodium borohydrate solution. It is filtered and dried to get intermediate product 2-(2,4-Dichlorophenyl)-3-(1H-1,2,4-triazol-1-YL)propan-1-OL (DCPT Alcohol) . This intermediate is reacted with tetra fluoro ethylene to get Tetraconazole.

Chemical Reaction:



Intermediate (DCPT Alcohol)



Material balance:

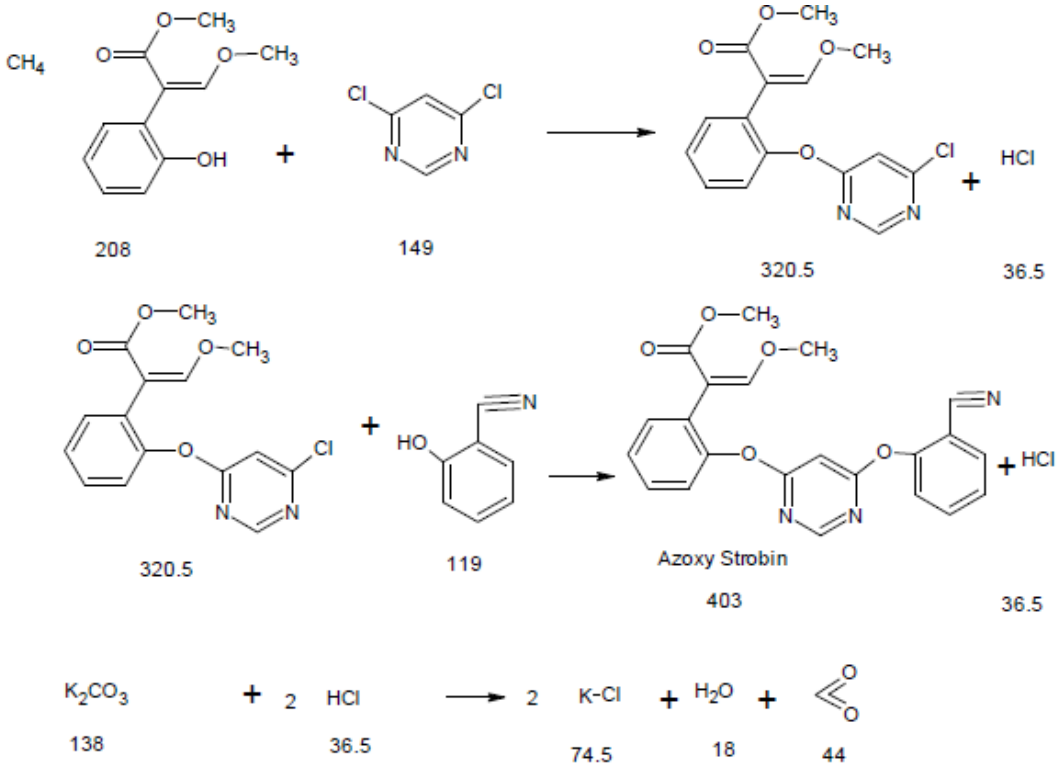
Input kg/MT		Input kg/MT	
Ethyl chloro acetate (ECA)	735.0	Spent solvent	1200
Methanol	225.0	Loss	98
2,4-Di Chloro Benzyldehyde	1065.0	Recovered Phosphoric acid	4800
Sodium Methoxide 30%	1025.0	Aqueous waste(to be sold) (Sodium acetate)	4687
Cuastic lye	1260.0	Aqueous waste to MEE	5700
Toluene	7375.0	Aqueous waste to ETP	6225
Phosphric acid	4875.0	Recovered NMP	306
N-Methyl Pyrrolidone (NMP)	340	Recovered Toluene	6637
1,2,4-Triazole(TRE)	340	Residue	750
para formaldehyde	150	Toluene distillation loss	738
Acetic Acid	335	Product	1000
Sodium borohydrite	46		
NaOH flakes	10		
HCl 30%	120		
Sodium Bicarbonate	375		
Tetra fluoro Ethane	290		
water	13575.0		
Total	**32141.0**	**Total**	**32141.0**

25. Azoxystrobin

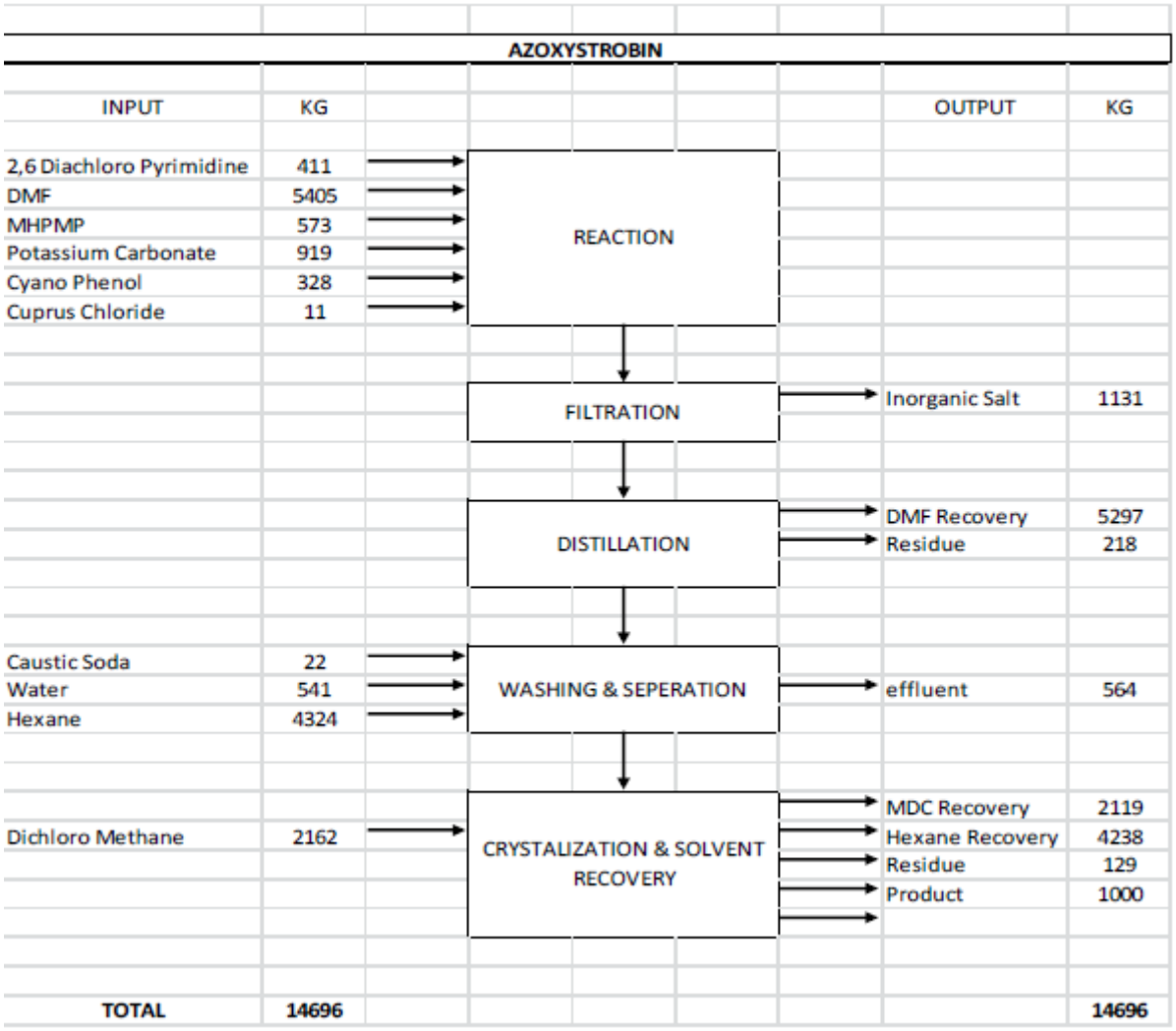
Process description:

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:



Process flowdiagram:



Material balance:

Input kg/MT		Output kg/MT	
2,6 Diachloro Pyrimidine	411	Inorganic salt	1131
DMF	5405	DMF secovery	5297
MHPMP	573	Residue	218
Potassium Carbonate	919	Effluent	564
Cyno phenol	328	MDC recovery	2119
Cuprus Chloride	11	Hexane Recovery	4238
Caustic soda	22	Residue	129
Water	541	Product	1000
Hexane	4324		
Dichloro Methane	2162		
Total	**14696**	**Total**	**14696**

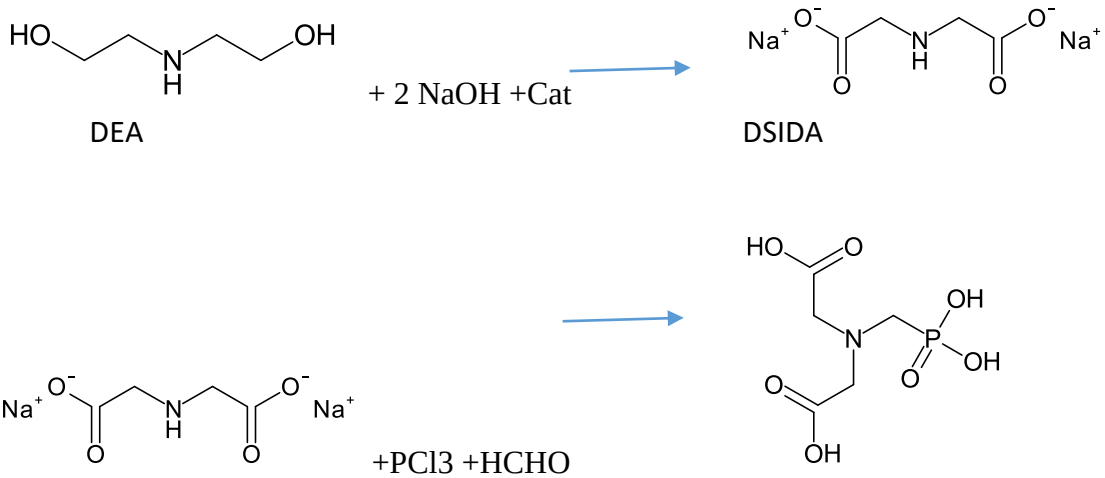
HERBICIDES

1. Glyphosate And It's Ammonium And Ipa Salts

Process description of Glyphosate

1. Diethanol amine (DEA) is reacted with sodium hydroxide in the presence of Cu catalyst at elevated temperature and pressure. It forms Disodium iminodiacetic acid. Hydrogen gas evolves and released to atmosphere. Spent catalyst after few batches is sent outside for regeneration.
2. PCl3 and formaldehyde are added to DSIDA at a very controlled rate and reaction mass is cooked to get optimum yield of PMIDA. It is filtered and take to the next step. The mother liquor is neutrallised and sent to MEE. The salt from MEE is sent to solid waste disposal sites.
3. PMIDA is reacted with Hydrogen Peroxide in presence of Catalyst and water as solvent. After cooling the mass , it is further reacted with Vanadyl Sulphate solution to get Glyphosate in slurry form. Slurry is filtered and washed with water. Wet cake is dried to get Glyphosate Tech of 95% purity. The mother liquor is treated with caustic lye to detoxify it before taking in the ETP.

Chemical reaction for Glyphosate



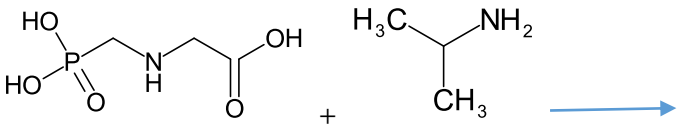
25 Manufacturing process of Ammonium Salt of Glyphosate:

1. The dried product, Glyphosate technical is reacted with ammonium carbonate in solid phase to convert it into ammonium salt of glyphosate which is added with adjuvants and formulated . The granules are packed in small packs.

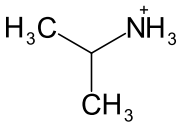
26 Manufacturing process of Isopropyl Amine (IPA) salt of Glyphosate:

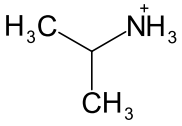
Dried Glyphosate is reacted with Isopropyl amine at low temperature in water as a solvent. After the reaction, emulsifiers and surfactants are added to make formulation of 41% IPA Salt of Glyphosate.

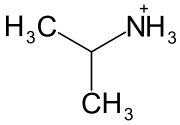
Chemical Reaction for IPA salt of Glyphosate:

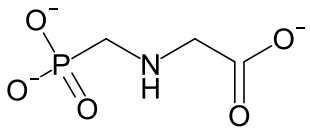


Glyphosate + Isopropyl amine









$C_{12}H_{35}N_4O_5P$

IPA salt of Glyphosate

(PubChem ID 22743554)

Process flow diagram

A									
105.4	DEA	830	7.874763						
	Water	550		Reactor			Filter catalyst-Cu (Recycle)	45	
	Catalyst -Cu	45					Hydrogen gas to atmosphere	65	
	Caustic Lye	1325						110	
		2750							
					2640				
	Water	15000					Aqueouse waste to MEE	13000	
	PCl3	970		Reactor			Aqueouse waste to ETP	3400	
	HCHO 40%	300					Drying loss	400	
	Caustic lye	190.000						16800	
		16460							
					1500		800		
	Water	3000					Aqueouse waste to MEE	3400	
	Cat-01	5		Reactor			Aqueouse waste to ETP	1200	
	H2O2 50%	490					Drying loss	300	
	Vanadyl Sulphite	5.000						4900	
	Caustic lye	100							21810
		3600							
		22810		Filter and Drier			200		
		Product: Glyphosate		1000	5.910165			21810	
B	IPA salt of Glyphosate (Formulation)								
	Glyphosate	340							
	DM Water	160							
	IPA70%	375		Reactor SS316					
	Emulsifier	125							
		1000							
					1000				
C	Ammonium Salt of Glyphosate (formulation)								
	Glyphosate	715							
116	Ammonium Carbonate	225	1.939655						
	Ammonium Sulfate	100							
	Surfactants and adjuvants	100		Plough shear mixer					
		1140							
							Drying Loss	140	
				Extruder cum drier					
		Product		1000	kgs				

Material balance:

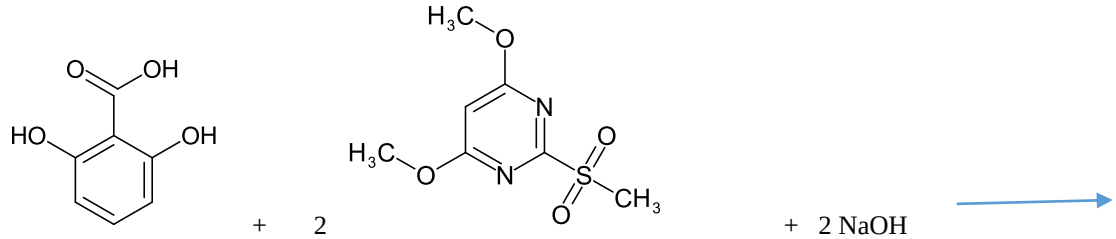
Input kg/MT		output Kg/MT	
DEA	830	Filter catalyst-Cu (Recycle)	45
Water	18550	Hydrogen gas to atmosphere	65
Catalyst -Cu	45	Aqueous waste to MEE	16400
Caustic Lye	1615	Aqueous waste to ETP	4600
PCl3	970	Drying loss	700
HCHO 40%	300	Product	1000
Cat-01	5		
H2O2 50%	490		
Vanadyl Sulphite	5.000		
Total	**22810**		**22810**

2. Bispyribac Sodium

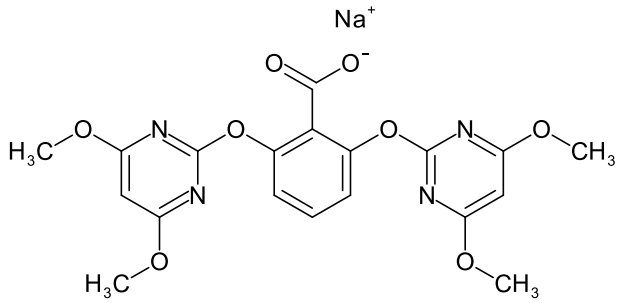
Process Description

Charge Toluene, TBAB, Caustic soda and 2,6 Di Hydroxy Benzoic acid in a reactor. Add 4,6 Di methoxy 2 Methoxy Sulfonyl Pyrimidine slowly. The reaction mass is cooked to complete the reaction. Cool the mass and filter. Take the cake in n-Butyl Alcohol and ethyl acetate. Crystallize the product and filter. The cake is dried at controlled temperature.

Chemical reaction

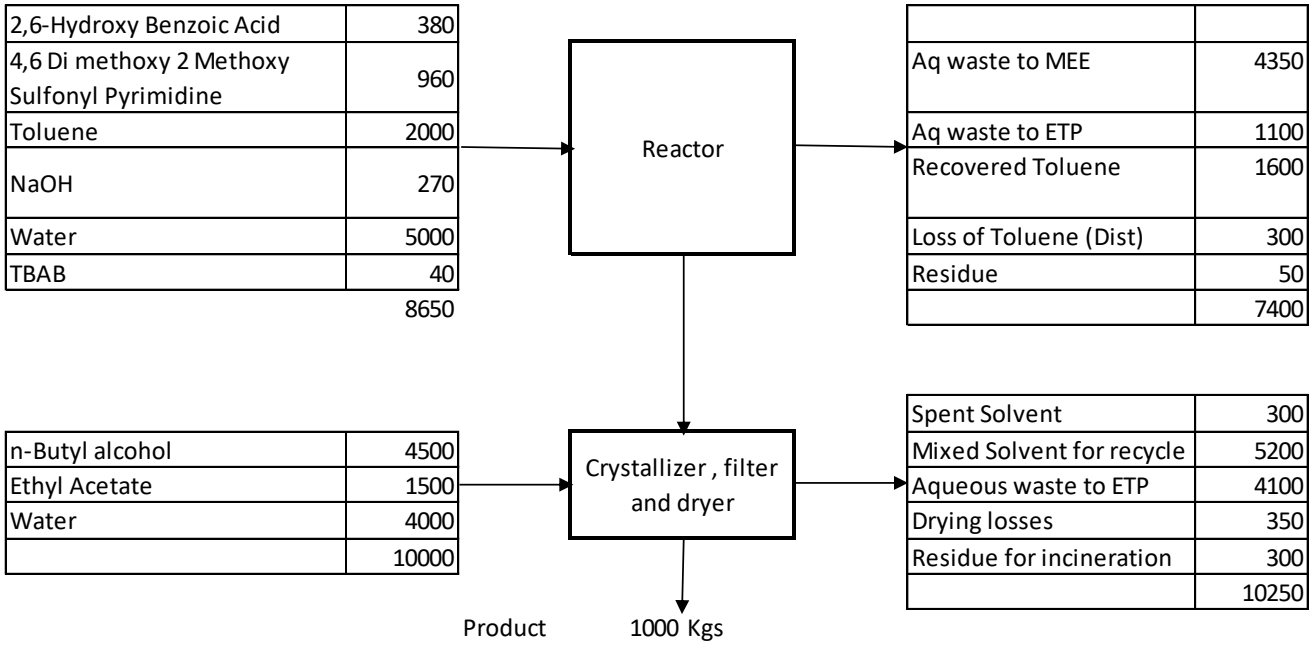


2,6-Hydroxy Benzoic Acid + 2 4,6-Dimethoxy-2-Methoxy Sulfonyl Pyrimidine + 2 NaOH



Bispyribac Sodium

Process flowdiagrm:



Material Balance

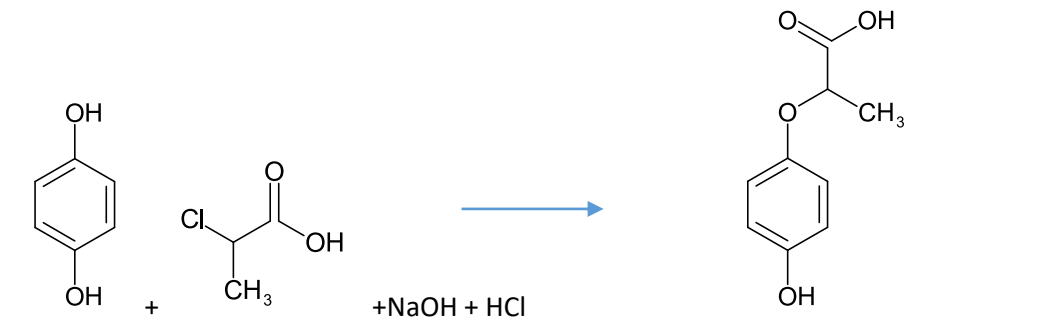
Input Kg/MT		**Output Kg/MT**	
2,6-Hydroxy Benzoic Acid	380	Aq waste to MEE	4350
4,6 Di methoxy 2 Methoxy Sulfonyl Pyrimidine	960	Aq waste to ETP	5200
Toluene	2000	Recovered Toluene	1600
NaOH	270	Loss of Toluene (Dist)	300
Water	9000	Residue (incineration)	350
TBAB	40	Spent Solvent	300
n-Butyl alcohol	4500	Mixed Solvent for recycle	5200
Ethyl Acetate	1500		
		Drying losses	350
		Product	1000
Total	**18650**	**Total**	**18650**

3.Clodinafop Propargyl

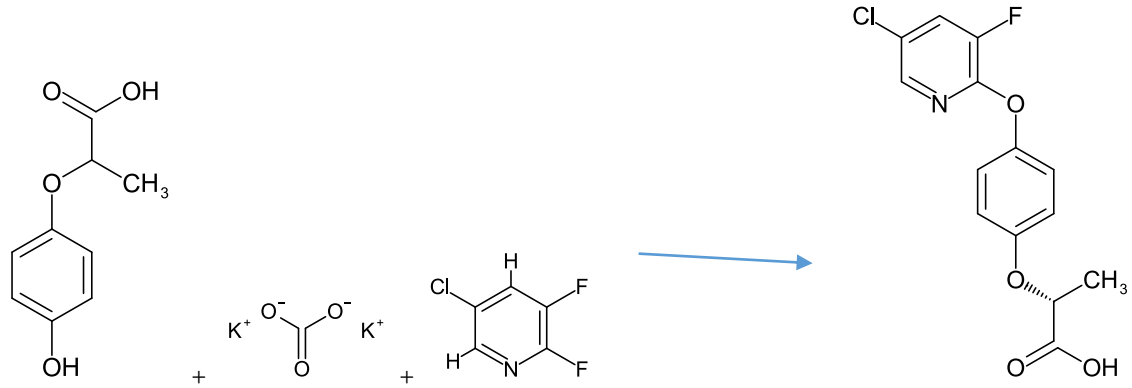
Process description

- Hydroquinone and 2-Chloro Propionic Acid (2-CPA) are condensed to get HPPA in the form of Na-salt. Execess Hydroquinone is extracted in Methyl Isobutyl ketone. It is recycled in next batch.Na-Salt of HPPA is reacted with 30% HCl solution and crystallised. This slurry is filtered and wet cake of HPPA is dried.
- Take R(+) 2-(4- hydroxyphenoxy) propionic acid (HPPA) of step-1 in solvent DMF . Charge potassium carbonate in it slowly at a controlled rate and complete formation of potassium salt .
- Add 5-Chloro -2,3-difloro pyridine (CDFP) at controlled rate. Maintain the temperature for complete conversion. After completion of reaction add propargyl chloride slowly. Recover DMF partly and add water. Solids are filtered and mixed in excess ethyl alcohol for purification. It is crystallised and filtered. The cake is dried at low temperature. Solvent is recovered from mother liquor.

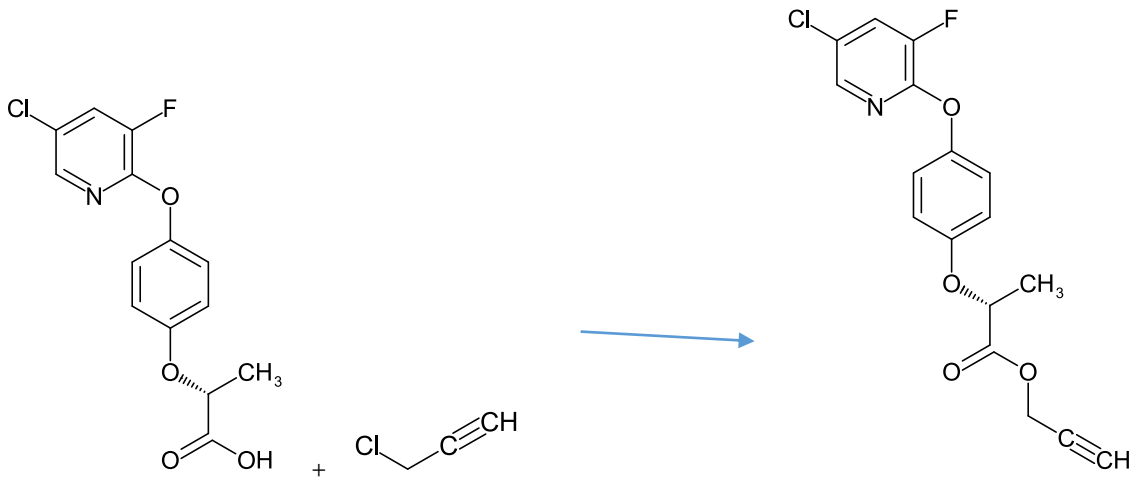
Chemical Reaction



Hydroquinone 2-CPA HPPA



HPPA CDFP Clodinafop



Clodinafop + Propargyl chloride → Clodinafop Propargyl

Process flowdiagrm:

Hydroquinone	600
2-CPA	450
Caustic lye	340
30% HCl solution	550
MEK	500
water	3000
	5440

Reactor

Recovered Hydroquinone	150
Aqueous waste to MEE	2880
Aqueous waste to ETP	1000
Evaporation loss Drying	200
Recovered MEK	560
Loss of MEK	40
	4830

DMF	3000
Potassium Carbonate	488
2,3-Difluro-5-chloro pyridine	502
Propargyl chloride	225
Water	4000
	8215

Reactor

Recovered DMF	2100
Aquous waste to MEE	1435
Aqueous waste to ETP	2790
Gas CO2	155
Loss of DMF	900
	7380

Ethyl Acohol	2000
	2000

Reactor

Recovered Ethyl alcohol	1550
Residue to incineration	245
Loss of ethyl alcohol	300
Drying loss	350
	2445

Product	1000

Material Balance

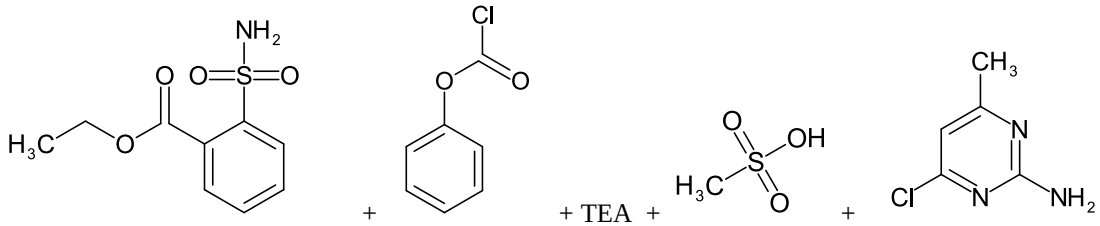
Input kg/MT		**Out put kg/MT**	
Hydroquinone	600	Recovered Hydroquinone	150
2-CPA	450		
DMF	3000	Recovered DMF	2100
Potassium Carbonate	488	Aquous waste to MEE	4315
2,3-Difluro-5-chloro pyridine	502	Aqueous waste to ETP	3790
Propargyl chloride	225	Gas CO2	155
Water	7000	Loss of DMF	900
Ethyl Alcohol	2000	Recovered MEK	560
Caustic lye	340	Loss of MEK	40
30% HCl solution	550	Recovered Ethyl alcohol	1550
MEK	500	Residue(Incineration)	245
		Loss of ethyl alcohol	300
		Drying loss	550
		Product	1000
Total	**15655**	**Total**	**15655**

4. Chlorimuron

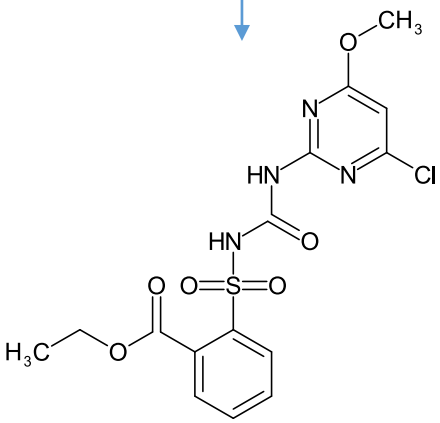
Process Description:

Sulfonamide ethyl benzoate (Sec Ethyl ester) and PCF are reacted in Acetonitrile and TEA is used as scavenger. After completing the reaction, Methyl sulfonic acid and ACMP are added. Solvent is distilled and water is added. The mass is filtered. The cake is dissolved in Methanol and recrystallized. Product is filtered and dried. It is packed in fibre drums as per the market requirement.

Chemical Reaction



Sulfonamide ethyl benzoate + PCF + TEA + MSA + ACMP



Chlorimuron

Process Flow

Sec ethyl ester	780					Recovered Acetonitril	1660
PCF	559					Recovered Methanol	690
TEA	676					Recovered TEA	655
Acetonitril	1950					Aqueous effluent to MEE	2083
Methan Sulfonic Aciid	319					Spent solvent	550
ACMP	429					Residue	765
Methanol	1300					Aqueouse waste to ETP	600
Caustic lye	250						7003
Water	1800						
	8063						
						Recovered Methanol	60
	Product			1000			

Reactor

Product filter and dryer

Material Balance:

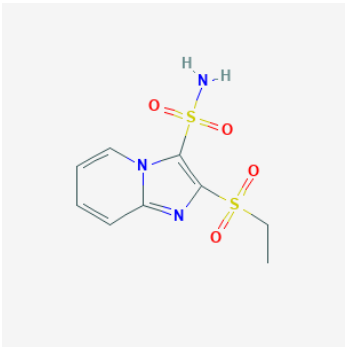
Input Kg/MT		**Output kg/MT**	
Sec ethyl ester	780	Recovered Acetonitril	1200
PCF	559	Recovered Methanol	690
TEA	676	Recovered TEA	655
Acetonitril	1950	Aqueous effluent to MEE	2153
Methan Sulfonic Aciid	319	Spent solvent	910
ACMP	429	Residue	805
Methanol	1300	Aqueouse waste to ETP	650
Caustic lye	250	Product	1000
Water	1800		
Total	**8063**	**Total**	**8063**

7. Sulfosulfuron

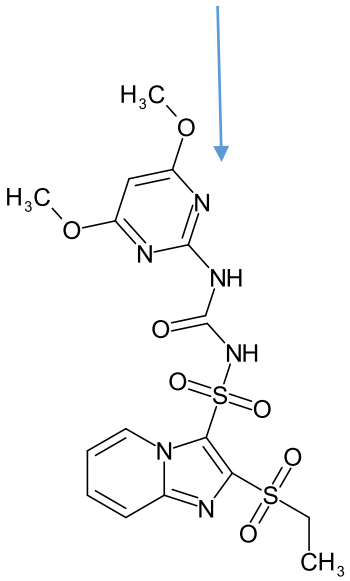
Process Description:

Take 2-Ethyl Sulfonyl Imidazo [1,2-A] Pyridine-3-Sulfonamide (ESPS) and TEA in acetonitrile and add PCF slowly. After completing the reaction add MSA and ADMP and cook the mass for 4-6 hours under the reaction monitoring system. The product is filtered in centrifuge. Solvent is recovered and recycled after purification. The residue is incinerated.Product is dried under vacuum and packed in fibre drums as per market requirement.

Chemical Reaction

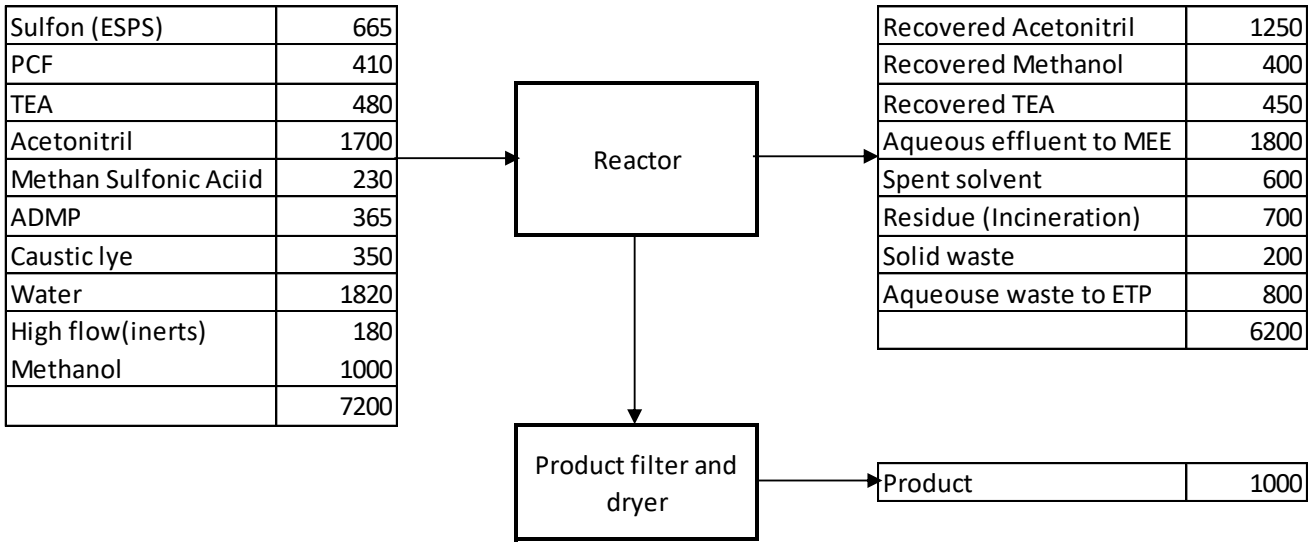


Sulfon +TEA+ PCF + MSA + ADMP



Sulfosulfuron (Product)

Process flowdaigram:



Material Balance

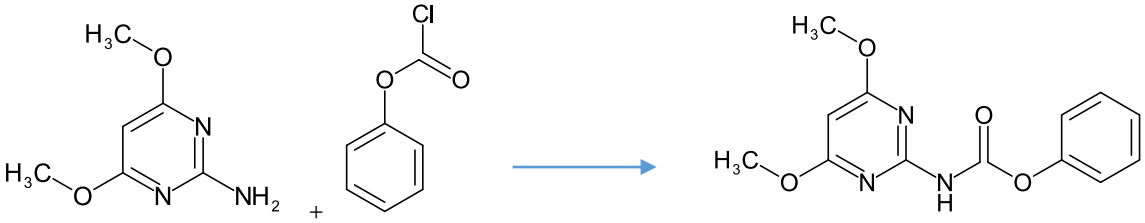
Input Kg/MT		**Output kg/MT**	
Sulfon (ESPS)	665	Recovered Acetonitril	1250
PCF	410	Recovered Methanol	400
TEA	480	Recovered TEA	450
Acetonitril	1700	Aqueous effluent to MEE	1800
Methan Sulfonic Acid	230	Spent solvent	600
ADMP	365	Residue (Incineration)	700
Caustic lye	350	Solid waste	200
Water	1820	Aqueous waste to ETP	800
High flow(inerts)	180	Product	1000
Methanol	1000		
Total	**7200**	**Total**	**7200**

8. NICO SULFURON

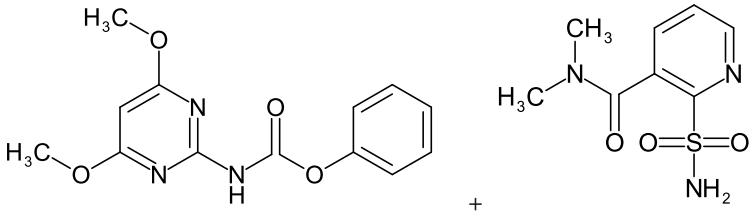
Process Description

2-Amino-4,6-dimethoxypyrimidine (ADMP) and Phenyl Chloro Formate are reacted at low temperature in the presence of 1,4-Dioxane and DMA . Acetonitrile is used as solvent. Intermediate, Pyrimidine carbamate (Phenyl N-(4,6-dimethoxypyrimidin-2-yl)carbamate)is filtered. It is further reacted with 2-Amino sulfonyl-N,N-dimethyl nicotinamide (SNA) in Acetonitrile in the presence of catalyst- DBU . The product forms and filtered at low temperature and dried under high vacuum. Solvent Acetonitrile is recovered from the mother liquor and residue is incinerated.

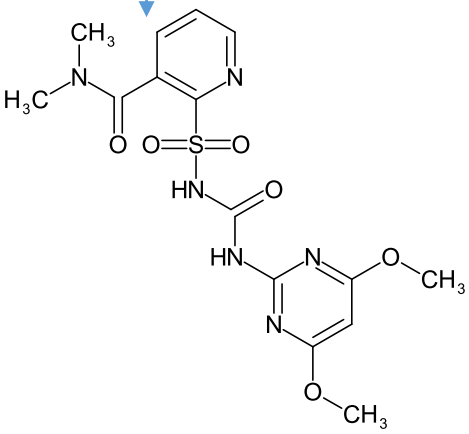
Chemical Reaction :



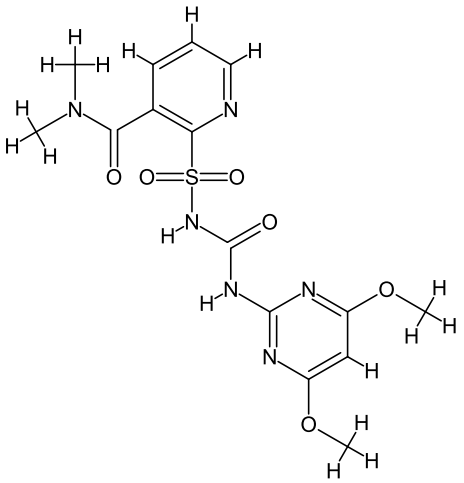
ADMP + PCF → Pyrimidine carbamate



Pyrimidine carbamate + SNA



Nicosulfuron (Product)



Process Flow

Nico sulfuron							
ADMP	625					Recovered Acetonitrile	1100
PCF	600					Effluent (Incineration)	1650
Acetonitrilr	2000	→	Reactor and filtration		→	Spent solvent	600
Cat -1	50						
DMA	75						3350
Water	600						
30%HCl	150						0
	4100			750			
SNA	625					Recovered Acetonitrile	1200
DBU	400	→	Reactor ,filtration and Drying		→	Residue	1525
Acetonitrile	2000					Spent solvent	550
Water	600					Drying loss	100
	3625						3375
	Product			1000			0

Material Balance:

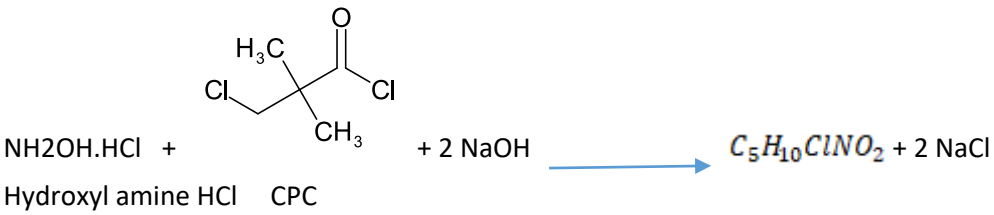
Input Kg/MT		**Output kg/MT**	
ADMP	625	Recovered Acetonitrile	2300
PCF	600	Effluent (Incineration)	3175
Acetonitrilr	4000	Spent solvent	1150
Cat -1	50	Drying loss	100
DMA	75	Product	1000
Water	1200		
30%HCl	150		
SNA	625		
DBU	400		
Total	**7725**		**7725**

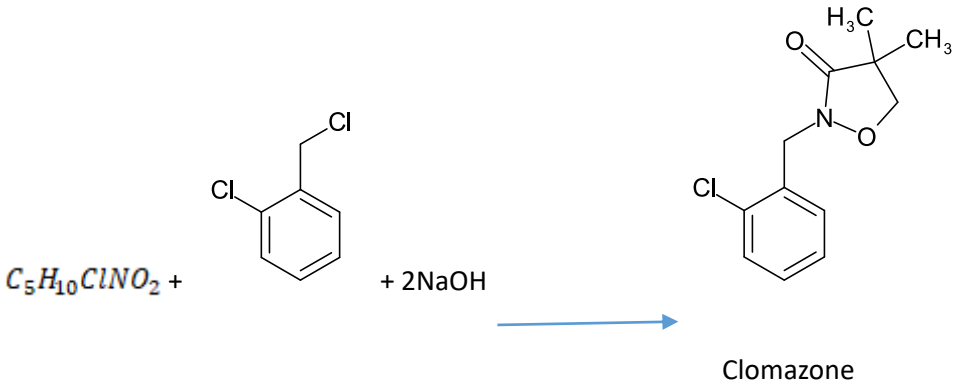
9. Clomazone

Process description

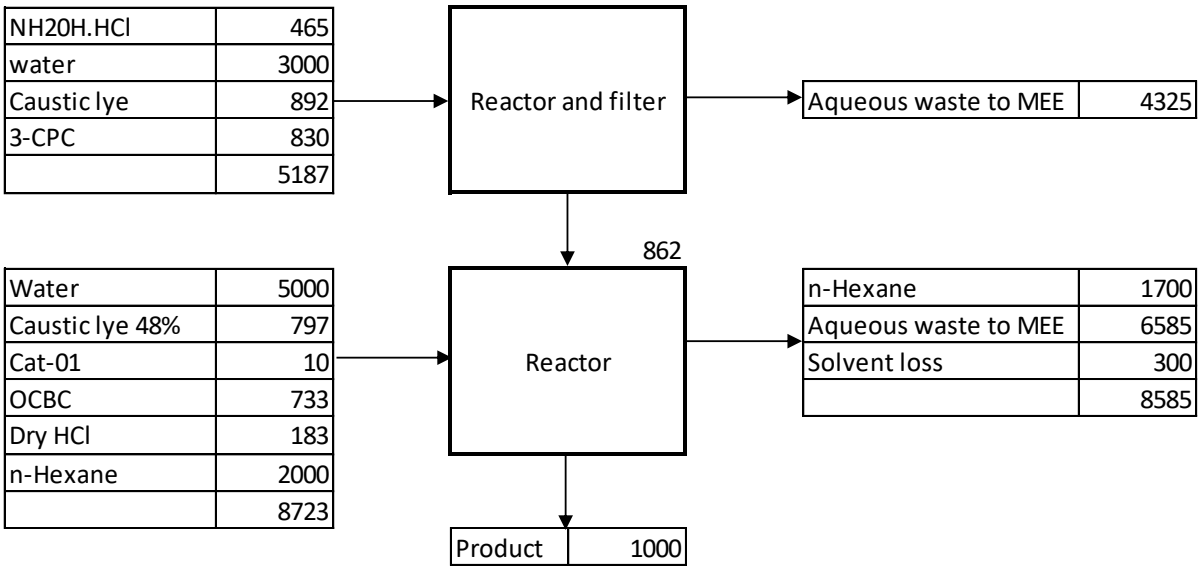
Take hydroxylamine HCl, water and add caustic lye to get desired alkalinity. Add 3-chloropivaloyl chloride (CPC) and caustic lye together slowly at reaction temperature. Filter the mass at room temperature. Solid cake is taken again in raw water and reacted with caustic lye. Add O-Chloro Benzyl chloride (OCBC) in it gradually and maintain alkalinity. Add solvent and separate aqueous layer. Organic layer is washed with water. Dry HCl is purged in organic mass and neutralised with caustic lye. After getting correct conversion, layers are separated. Solvent is recovered and recycled and the product is collected in drums.

Chemical Reaction





Process flowdaigram:



Material Balance

Input Kg/MT		Input Kg/MT	
NH20H.HCl	465	Recovered EDC	1700
Caustic lye	1689	Aqueous waste to MEE	10910
3-CPC	830	Solvent loss	300
Water	8000	Product	1000
Cat-01	10		
OCBC	733		
Dry HCl	183		
EDC	2000		
Total	**13910**	**Total**	**13910**

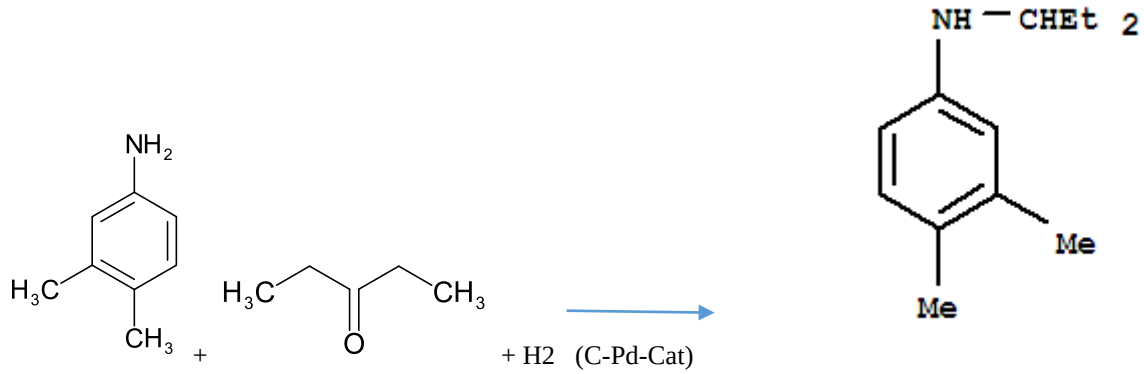
10. Pendimethalin

Process Description

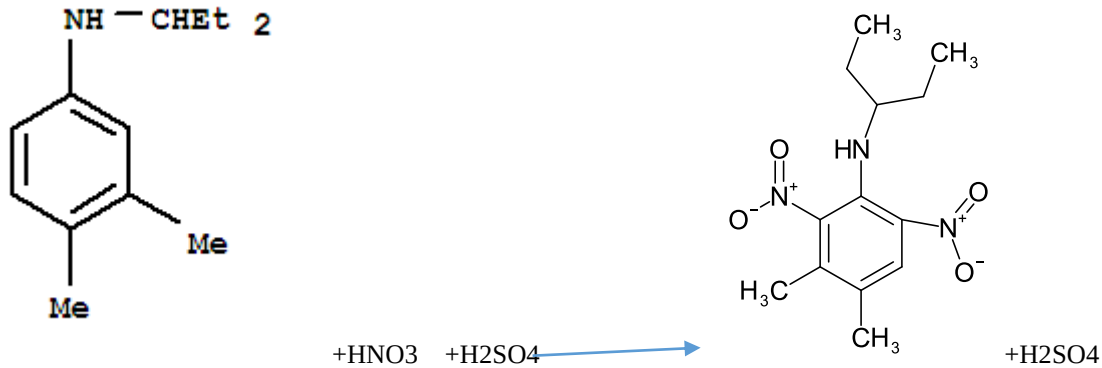
Take 3,4-xylidine, EDC ,Diethyl keton and catalyst in a pressure reactor. Hydrogen gas is purged at regulated rate to maintain the reaction temperature. Heat of reaction is withdrawn by cooling with water. After completion of reaction, separate catalyst which will be recycled in next batches for 8-10 cycles. It is regenerated at the catalyst manufacturer's facility. Solvent is recovered to get the intermediate N-(1-Ethylpropyl)-3,4-dimethylaniline.

Take intermediate of step 1 , solvent EDC and sulphuric acid. Add HNO3 acid and control rate by maintaining reaction temperature. After complete conversion, mass layers are separated. Spent sulphuric acid is disposed to authorised dealers. Organic layer is washed with water and sodium bi carbonate solution. Recover EDC and add another solvent heptane and filter the mass to remove impurities. Recover solvent and product is either flaked or filled in drums in molten condition.

Chemical reaction

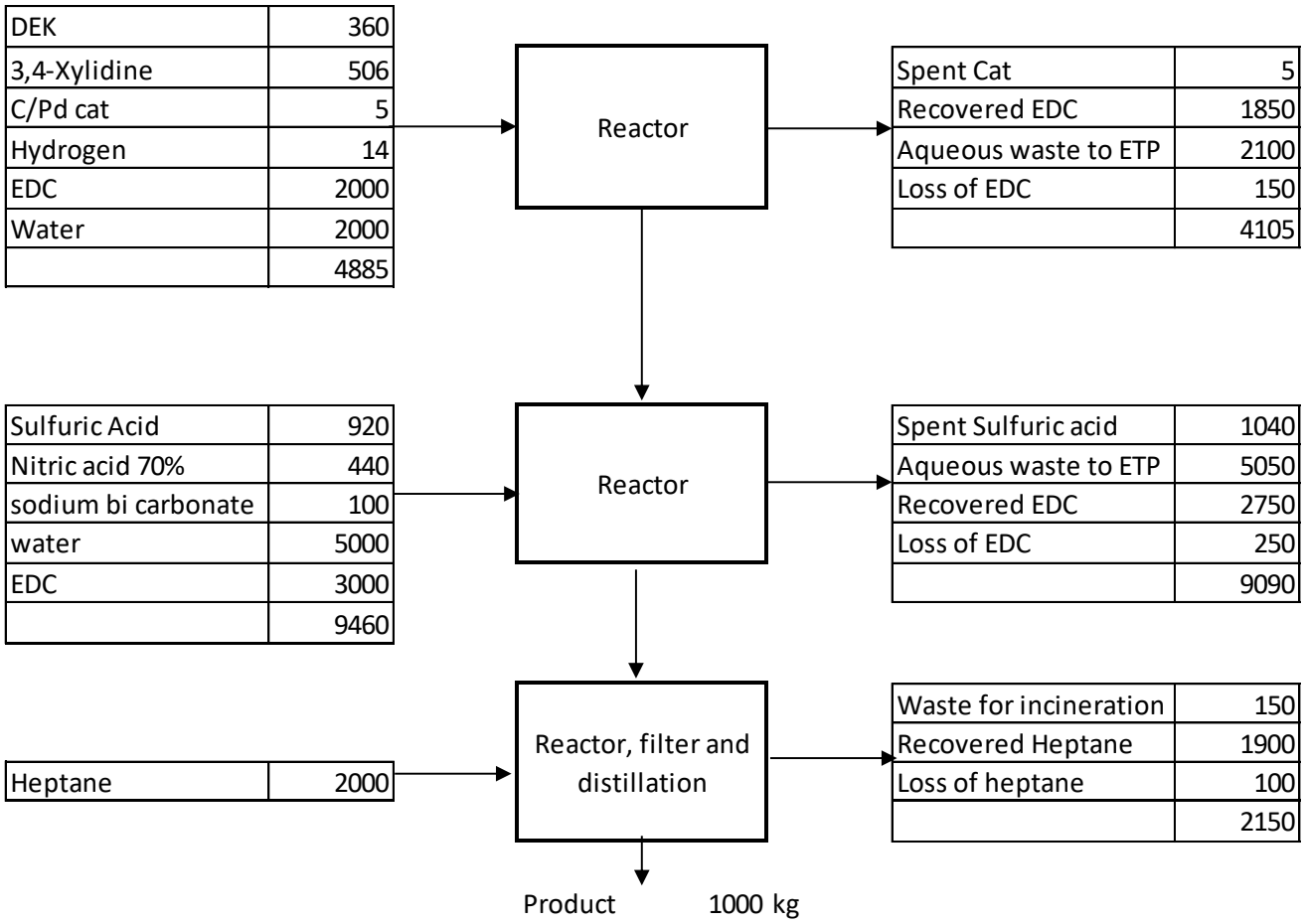


3,4-Xylidine + DEK + H2 (C-Pd-Cat) N-(1-Ethylpropyl)3,4-dimethylaniline



+HNO3 +H2SO4 +H2SO4

Process flowdaigram:



Material Balance

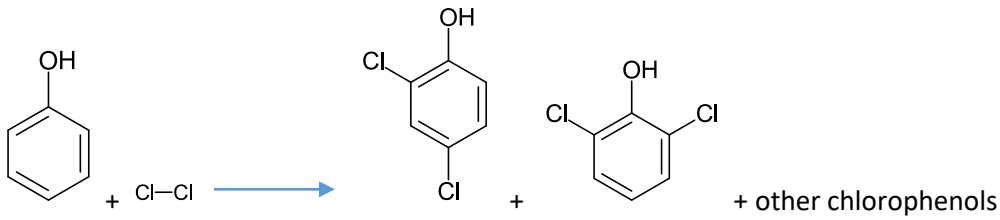
Input kg/MT		**Output kg/MT**	
DEK	360	Spent Cat	5
3,4-Xylidine	506	Recovered EDC	4600
C/Pd cat	5	Aqueous waste to ETP	7150
Hydrogen	14	Loss of EDC	400
EDC	5000	Spent Sulfuric acid	1040
Sulfuric Acid	920	Waste for incineration	150
Nitric acid 70%	440	Recovered Heptane	1900
sodium bi carbonate	100	Loss of heptane	100
Heptane	2000	Product	1000
Water	7000		
Total	**16345**	**Total**	**16345**

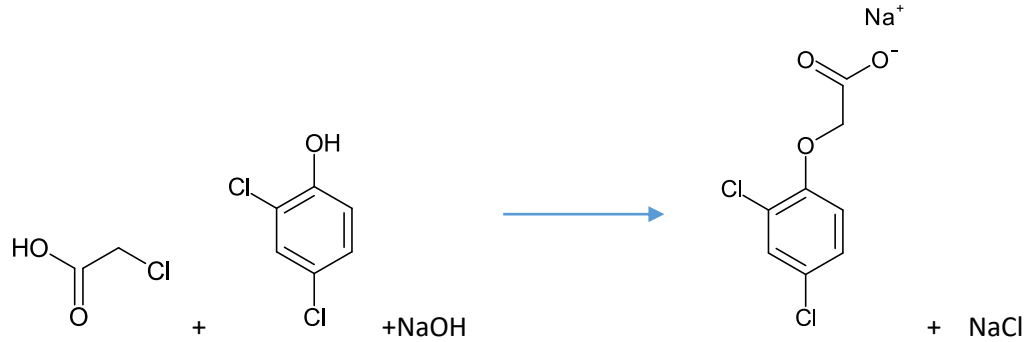
11. (2,4-D ACID) :

Process Description

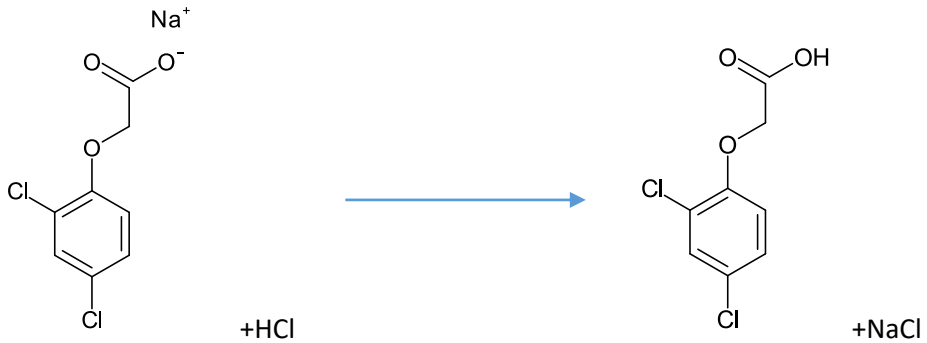
01. Phenol is reacted with chlorine gas. It form 2,4-Dichloro Phenol, 2,6-Dichloro phenol and other chlorinated phenol compounds. HCl gas is scrubbed with water followed by caustic scrubber. 2,4-DCP and 2,6- DCP are separated by distillation. The residue is either incinerated or sold to authorised agency. 2,6-DCP is sold as product.
02. 2,4-DCP is reacted with Mono chloro acetic acid and caustic lye in aqueous media . It forms 2,4-D Sodium salt. It is filtered. The mother liquor is sent to MEE after neutralisation with aqueous HCl. Salt of MEE is sent to solid disposal site.
03. The filtered wet cake is mixed with water and acidified with hydrochloric acid. The material is filtered at low temperature.
04. The cake is dried and packed as per the market requirement.

Chemical Reaction





MCA 2,4-DCP 2,4-D Sodium salt



2,4-D Acid

Material Balance

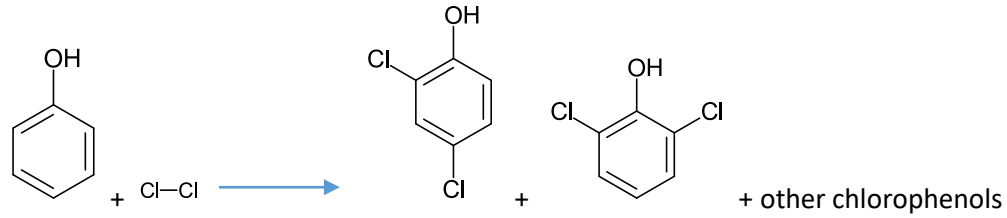
Input kg/MT		Input kg/MT	
Phenol	550	2,6-DCP	57
chlorine	848	Residue	97
MCA	584	Dil HCl	1744
Caustic Lye	736	Aqueous waste to MEE	22734
Raw water	24610	Aqueous waste to ETP	2300
HCl30% solution	960	Evaporation loss	356
		Product	1000
Total	**28288**	**Total**	**28288**

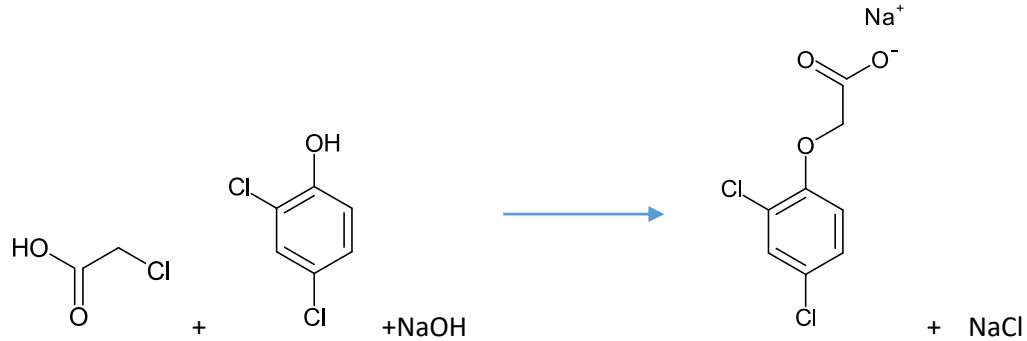
09. SODIUM SALT OF 2,4- DI CHLORO PHENOXY ACETIC ACID (2,4-D SODIUM) :

Process Description

1. Phenol is reacted with chlorine gas. It form 2,4-Dichloro Phenol , 2,6-Dichloro phenol and other chlorinated phenol compounds. HCl gas is scrubbed with water followed by caustic scrubber. 2,4-DCP and 2,6- DCP are separated by distillation. The residue is either incinerated or sold to authorised agency. 2,6-DCP is sold as product.
2. 2,4-DCP is reacted with Mono chloro acetic acid and caustic lye in aqueous media . It forms 2,4-D Sodium salt. It is filtered. The mother liquor is sent to MEE after neutralisation with aqueous HCl. Salt of MEE is sent to solid disposal site.

Chemical Reaction





MCA 2,4-DCP 2,4-D Sodium salt

Material Balance

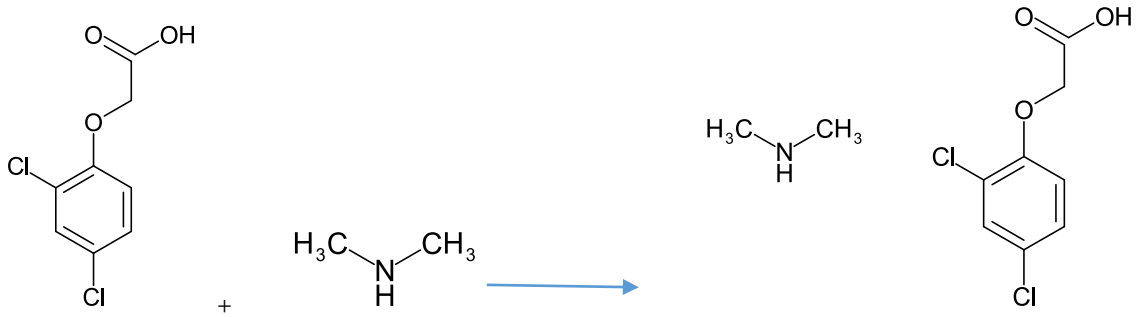
Input kg/MT		Input kg/MT	
Phenol	470	2,6-DCP	49
chlorine	724	Residue	49
MCA	458	Dil HCl	1480
Caustic Lye	548	Aqueous waste to MEE	9982
Raw water	10610	Aqueous waste to ETP	250
		Product	1000
Total	**12810**	**Total**	**12810**

12. 2,4-D AMINE

Process Description

Take 2,4-D Acid in water and add DMA 40% (Di methyl amine) slowly . Filter the mass and fill the product in drums.

Chemical Reaction



2,4-D Acid DMA 40% 2,4-D amine (water solution)

Material Balance:

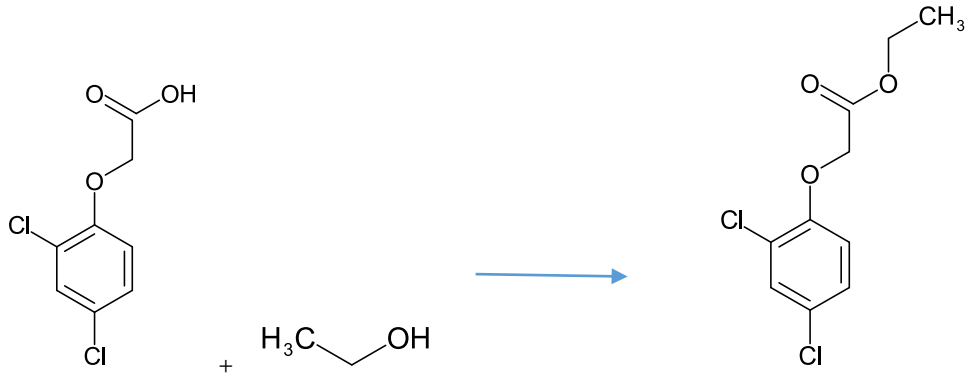
Input kg/MT		**output kg/MT**	
2,4-D Acid	620	Sludge - solid waste	35
DMA 40% Solution	315		
water	100	Product	1000
Total	**1035**	**Total**	**1035**

13. 2,4-D ETHYL ESTER

Process Description

Take 2,4-D Acid in solvent Benzene . Add PTSA . Add ethyl alcohol gradually at elevated temperature. After completing the reaction, give sodium bicarbonate wash and water wash. Recover solvent for recycling in the next batch. Product is filled in drums.

Chemical Reaction:



Material Balance:

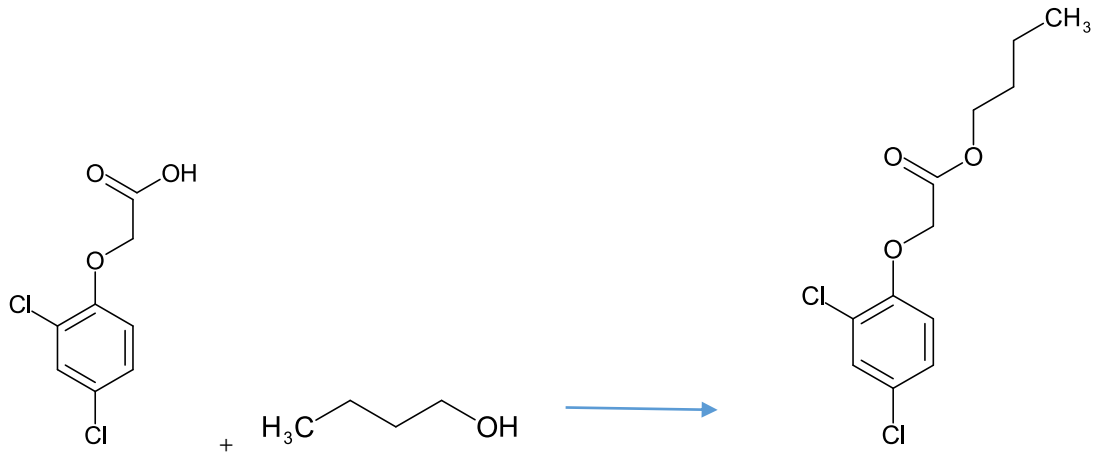
Input kg/MT		**Input kg/MT**	
2,4-D Acid	855	Aqueous waste to MEE	1015
Ethyl alcohol	303	Aqueous waste to ETP	3200
Benzene	2000	Toluene	1890
Sodium bi-carbonate	15	Loss of toluene in dist	110
Raw water	4000	Product	1000
PTSA	42		
Total	**7215**	**Total**	**7215**

13. 2,4-D Butyl Ester

Process Description

Take 2,4-D Acid in solvent Toluene . Add PTSA . Add Butyl alcohol gradually at elevated temperature. After completing the reaction , give sodium bicarbonate wash and water wash. Recover solvent for recycling in the next batch. Product is filled in drums.

Chemical Reaction



2,4-D Butyl ester

Material balance:

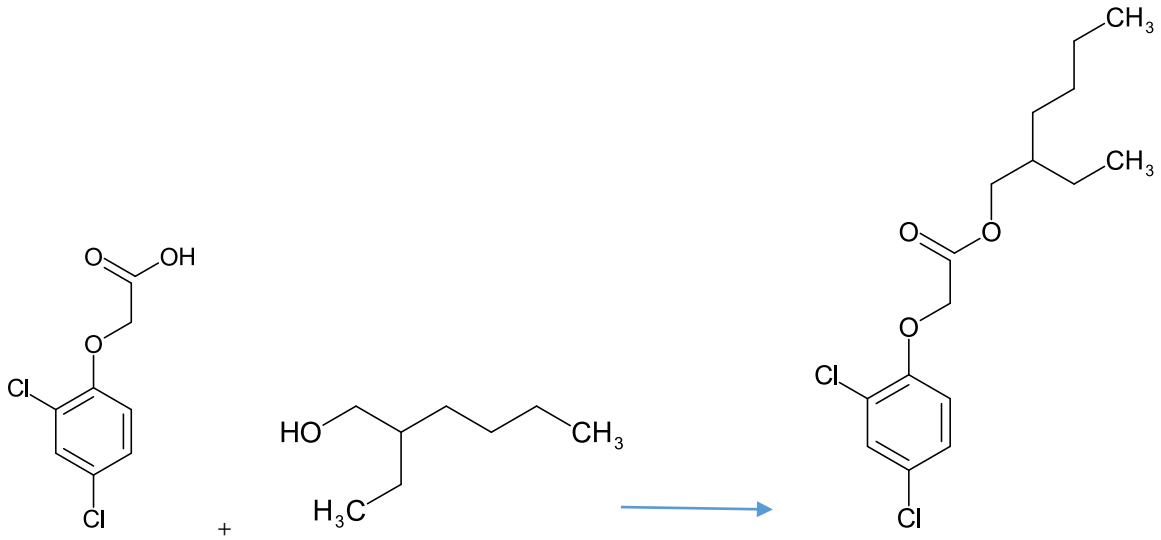
Sr. No.	Input kg/MT		Input kg/MT	
1	2,4-D Acid	840	Aqueous waste to MEE	1000
2	Butyl alcohol	295	Aqueous waste to ETP	3200
3	Toluene	2000	Toluene	1890
4	Sodium bi-carbonate	15	Loss of toluene in dist	110
5	Raw water	4000	product	1000
6	PTSA	50		
	Total	**7200**	**Total**	**7200**

14. 2,4-D Ethyl Hexyl Ester

Process Description

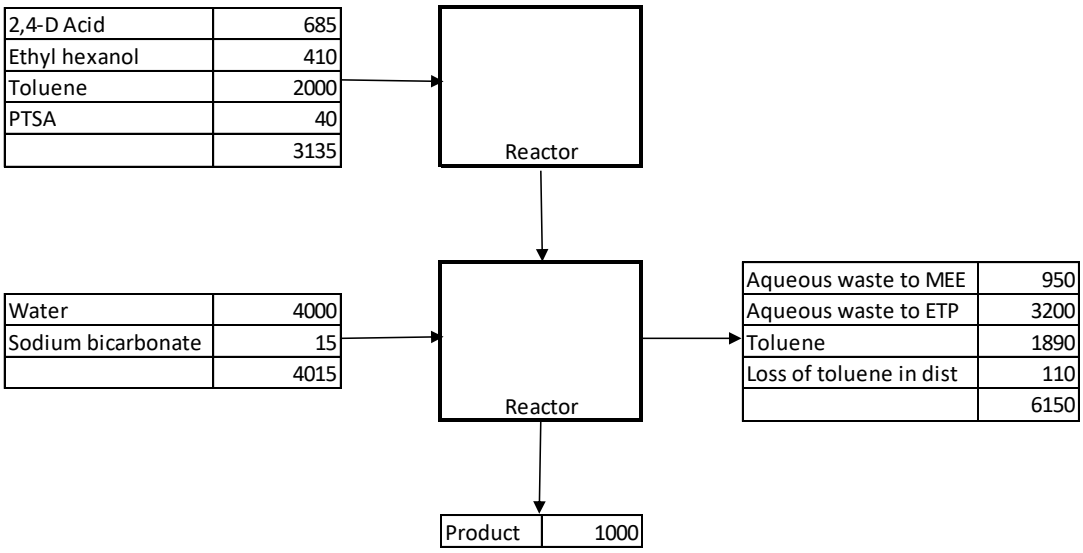
Take 2,4-D Acid in solvent Toluene. Add PTSA & Ethyl hexyl alcohol gradually at elevated temperature. After completing the reaction, give sodium bicarbonate wash and water wash. Recover solvent for recycling in the next batch. Product is filled in drums.

Chemical Reaction



2,4-D Acid + ethyl hexyl alcohol → 2,4-D Ethyl hexyl ester

Process flowdiagram:



Material Balance:

Input kg/MT		**Input kg/MT**	
2,4-D Acid	685	Aqueous waste to MEE	950
Ethyl hexanol	410	Aqueous waste to ETP	3200
Toluene	2000	Toluene	1890
Sodium bi-carbonate	15	Loss of toluene in dist	110
Raw water	4000	Product	1000
PTSA	40		
	7150		7150

15. Metribuzin

Process Description
Scheme1:

Take water and Triazinone (4-Amino-6-(tert butyl)-3-mercapto-1,2,4-triazin-5(4H)-one) in a reactor. Add Cat-1 and Cat-2 and add 48% caustic lye.

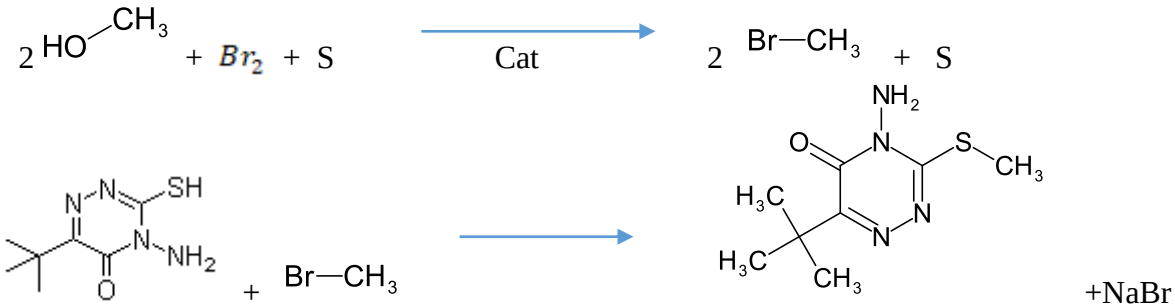
Purge Methyl bromide gas in the solution of step 1 continuously alongwith 10% NaOH solution. Methyl Bromide is generated by reaction between Methanol and Bromine in a separate reactor. After completion of reaction, cool the mass and filter to obtain wet cake. It is dried. Mother liquor contains NaBr. It is sold to the authorised dealers.

Scheme-2:

Metribuzin can alternately manufactured by following method also depending upon the financial viability at the time of manufacturing;

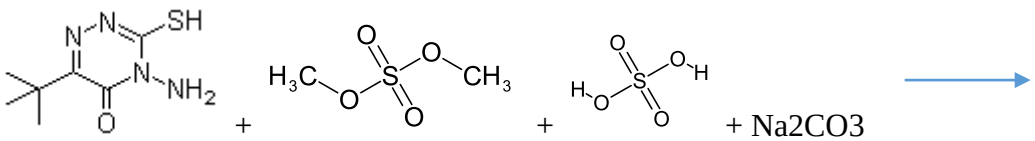
Triazinone is charged slowly in Sulfuric acid. Temperature is raised to 45 deg C and Di Methyl sulfate is charged. Maintain temperature for to complete the reaction. After completion of methylation, quench in 20% Soda ash solution. Finally adjust pH 10 with NaOH lye. Filter, centrifuged and dry the wet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

Chemical Reaction Scheme-1:

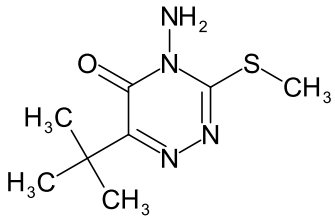


Triazinone Metribuzin

Chemical Reaction Scheme-2 :



Triazinone DMS Sulfuric Acid Soda Ash



+Na2SO4

Metribuzin

Process flowdiagram:

Sccheme-1

Triazinone	1030
Water	2000
Caustic Lye	450
	3480

Reactor

Methanol	495
Bromine	411
Cat-1	10
Cat-2	14
Caustic lye	45
	975

Methylation Reactor

Methanol Loss	95
Recovered Methanol	235
	330

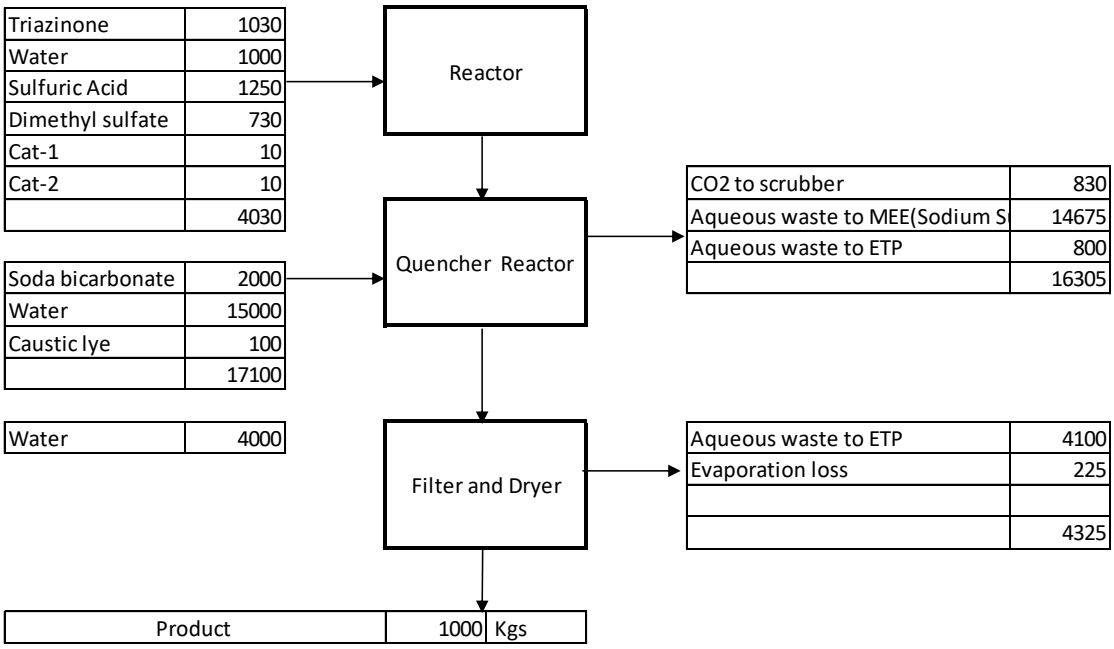
Water	4000

Filter and Dryer

Aqueous waste (NaBr solution)	3515
Aqueous waste to ETP	3200
Drying evaporation losses	410
	7125

Product	1000	Kgs

Scheme-2



Material Balance

For scheme-1

Input kg/MT		**Out put kg/MT**	
Triazinone	1030	Methanol Loss	95
Water	6000	Recovered Methanol	235
Caustic Lye	495	Aqueous waste (NaBr solution)	3515
Methanol	495	Aqueous waste to ETP	3200
Bromine	411	Drying evaporation losses	410
Cat-1	10	Product	1000
Cat-2	14		
Total	**8455**	**Total**	**8455**

For Scheme-2

Input kg/MT		**Out put kg/MT**	
Triazinone	1030	Aqeous waste to MEE	18175
Water	20000	Aqueous waste to ETP	4900
Caustic Lye	100	CO_2 to scrubber	830
Di methyl sulfate	730	Drying evaporation losses	225
Soda bicarbonate	2000	Product	1000
Sulfuric Acid	1250		
Cat-1	10		
Cat-2	10		
Total	**25130**	**Total**	**25130**

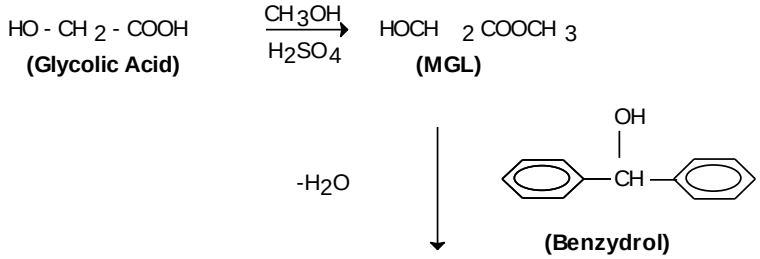
B. INTERMEDIATES

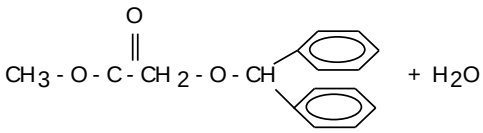
1. DHANSAFE

Process Description:

Manufacturing is carried out by Esterification reaction of Glycolic Acid with methanol and distillation to obtain Methyl Glycolate. Distillate Methyl Glycolate is then reacted in presence of solvent with Benzhydrol and intermediate product is water washed. It is further subjected to layer separation and neutralization. The mass is then distilled to get final product as residue and solvent is recovered for reuse.

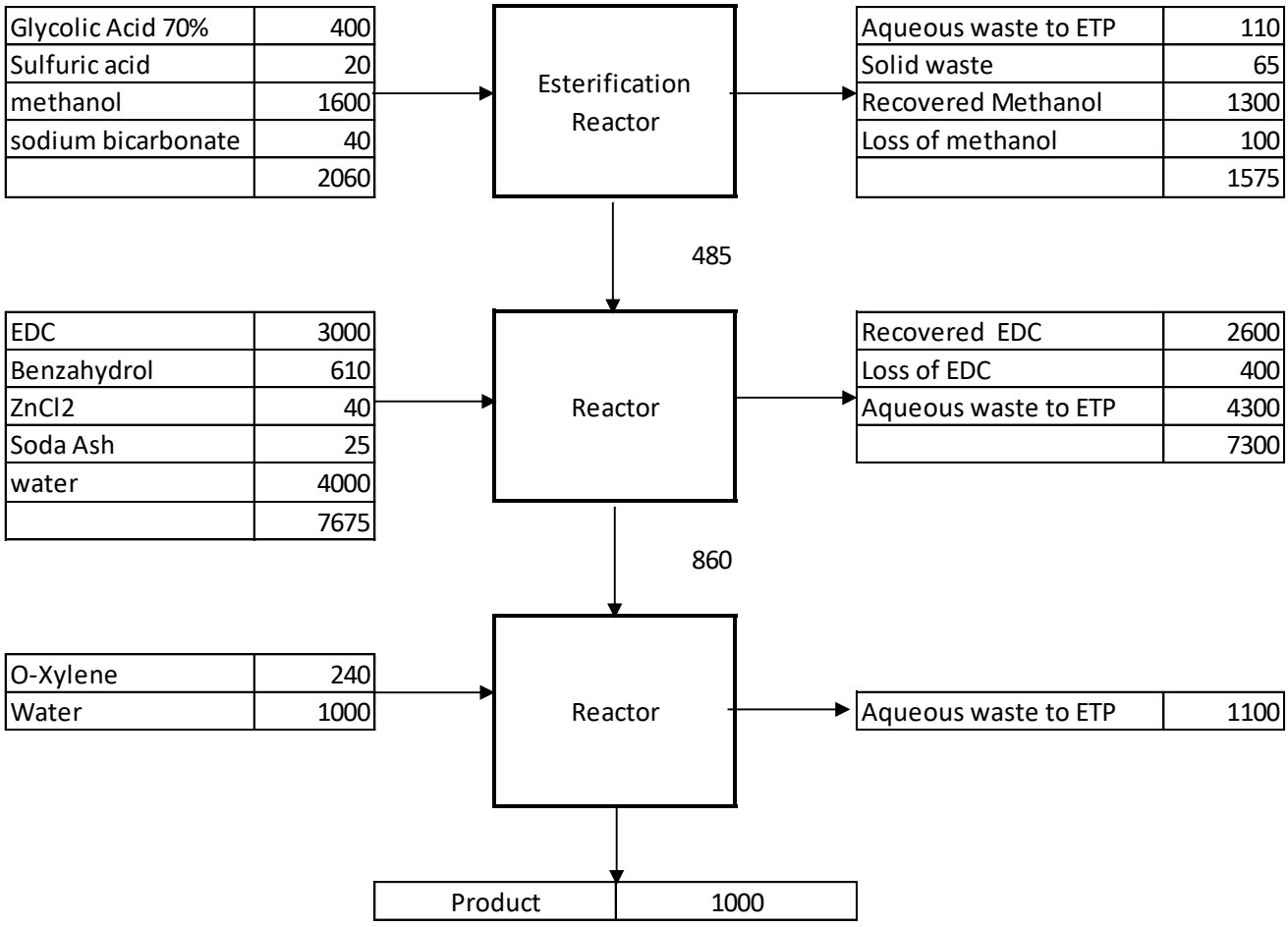
Chemical Reaction





(Methyl Diphenyl Methoxy Acetate)

Process Flow



Material Balance

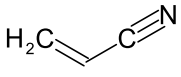
Input kg/MT		**Output kg/MT**	
Glycolic Acid 70%	400	Aqueous waste to ETP	5410
Sulfuric acid	20	Solid waste	65
methanol	1600	Recovered Methanol	1300
sodium bicarbonate	40	Loss of methanol	200
EDC	3000	Recovered EDC	2400
Benzahydrol	610	Loss of EDC	600
ZnCl2	40	Product	1000
Soda Ash	25		
water	5000		
O-Xylene	240		
Total	**10975**	**Total**	**10975**

2. DVACL (INTERMEDIATE)

Process Description:

01. Acrylonitrile and Carbon tetrachloride are reacted at elevated temperature in presence of Acetonitrile as solvent and a catalyst. It forms Tetra chloro Butyronitrile (TCBN). Organic layer contains crude TCBN. Unreacted CTC and solvent acetonitrile are recovered for re cycling. Pure TCBN is disytilled under vacuum.
02. TCBN is hydrolyzed by water at elevated temperature in presence of Sulfuric acid and converted to Tetrachloro Butyric Acid (TCBA). It is taken out in organic layer in toluene as a solvent.
03. TCBA is chlorinated with thyonyl chloride to get TCB Acid Chloride (TCBACL).
04. Distilled TCBACl is added in the mixture of n-Hexane, Isobutylene and TEA under reflux conditions. It forms 2 CB. Layers are separated. TEA is recovered from the aqueous solution.
05. 2CB in n-Hexane is isomerized to 4-chloro cyclobutanone (4CB). 4-CB is reacted with NaOH in aqueous media to form Sodium salt of DVA (DVA Na).It is reacted with HCl acid in aqueous form to form DVAcid (Cypermethric Acid). It is separated in n-Hexane as organic layer.
06. DV Acid is reacted with thionyl chloride to get DVACl. Gases HCl and SO2 are scrubbed in scrubbers. Pure DVACl is distilled from the crude mass as product. Product is filled in drums. The residue is incinerated.

Chemical Reaction

01.  $+ CCl_4 \rightarrow C_4H_3Cl_4N$

02. $C_4H_3Cl_4N + H_2SO_4 \rightarrow CCl_3CH_2CHClCOOH$

TCBN TCBA

03. $CCl_3CH_2CHClCOOH + SOCl_2 \rightarrow CCl_3CH_2ClCOCl + SO_2 + HCl$

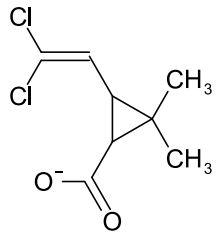
04. $CCl_3CH_2ClCOCl + (CH_3)_2CCH_2 \rightarrow CCl_3CH_2C_4H_2(CH_3)_2$

TCBACl

05. $CCl_3 - CH_2 - CCl - CO$ (I I) $(CH_3)_2C - CH_2$ (2-CB) ⟶ $CCl_3 - CH_2 - C - CO$ (I I) $(CH_3)_2C - CHCl$ (4-CB)

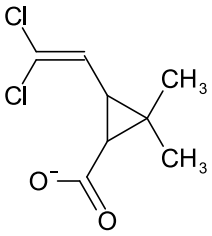
06. $CCl_3 - CH_2 - C - CO$ (I I) $(CH_3)_2C\text{-}CHCl + NaOH + HCl$ ⟶

4-CB

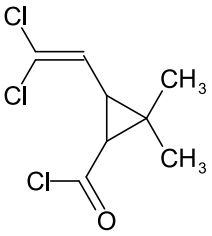


DiVinyl Acid

07.



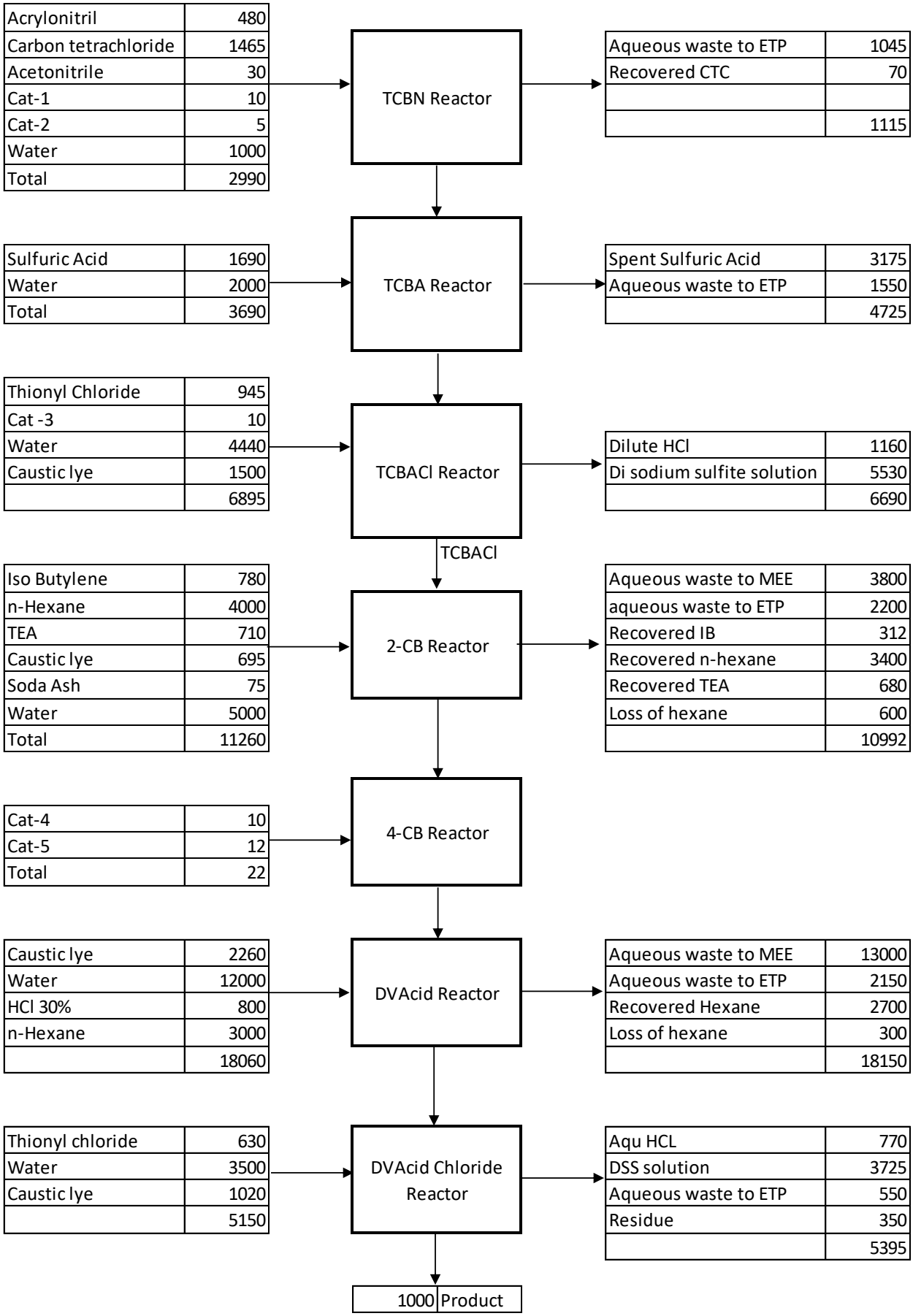
+ $SOCl_2$ ⟶



DVAcid

DVAcid Chloride

Process flowdiagram:



Material balance

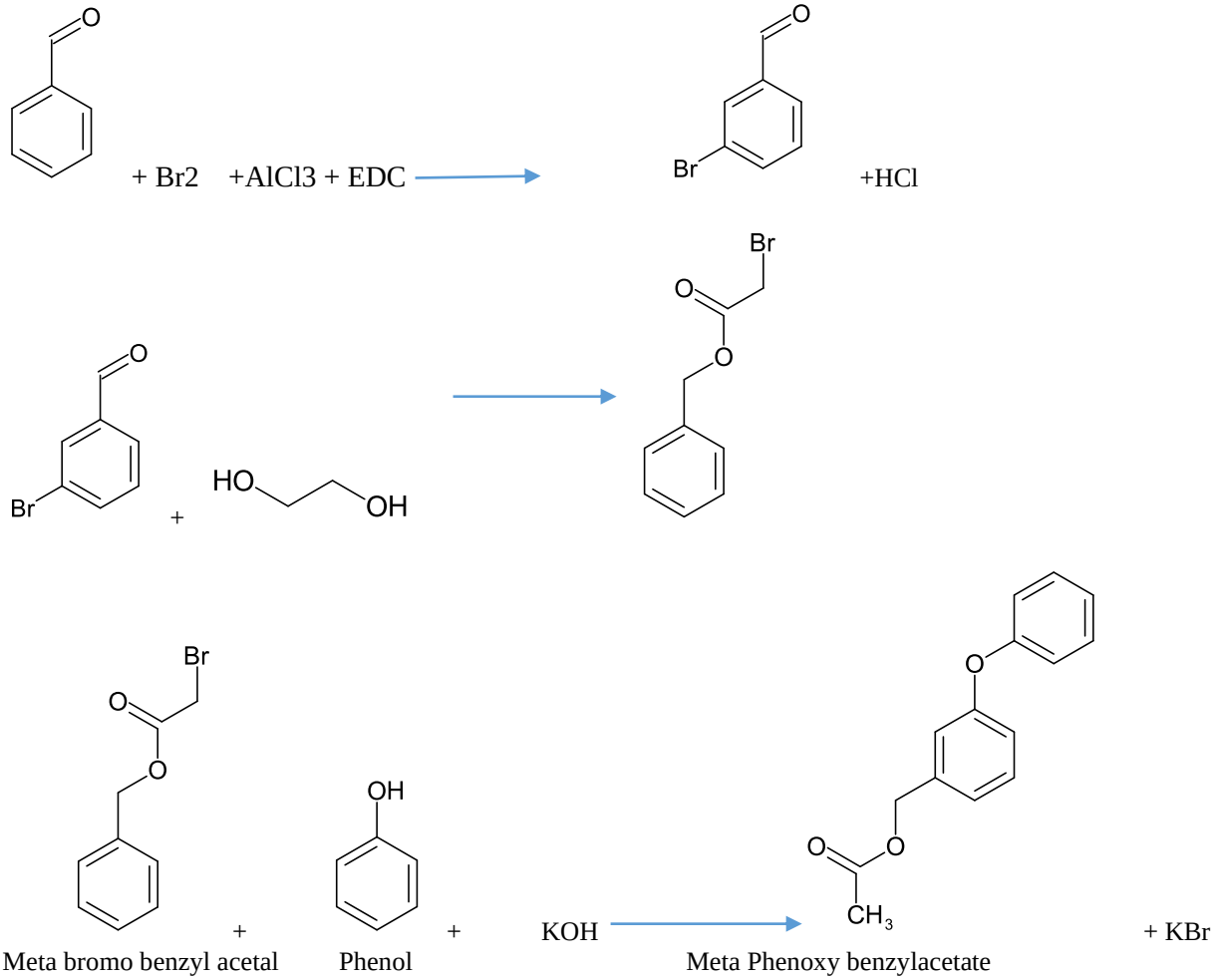
Input kg/MT		**Output kg/MT**	
Acrylonitril	480	Aqueous waste to ETP	7495
Carbon tetrachloride	1465	Recovered CTC	70
Acetonitrile	30	Spent Sulfuric Acid	3175
Sulfuric Acid	1690	Dilute HCl	1930
Thionyl Chloride	1575	Di sodium sulfite solution	9255
Iso Butylene	780	Aqueous waste to MEE	16800
n-Hexane	7000	Recovered IB	312
TEA	710	Recovered n-hexane	6100
Caustic lye	5475	Recovered TEA	680
Soda Ash	75	Loss of hexane	900
Cat-1	10	Residue	350
Cat-2	5	Product	1000
Cat-3	10		
Cat-4	10		
Cat-5	12		
HCl 30%	800		
Water	27940		
Total	**48067**	**Total**	**48067**

3. Meta Phenoxy Benzaldehyde (MPBAD)

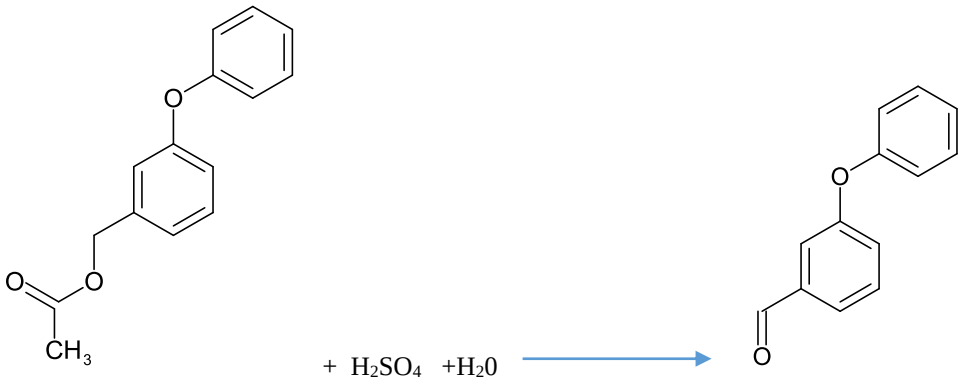
Process Description:

01. Take EDC, Aluminium Chloride and Benzaldehyde. Add Bromine slowly along with chlorine. After completion of bromination the reaction mass is quenched in chilled water and layers are separated. The organic layer is washed with sodium thiosulfate solution and water. The aqueous layer is sold to the authorised vendors. Organic layer contains Meta Bromo Benzaldehyde. (MBB).
02. MBB is converted to Meta bromo benzylacetal (MBBA) after reacting with Mono ethylene glycol (MEG).
03. Take phenol and convert it into Potassium salt by reacting with Phenol. It is further reacted with MBBA of previous step to convert it into meta Phenoxy benzyl acetate in Toluene solvent. Organic mass is separated by layer separation. The aqueous layer contains KBr. It is sold to authorised dealers for bromine recovery.
04. Meta Phenoxy Benzyl acetate is hydrolysed with dilute sulphuric acid to get Meta Phenoxy Benzaldehyde. (MPBAD)

Chemical Reaction



Meta bromo benzyl acetal Phenol Meta Phenoxy benzylacetate



Meta Phenoxy benzylacetate MPBAD

Material balance:

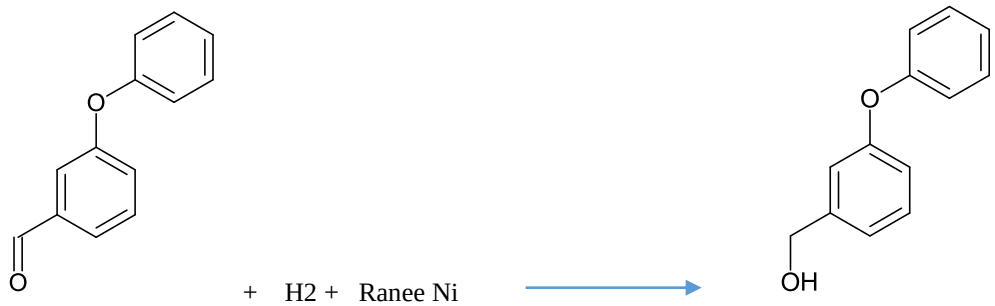
Input kg/MT		**Output kg/MT**	
Benzaldehyd	680	Aqueous waste to ETP	6890
Bromine	522	AlCl3 soltion	8600
EDC	3000	Aqueous waste -KBr solution	4200
AlCl3	1150	Dilute HCl	485
Chlorine	234	Distilled Toluene	2600
HCl 30%	500	loss of toluene	400
Water	17000	Recovered MEG	756
Sodium Thio sulfate	100	Recovered EDC	2400
MEG	945	Loss of EDC	600
Phenol	570		
KOH	350	Residue	210
Toluene	3000	Product	1000
Formic Acid	20		
Cat	10		
Sulfuric Acid	60		
Total	**28141**	**Total**	**28141**

4. Meta Phenoxy Benzyl Alcohol (MPBA):

Process Description

It is produced by hydrogenation of metaphenoxy benzaldehyde . Take Metphenoxy benzaldehyde (MPBAD) in solvent isopropyl alcohol. Add Raney Nickel . Hydrogen is passed at elevated pressure. After completion of hydrogenation , Catalyst is separated for recycling in next batch. Product MPBA is collected after distilling solvent. Spent Catalyst is sent for regeneration to catalyst manufacturers.

Chemical Reaction



MPBAD MPBA

Process flowdiagrm:

Input Output

MPBAD	1010
Hydrogen	15
Catalyst Raney Ni	50
IPA	1000
Raw Water	3000
	5075

Hydrogenator

Recovered Catalyst -Raney Ni	50
Recovered IPA	900
Loss of IPA	90
Aqueous waste to ETP	3020
Product	1000
Hydrogen loss	5

Material balance:

In put Kg/MT		Output Kg/MT	
MPBAD	1010	Recovered Catalyst -Raney Ni	50
Hydrogen	15	Recovered IPA	900
Catalyst Raney Ni	50	Loss of IPA	100
IPA	1000	Aqueous waste to ETP	3020
Raw Water	3000	Hydrogen losses	5
		Product	1000
Total	**5075**	**Total**	**5075**

5. Phenyl Acetyl Chloride

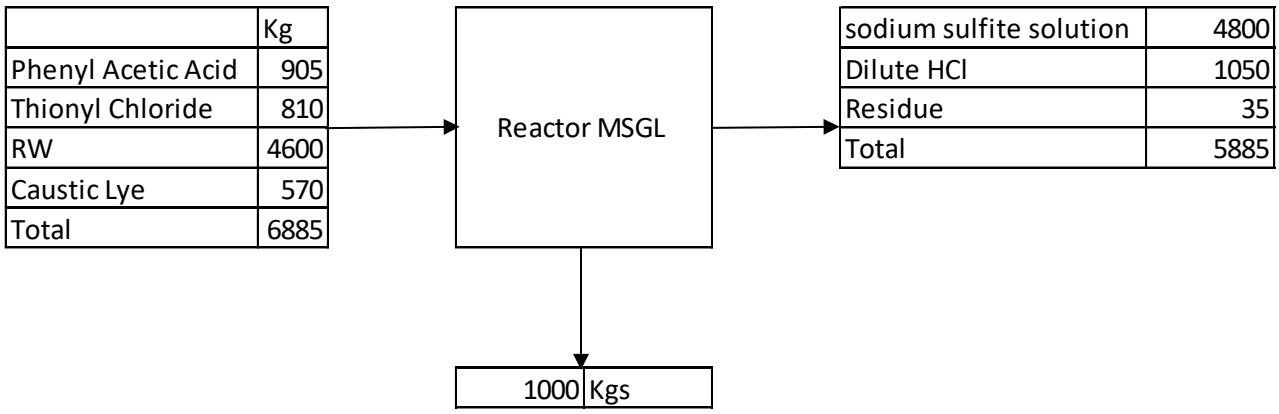
Process Description

Phenyl Acetic Acid is charged in to the MSGL Reactor and heating is started. After the required temperature, Thionyl Chloride is added slowly in the reactor. Hydrochloric Acid gas and SO2 gas generate which are scrubbed in the reactor. After completion of reaction, dissolved gases are stripped and Phenyl Acetyl Chloride is distilled. Residue is sent for the incineration.

Chemical Reaction

$C_6H_5CH_2COOH + SOCl_2 = C_6H_5CH_2COCl + SO_2 + HCl$

Process Flow



Material balance:

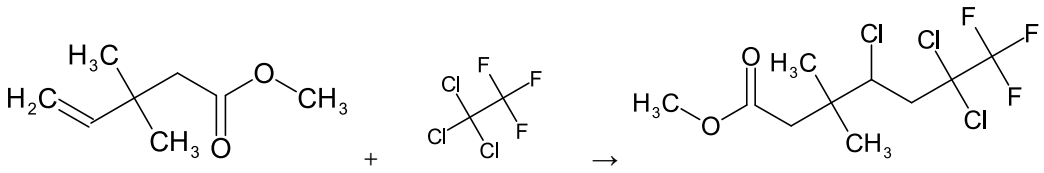
In put Kg/MT		Output Kg/MT	
Phenyl Acetic Acid	905	sodium sulfite solution	4800
Thionyl Chloride	810	Dilute HCl	1050
RW	4600	Residue	35
Caustic Lye	570	Product	1000
Total	**6885**	**Total**	**6885**

6. Lambda Cyhalothric Acid

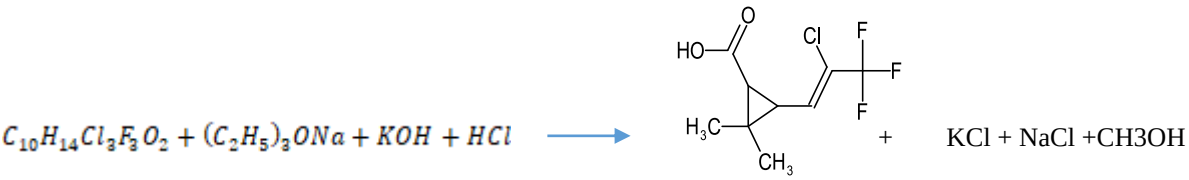
Process Description:

01. Take t-Butyl Alcohol Cat-1 & 2, Methyl 3, 3-dimethylpent-4-enoate and R-113 gas. Complete the reaction at elevated temperature and pressure. After completion of reaction, distil the solvent and fractionate bottom product to get Methyl 4,6,6-trichloro-7,7,7-trifluoro-3,3-dimethylheptanoate (Heptanoate intermediate).
02. Take Dimethylformamide. t-Butanol and Sodium t-butoxide in a reactor. Add Hepanoate intermediate slowly at very low temperature. Add KOH slowly and neutralise the mass. Recover solvent and add water. Add 30 % HCl solution to acidify the mass and filter to get Lambda Cyhalothric Acid.

Chemical Reaction:



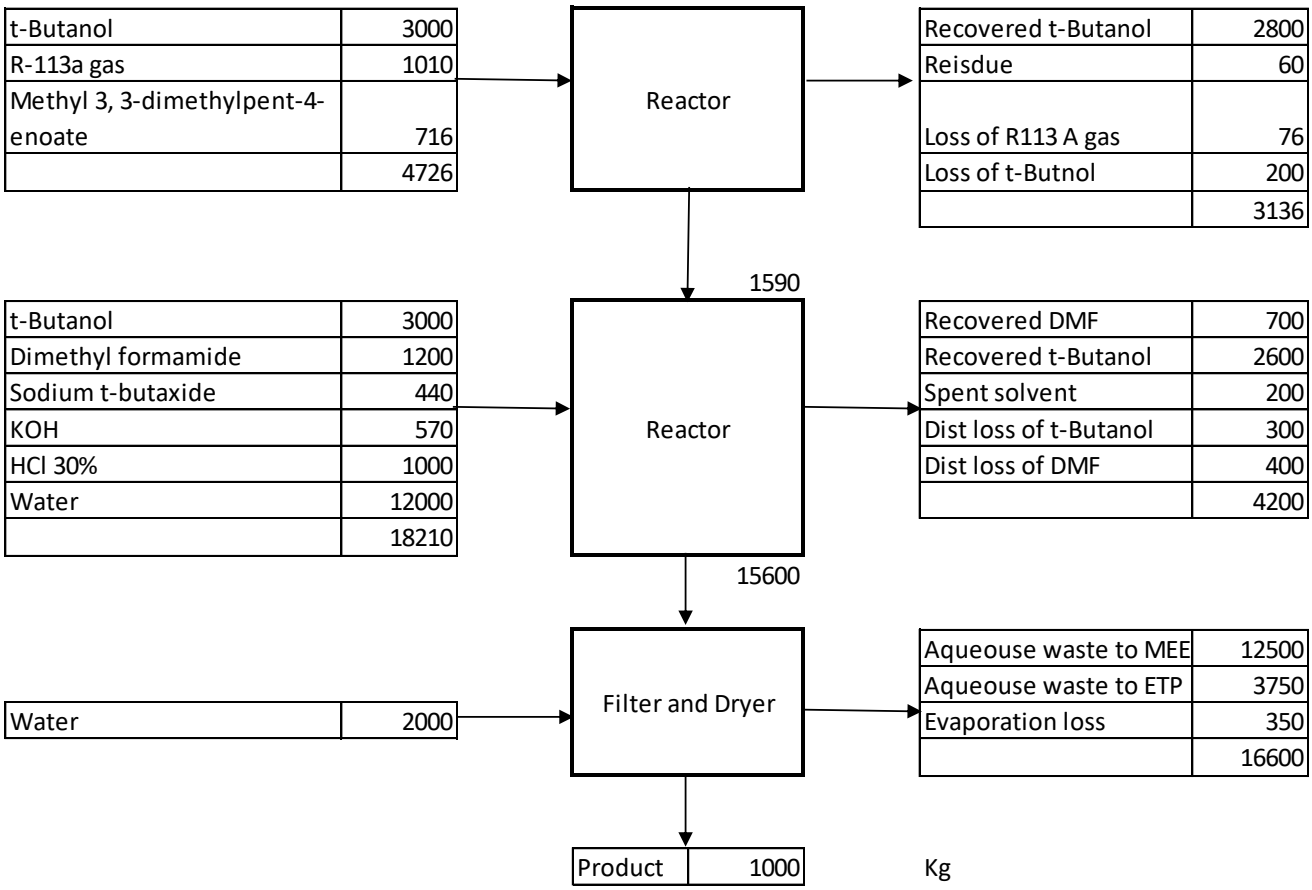
Methyl 3, 3-dimethylpent-4-enoate C-113a (C10H14Cl3F3O2) Heptanoate Intermediate



$C_{10}H_{14}Cl_3F_3O_2 + (C_2H_5)_3ONa + KOH + HCl$ → + KCl + NaCl +CH3OH

Lambda Cyhalothric Acid

Process flowdiaram



Material Balance

Input kg/MT		Output kg/MT	
R-113a gas	1010	Recovered t-Butanol	5400
Methyl 3, 3-dimethylpent-4-enoate	716	Residue for incineration	60
t-Butanol	6000	Loss of R113 A gas	76
Dimethyl formamide	1200	Loss of t-Butanol	500
Sodium t-butaxide	440	Recovered DMF	700
KOH	570	Dist loss of DMF	400
HCl 30%	1000	Spent solvent	200
Water	14000	Aqueous waste to MEE	12500
		Aqueous waste to ETP	3750
		Evaporation loss	350
		Product	1000
Total	**24936**	**Total**	**24936**