

LIST OF ANNEXURES

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Annexure-I

LIST OF PRODUCTS

S. No	Name of the Product	Quantity In Kg/Month	Quantity In Kg/Day
1	Closantel Amine(Intermediate of Closantel Base)	3000.00	100.00
2	Closantel Sodium	2000.00	66.67
3	Niclosamide	1000.00	33.33
4	Rafoxanide	1000.00	33.33
5	Triclabendazole	2000.00	66.67
Total		9000.00	300.00

Annexure-II

1. CLOSANTEL AMINE (INTERMEDIATE OF CLOSANTEL BASE)

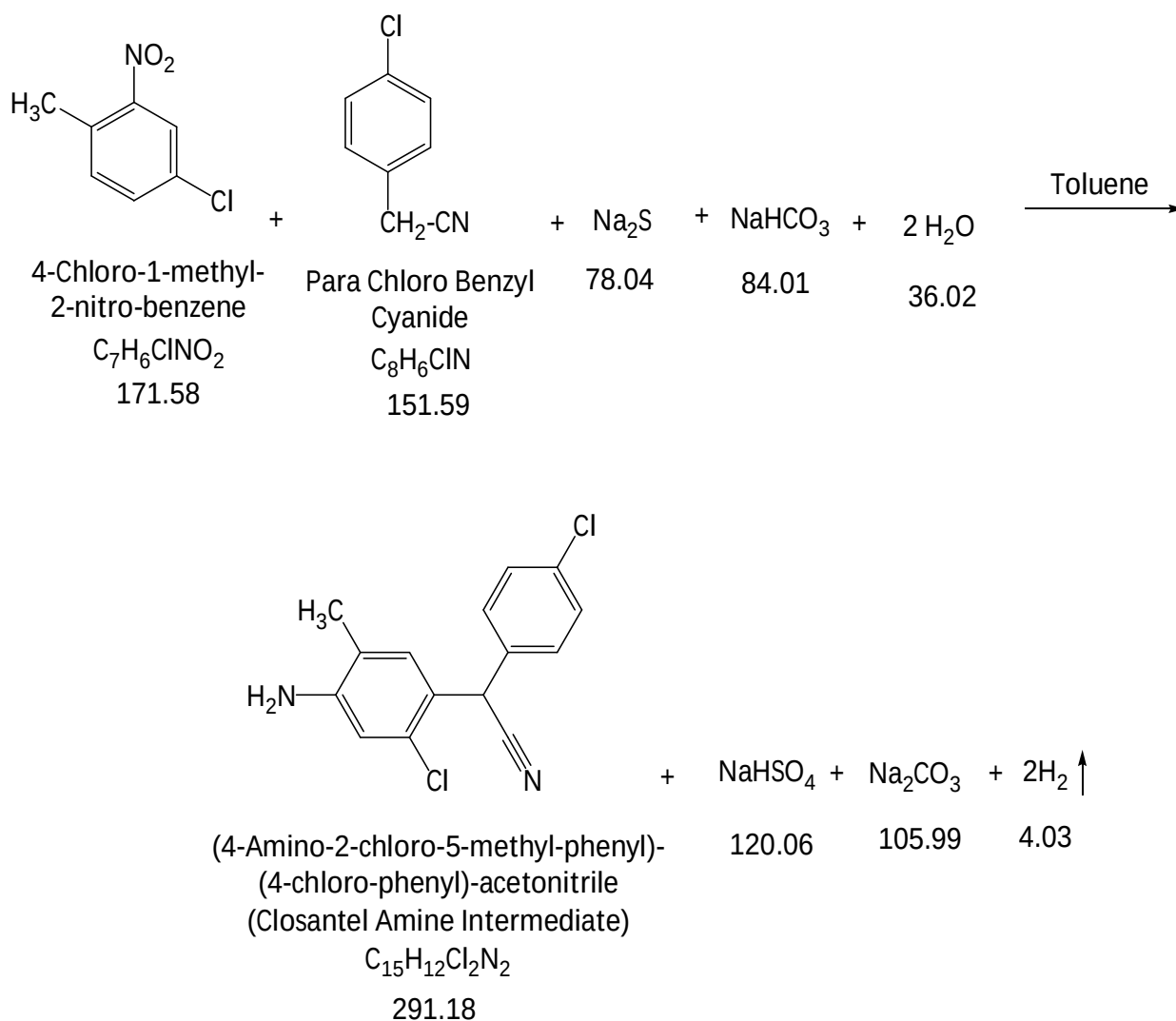
Process Description:

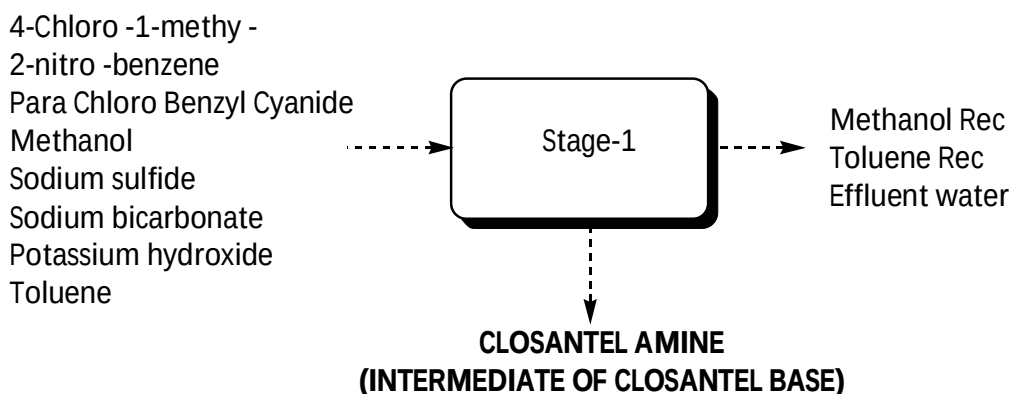
Stage-1:

Para Chloro 2-Nitro Toluene is condensed with Para Chloro Benzyl Cyanide in Methanol media in the presence of Sodium bicarbonate and Sodium sulfide to form Closantel Amine.

Route of Synthesis:

Stage-1



Flow Chart**Material Balance:**

Material balance of Closantel Amine (Intermediate of Closantel Base) Stage-1Batch Size:100Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
4-Chloro -1-methy -2-nitro -benzene	62.00	Closantel Amine (Intermediate of Closantel Base)	100.00
Para Chloro Benzyl Cyanide	55.00	Methanol Recovery	475.00
Methanol	500.00	Methanol loss	10.00
Sodium sulfide	28.20	Toluene Recovery	475.00
Sodium bicarbonate	30.50	Toluene loss	10.00
Potassium hydroxide	10.00	Effluent water	1588.70
Toluene	500.00	(Water-1487, Sodium bisulfate-43.4,Sodium carbonate-38.3, Methanol-5,Toluene-5, Potassium hydroxide-10)	
Water	1500.00	Process Emission	1.45
		(Hydrogen)	
		Organic Residue	25.55
		(Organic impurities-5.55, Methanol-10,Toluene-10)	
Total	2685.70		2685.70

2. CLOSANTEL SODIUM

Process Description:

Stage-1:

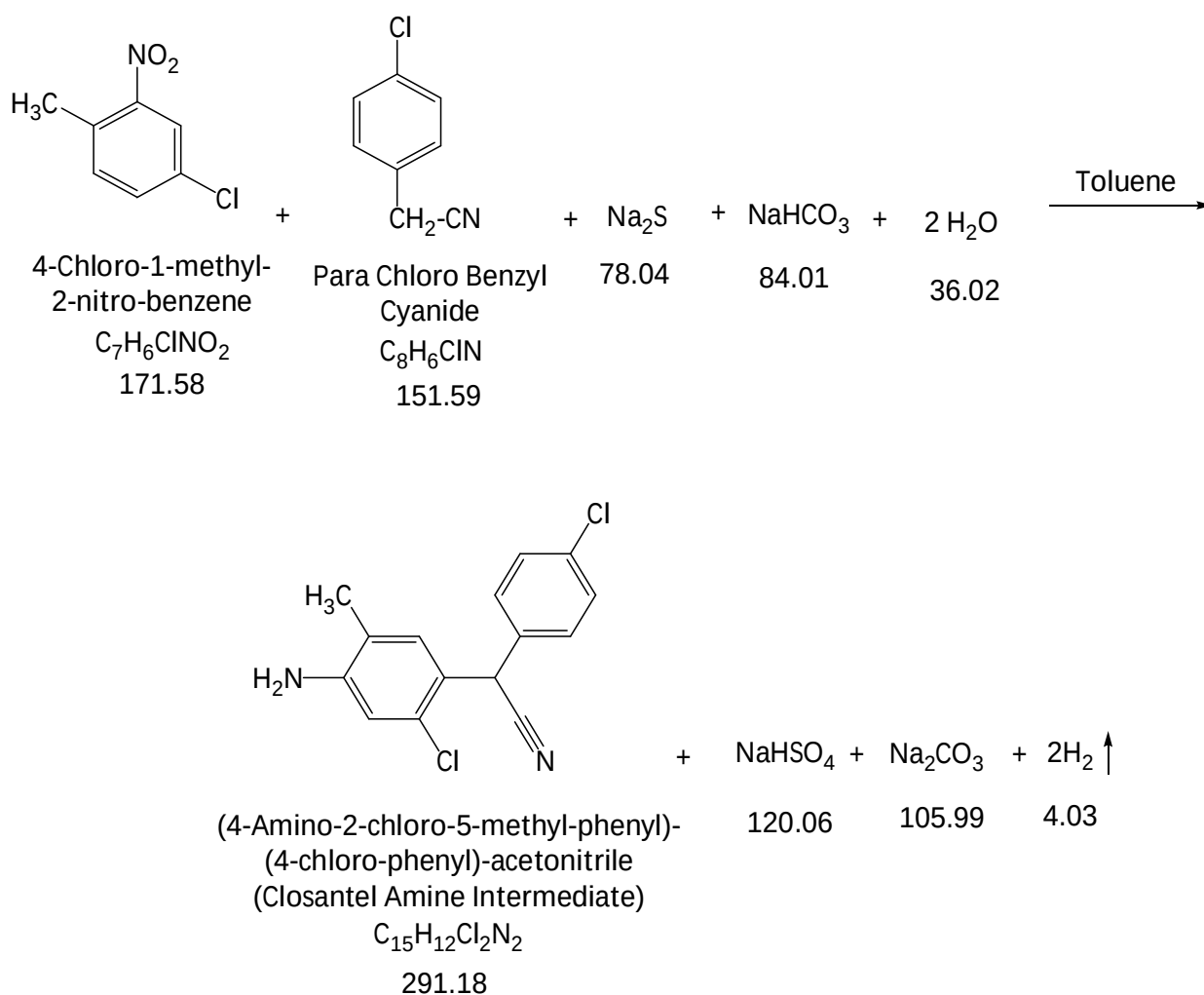
Para Chloro 2-Nitro Toluene is condensed with Para Chloro Benzyl Cyanide in Methanol media in the presence of Sodium bicarbonate and Sodium sulfide to form Closantel Amine Intermediate.

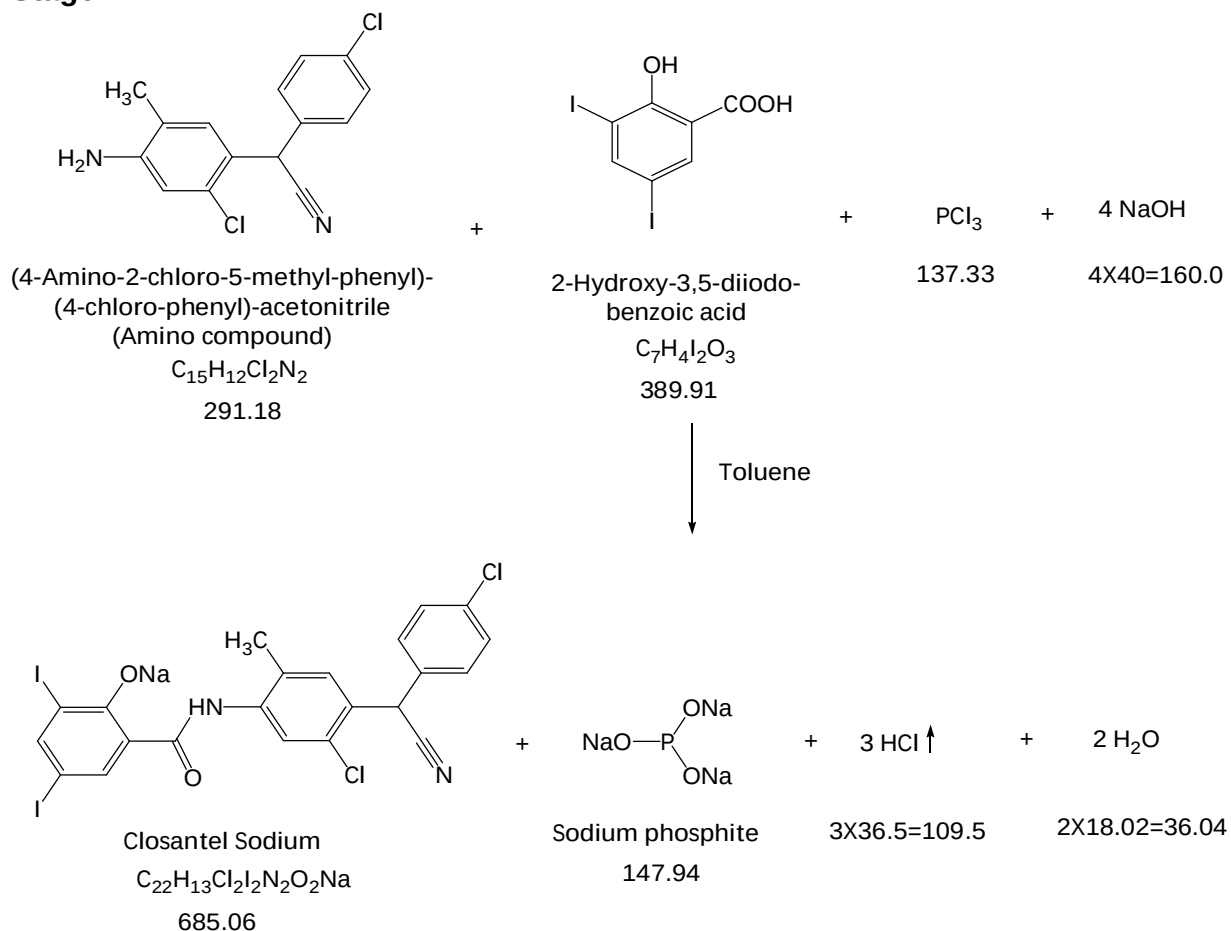
Stage-2:

The amino compound obtained from stage-1 is condensed with 3,5-Diiodo Salicylic in the presence of Phosphorous trichloride in Toluene media to get Closental Technical Product.

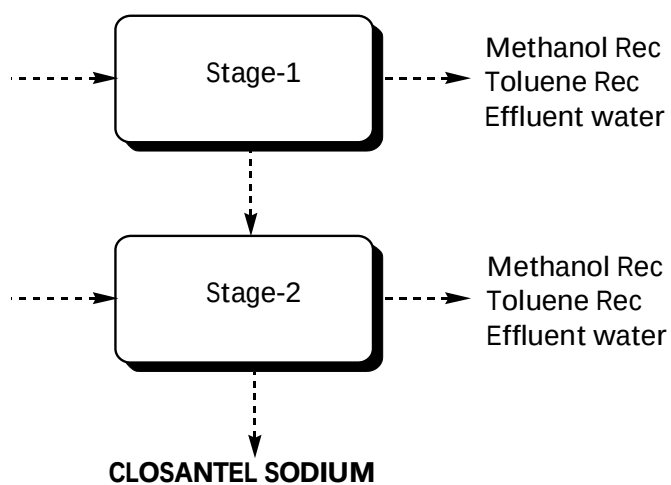
Route of Synthesis:

Stage-1



Stage-2**Flow Chart**

4-Chloro -1-methy -2-nitro
 -benzene
 Para Chloro Benzyl Cyanide
 Methanol
 Sodium sulfide
 Sodium bicarbonate
 Potassium hydroxide
 Toluene
 Stage-1
 2-hydroxy -3,5-diiodo-
 benzoic acid
 Phosphorus trichloride
 Sodium Hydroxide
 Toluene
 Methanol



Material Balance:

Material balance of Closantel Sodium Stage-1 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
4-Chloro -1-methy -2-nitro -benzene	56.00	Stage-1	90.00
Para Chloro Benzyl Cyanide	50.00	Methanol Recovery	475.00
Methanol	500.00	Methanol loss	10.00
Sodium sulfide	26.00	Toluene Recovery	475.00
Sodium bicarbonate	28.00	Toluene loss	10.00
Potassium hydroxide	10.00	Effluent water	873.70
Toluene	500.00	(Water-788, Sodium bisulfate-31.2, Sodium carbonate-34.5, Methanol-5, Toluene-5, Potassium hydroxide-10)	
Water	800.00	Process Emission	1.32
		(Hydrogen)	
		Organic Residue	34.98
		(Organic impurities-14.98, Methanol-10, Toluene-10)	
Total	1970.00	Total	1970.00

Material balance of Closantel Sodium Stage-2 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-1	90.00	Closantel Sodium	200.00
2-hydroxy -3,5-diiodo-benzoic acid	121.00	Methanol Recovery	475.00
Phosphorus trichloride	43.00	Methanol loss	10.00
Sodium Hydroxide	50.00	Toluene Recovery	570.00
Toluene	600.00	Toluene loss	12.00
Methanol	500.00	Effluent water	770.85
Activated carbon	5.00	(Water-700, Generated water-11.13, Sodium phosphite-45.72, Methanol-5, Toluene-9)	
Hyflow	3.00	Process Emission	33.80
Water	700.00	(Hydrogen chloride)	
		Spent carbon & Hyflow	8.00
		Organic Residue	32.35
		(Organic impurities-13.35, Methanol-10, Toluene-9)	
Total	2112.00	Total	2112.00

3. NICLOSAMIDE

Process Description:

Stage-1:

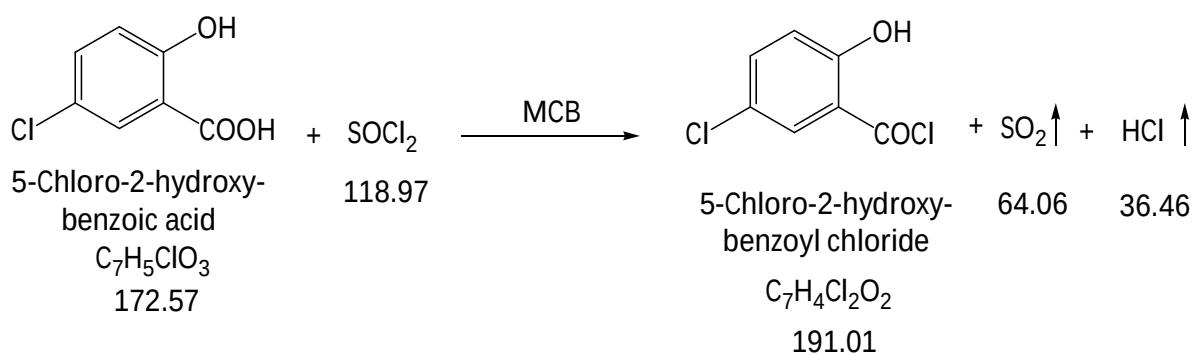
5 Chloro Salicylic Acid and Thionyl chloride added to reactor containing Mono Chloro Benzene solvent to get 5-Chloro-2-Hydroxy Benzoyl Chloride.

Stage-2:

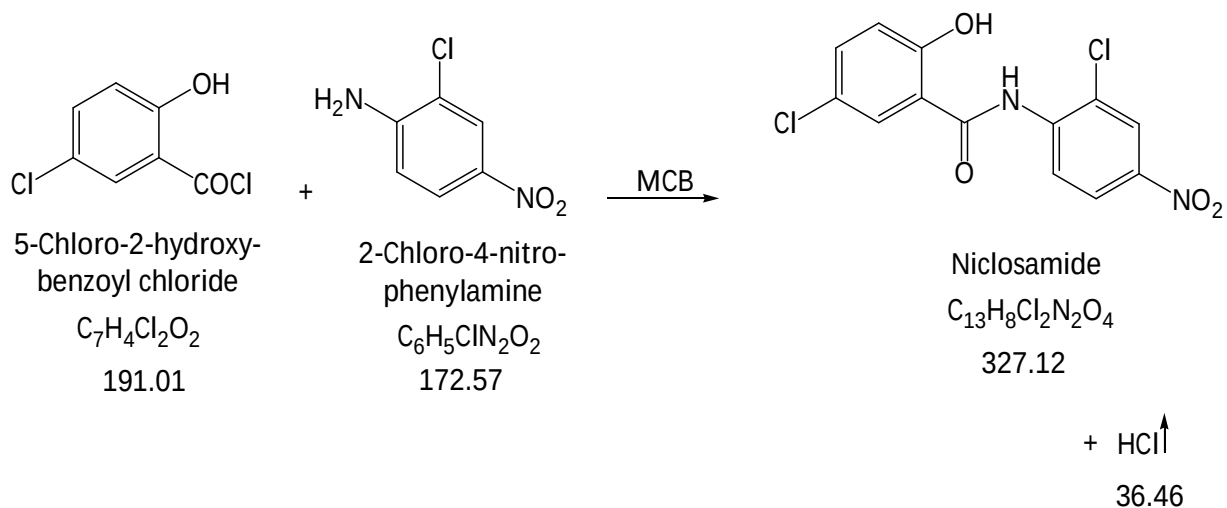
2-Chloro-4-nitro aniline is added to Stage-1 compound mixture to get Niclosamide.

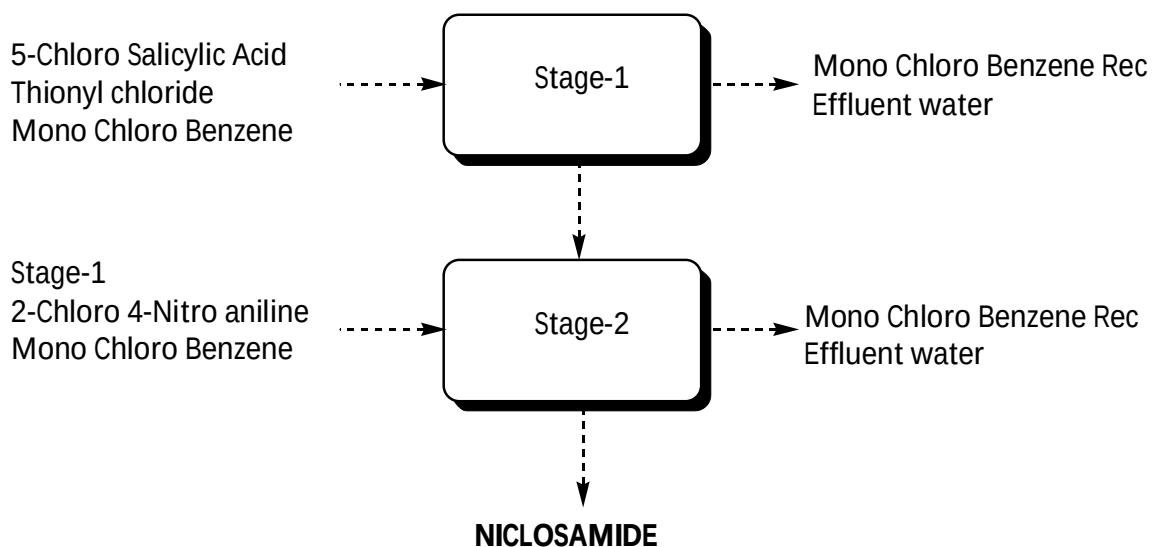
Route of Synthesis:

Stage-1



Stage-2



Flow Chart**Material Balance:**

Material balance of Niclosamide Stage-1 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
5-Chloro Salicylic Acid	115.00	Stage-1	122.00
Thionyl chloride	77.50	Mono Chloro Benzene Recovery	475.00
Mono Chloro Benzene	500.00	Mono Chloro Benzene loss	10.00
Water	200.00	Effluent water	200.00
		(Water-200)	
		Process emission	66.96
		(Sulfur dioxide-42.65, Hydrogen chloride-24.31	
		Organic residue	18.54
		(Organic impurities-3.54, Mono chloro benzene-15)	
Total	892.50	Total	892.50

Material balance of Niclosamide Stage-2 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-1	122.00	Niclosamide	200.00
2-Chloro 4-Nitro aniline	110.00	Mono Chloro Benzene Recovery	570.00
Mono Chloro Benzene	600.00	Mono Chloro Benzene loss	12.00
water	400.00	Effluent water	400.00
		(Water-400)	
		Process emission	23.29
		(Hydrogen chloride-)	
		Organic residue	26..71
		(Mono chloro benzene-18, Organic impurities-8.71)	
Total	1232.00		1232.00

4. RAFOXANIDE

Process Description:

Stage-1:

Iodine is reacted with chlorine in dilute Hcl medium to get Iodine mono Chloride and Iodine Mono Chloride reacted with Salicylic acid to form 3,5,Diiodo Salicylic acid (DISA).

Stage-2:

3,4 Dichloro Nitro Benzene is reacted with Para Chloro Phenol in the presence of Potassium Hydroxide flakes to get Stage-2 Intermediate (Nitro Ether Compound).

Stage-3:

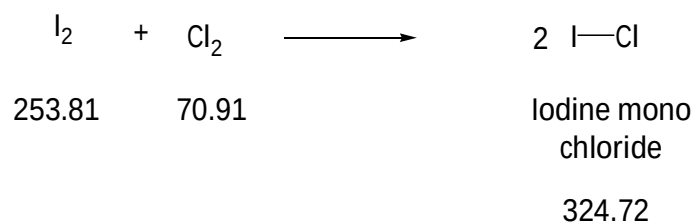
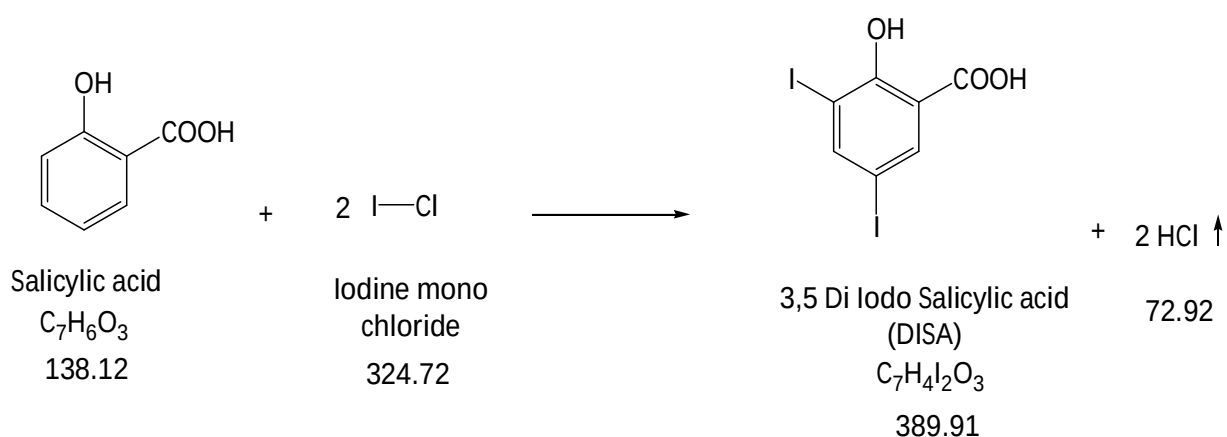
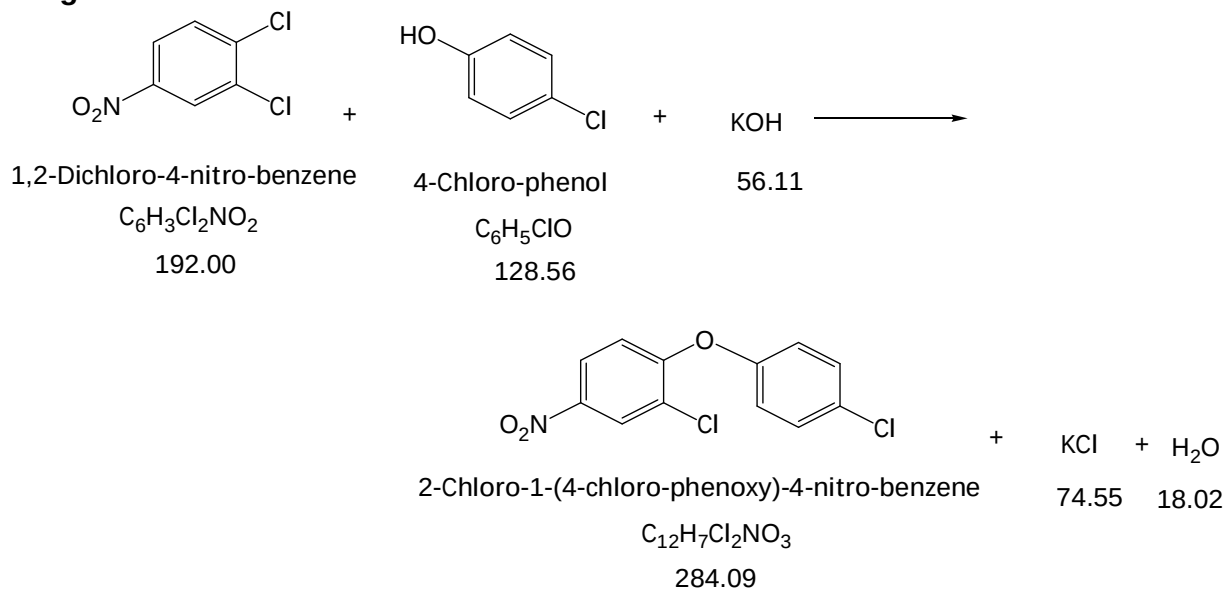
Stage-2 intermediate in Toluene media is reduced with Iron dust in the Hcl media to give an amino derivative.

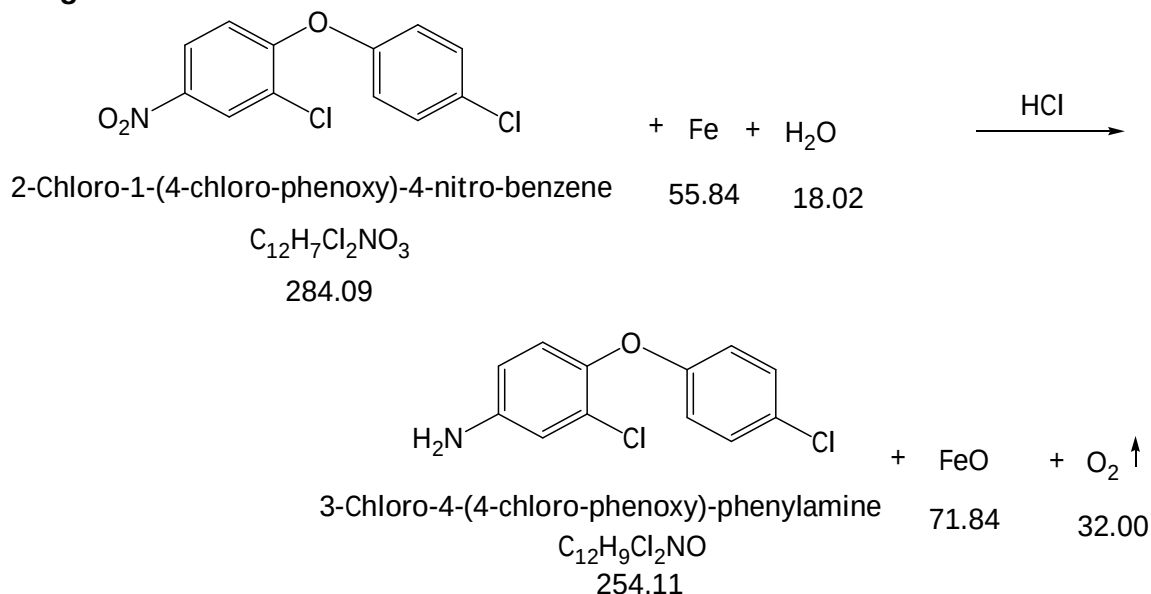
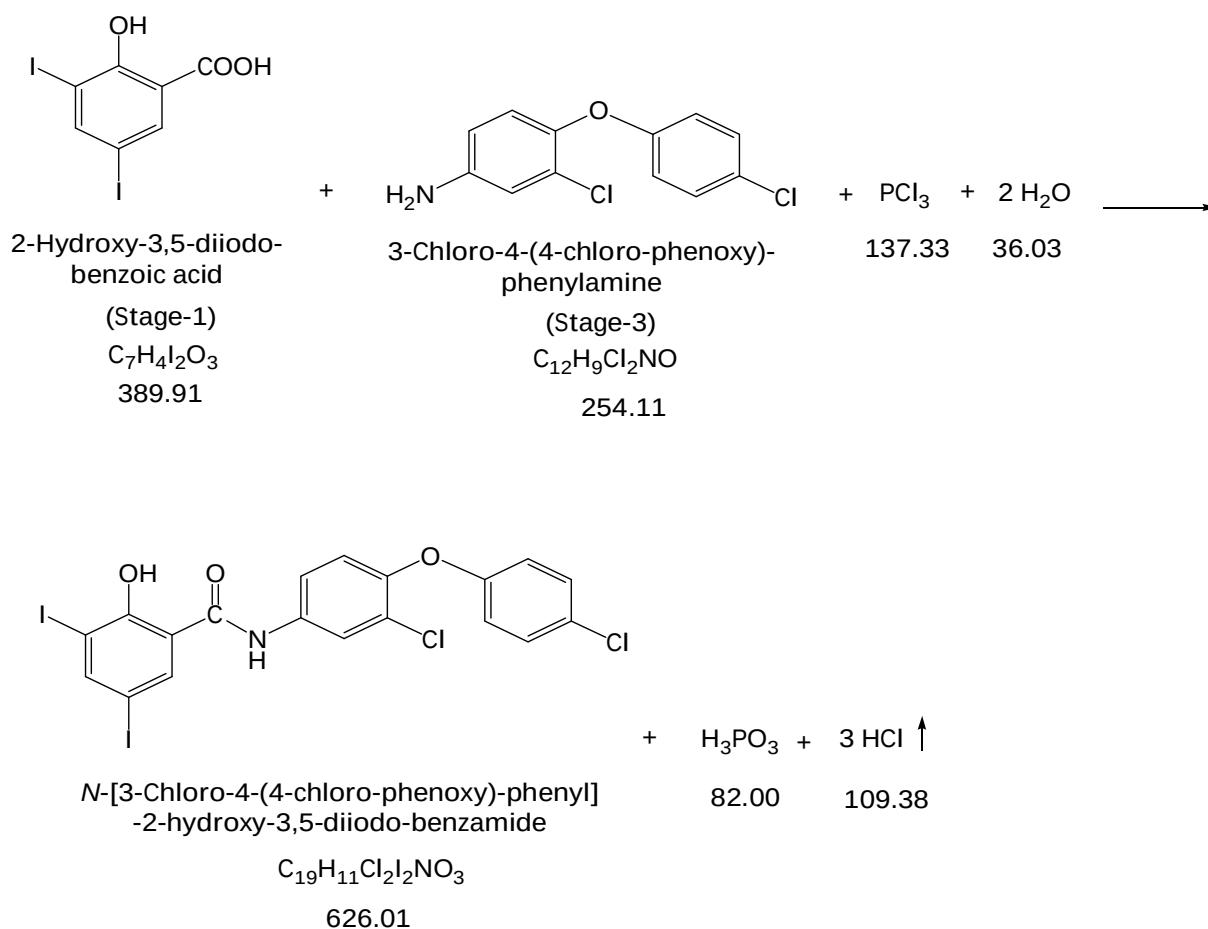
Stage-4:

Stage-3 amino compound is condensed with stage-1 compound in toluene media in the presence of Potassium trichloride to get Rafoxanide technical product.

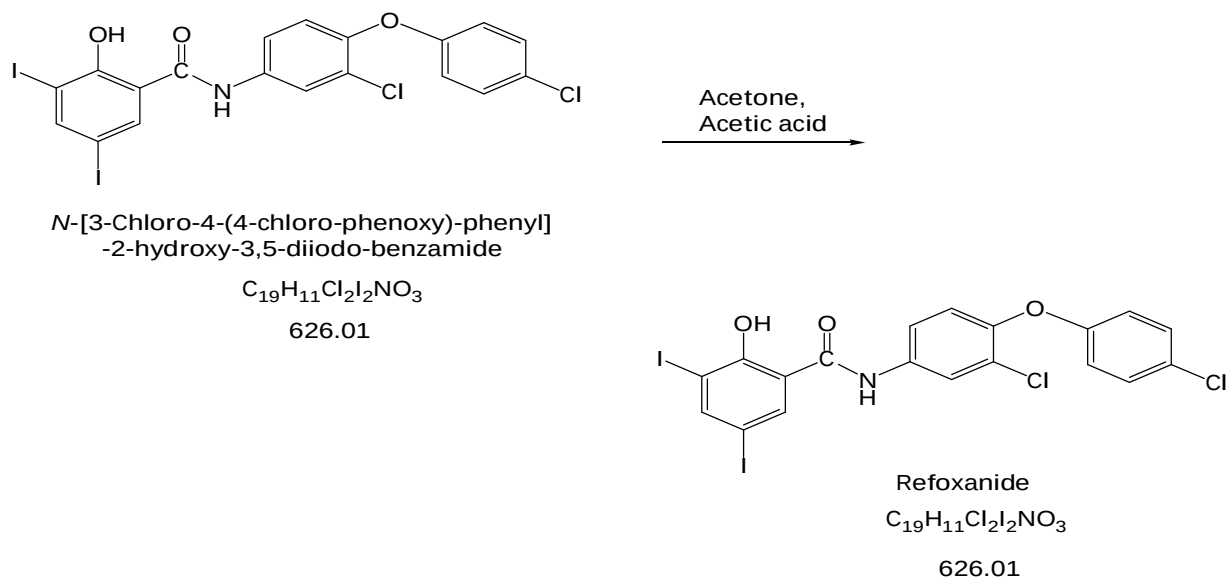
Stage-5:

Dried Refoxanide technical compound is purified in acetone to get pure compound of Refoxanide.

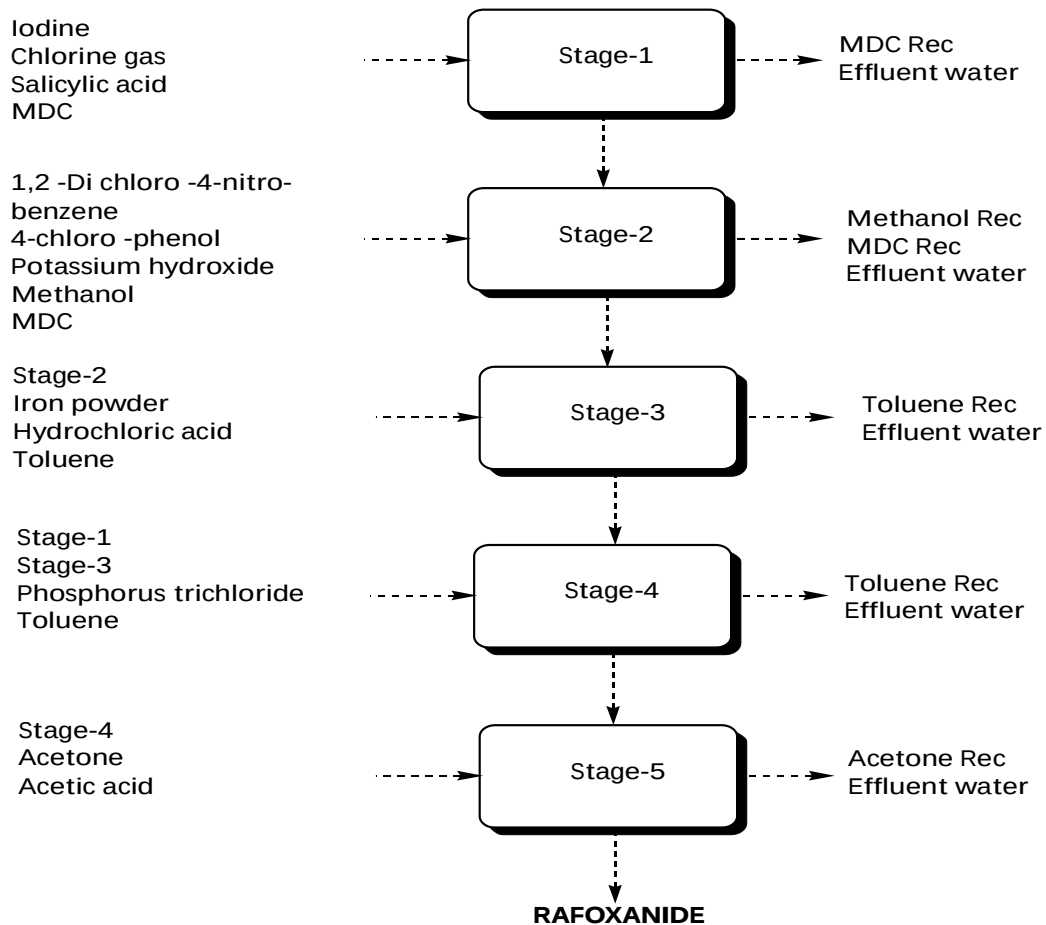
Route of Synthesis:**Stage-1:****Step-A****Step-B****Stage-2**

Stage-3**Stage-4**

Stage-5



Flow Chart



Material Balance:

Material balance of Rafoxanide Stage-1 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Iodine	97.00	Stage-1	135.00
Chlorine gas	27.00	MDC Recovery	475.00
Salicylic acid	50.00	MDC loss	10.00
MDC	500.00	Effluent water	300.00
Water	300.00	(Water-300)	
		Process emission	26.40
		(Hydrogen chloride)	
		Organic residue	27.60
		(MDC -15, Organic impurities-12.6)	
Total	974.00	Total	974.00

Material balance of Rafoxanide Stage-2 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
1,2 –Di chloro -4-nitro- benzene	75.00	Stage-2	104.00
4-chloro -phenol	50.22	Methanol recovery	475.00
Potassium hydroxide	22.00	Methanol loss	10.00
Methanol	500.00	MDC Recovery	475.00
MDC	500.00	MDC loss	10.00
Water	500.00	Effluent water	542.12
		(water-500, Methanol -6, Potassium chloride-29.12, Generated water-7)	
		Organic residue	31.10
		(Organic impurities-7.1, Methanol- 9, MDC-15)	
Total	1647.22	Total	1647.22

Material balance of Rafoxanide Stage-3 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-2	104.00	Stage-3	88.00
Iron powder	20.45	Toluene recovery	760.00
Hydrochloric acid	10.00	Toluene loss	16.00
Toluene	800.00	Effluent water	503.41
Water	500.00	(water- 493.41, Toluene-10)	0
		Spent Iron(II) oxide	26.29
		Process emission	11.70
		(Oxygen)	0
		Organic residue	29.05
		(Organic impurities-15.05, Toluene-14)	0
Total	1434.45	Total	1434.45

Material balance of Rafoxanide Stage-4 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-1	135.00	Stage-4	210.00
Stage-3	88.00	Toluene Recovery	665.00
Phosphorus trichloride	47.55	Toluene loss	14.00
Toluene	700.00	Effluent water	525.90
Water	500.00	(Water-487.5, Toluene-10, Phosphorous acid-28.40)	
		Process emission	37.87
		(Hydrogen chloride)	
		Organic residue	17.78
		(Organic impurities- 6.78,Toluene -11)	
Total	1470.55	Total	1470.55

Material balance of Rafoxanide Stage-5 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-4	210.00	Rafoxanide	200.00
Acetone	500.00	Acetone Recovery	475.00
Acetic acid	20.00	Acetone loss	10.00
Activated carbon	5.00	Effluent water	627.00
Hyflow	3.00	(Water-600, Acetic acid-20, Acetone-7)	
Water	600.00	Spent Carbon & Hyflow	8.00
		Organic Residue	18.00
		(Acetone-8 organic impurities- 10)	
Total	1338.00	Total	1338.00

5. TRICLABENDAZOLE

Process Description:

Stage-1:

3, 4, Dichloro aniline in acetic acid reacts with acetic anhydride to form Acetamide compound. Acetamide compound reacts with Nitric acid and potassium hydroxide to get stage-1 compound.

Stage-2:

Stage-1 compound reacts with 2, 3, Dichloro Phenol in the presence of DMSO to get Stage-2 compound.

Stage-3:

Stage-2 compound in methanol media is reduced in presence Raney nickel to get Stage-3 compound.

Stage-4:

Stage-3 compound in methanol reacts with carbon disulfide and sodium hydroxide to form stage-4 compound.

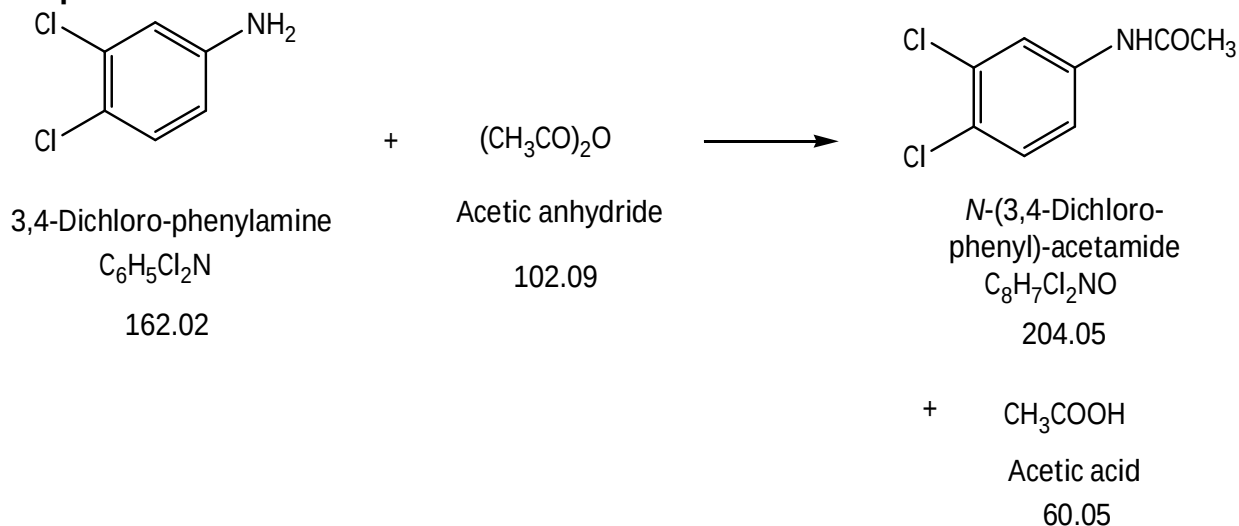
Stage-5:

Stage-4 compound in methanol reacts with Dimethyl sulphate to form Triclabendazole.

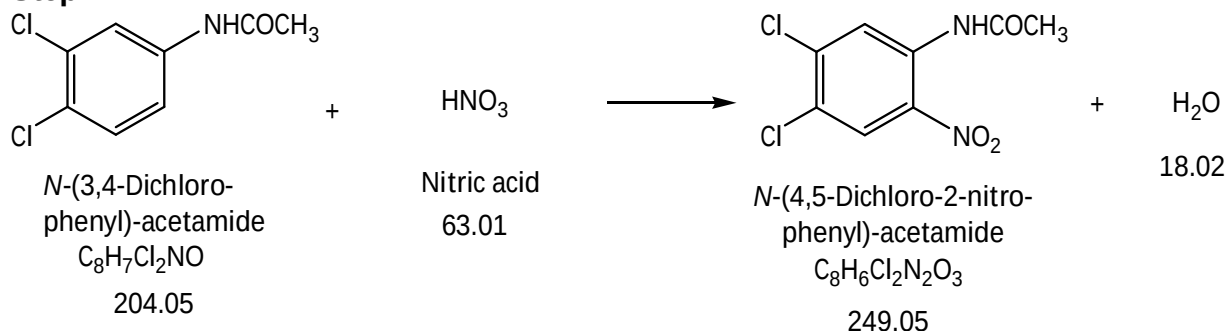
Route of Synthesis

Stage-1

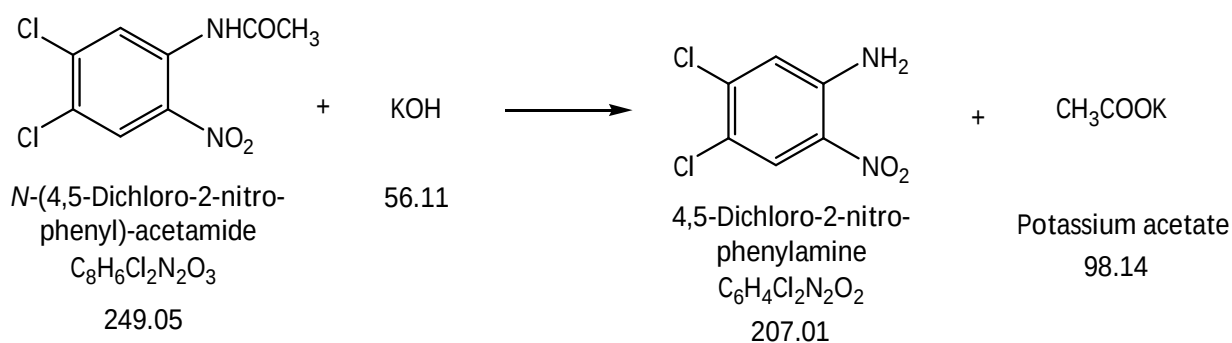
Step-A



Step-B

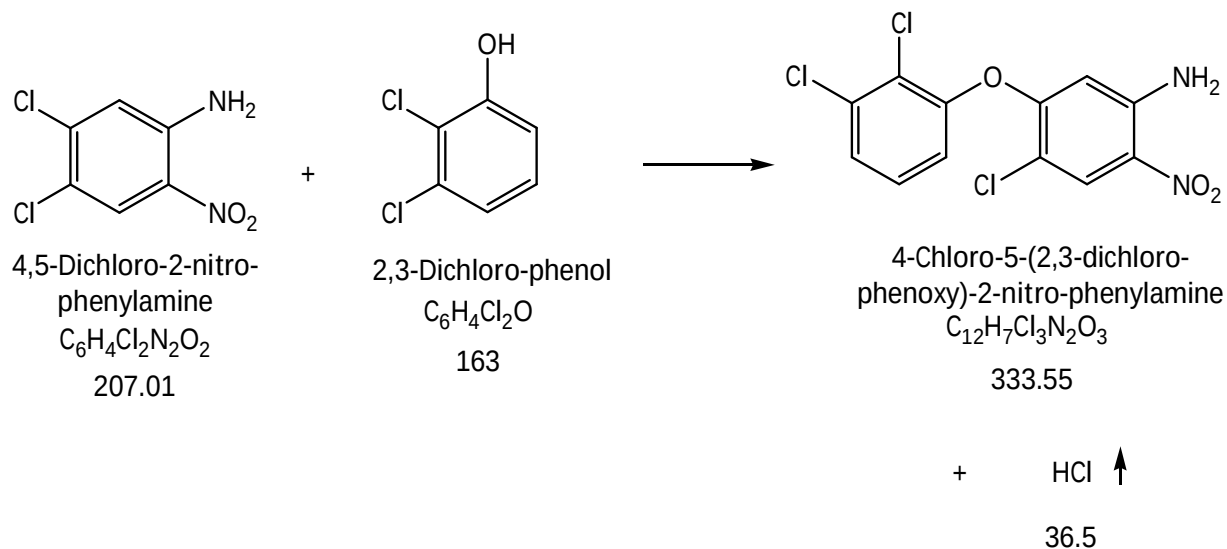


Step-C

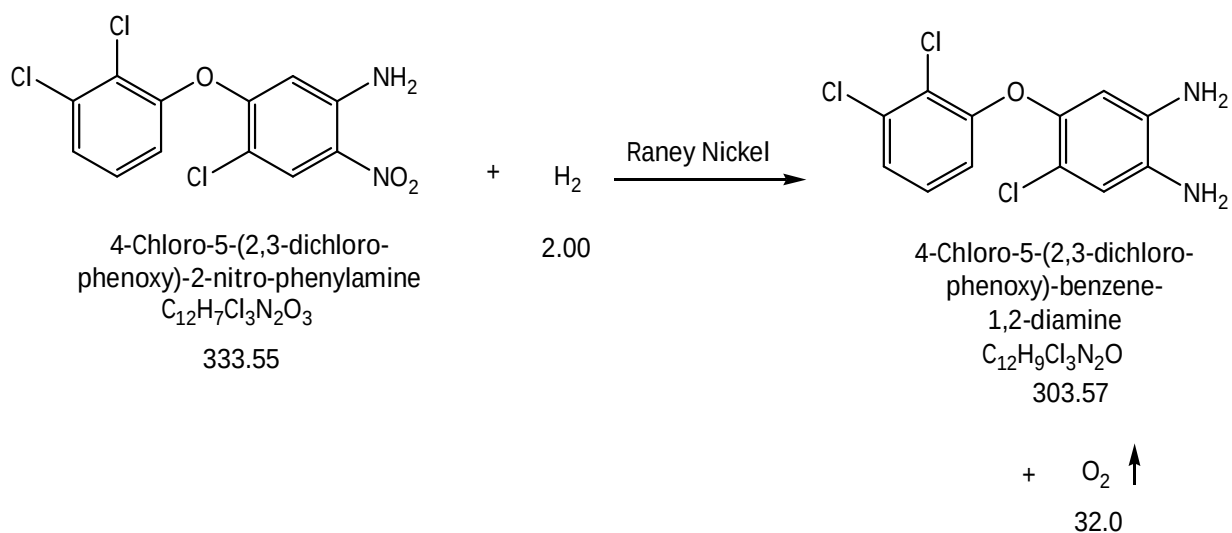


Stage-2

Additional Information

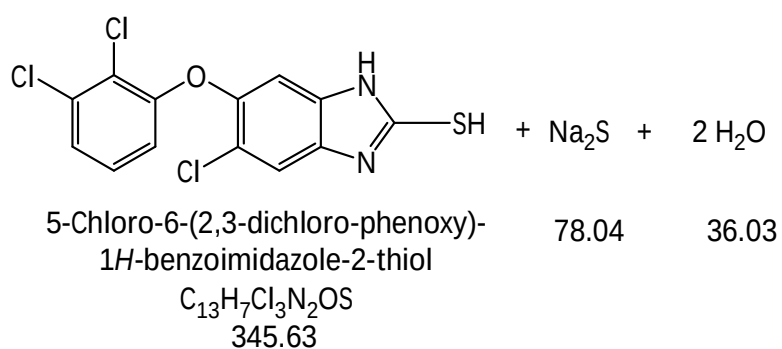
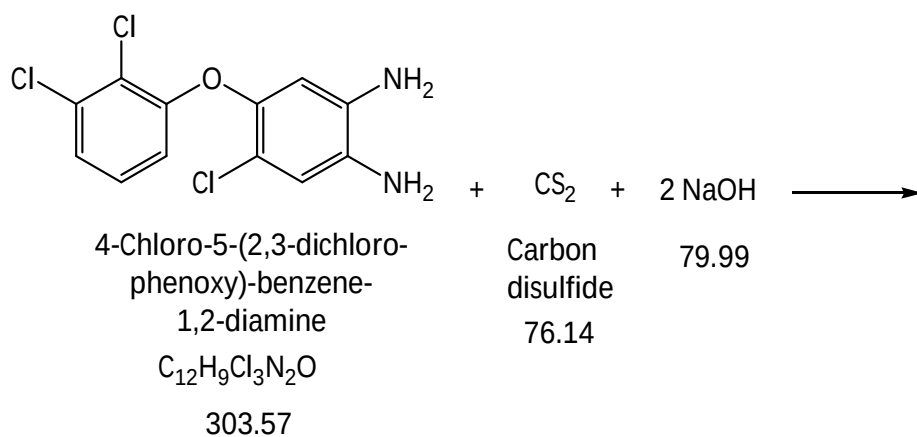


Stage-3

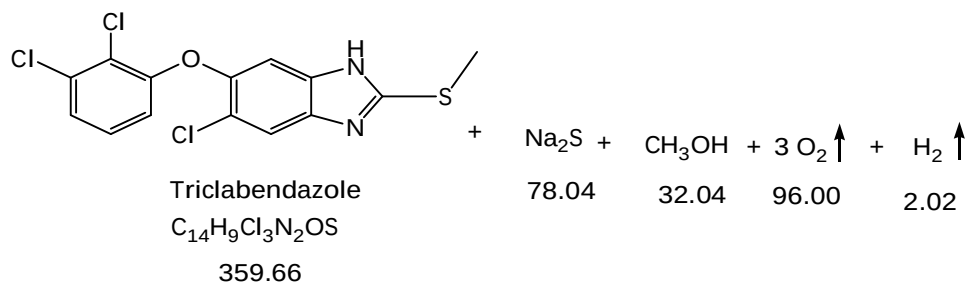
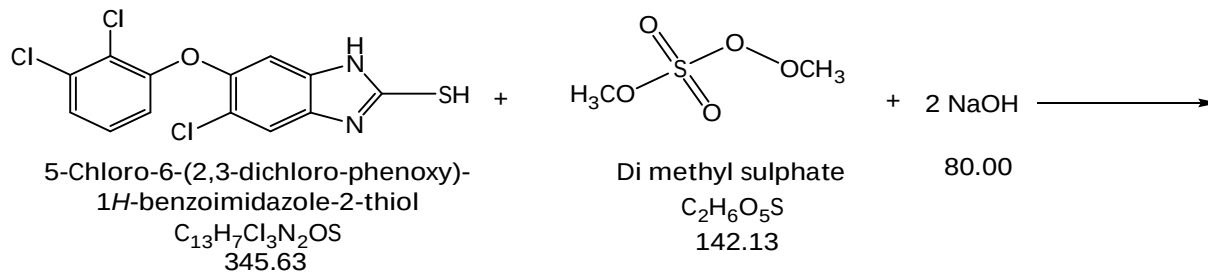


Stage-4

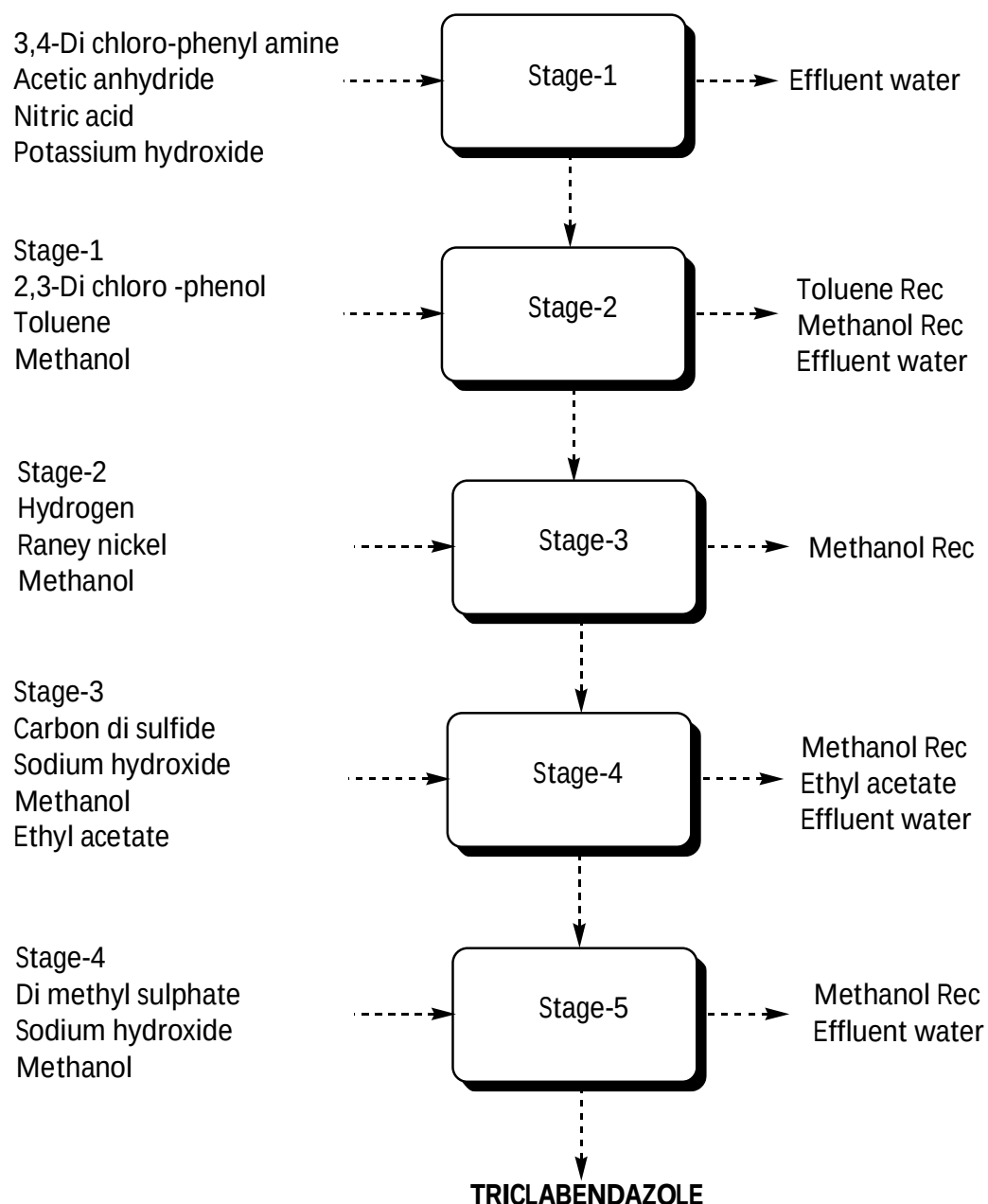
Additional Information



Stage-5



Flow Chart



Material balance:

Additional Information

Material balance of Triclabendazole Stage-1 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
3,4-Di chloro-phenyl amine	120.00	Stage-1	140.00
Acetic anhydride	76.00	Effluent water	924.27
Nitric acid	45.00	(Water-800, Acetic acid-44.47, Potassium acetate-67, generated water-12.80)	
Potassium hydroxide	40.00	Organic residue	16.73
Water	800.00		
Total	1081.00	Total	1081.00

Material balance of Triclabendazole Stage-2 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-1	140.00	Stage-2	214.00
2,3-Di chloro -phenol	110.50	Methanol recovery	665.00
Toluene	500.00	Methanol loss	14.00
Methanol	700.00	Toluene recovery	475.00
Water	800.00	Toluene loss	10.00
		Effluent water	816.00
		(Water-800, Toluene -7, Methanol-9)	
		Process emission	24.68
		(Hydrogen chloride)	
		Organic residue	31.82
		(Methanol-12, Toluene-8, Organic Impurities-11.82)	
Total	2250.50	Total	2250.50

Material balance of Triclabendazole Stage-3Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-2	214.00	Stage-3	185.00
Hydrogen	1.50	Methanol Recovery	760.00
Raney nickel	10.00	Methanol Loss	16.00
Methanol	800.00	Effluent water	412.00
Water	400.00	(Water-400,Methanol-12)	
		Spent Raney nickel	10.00
		Process emission	20.53
		(Oxygen)	
		Organic Residue	21.97
		(Organic impurities-9.97, Methanol-12)	
Total	1425.50	Total	1425.50

Material balance of Triclabendazole Stage-4 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-3	185.00	Stage-4	200.00
Carbon di sulfide	46.90	Methanol Recovery	760.00
Sodium hydroxide	49.00	Methanol Loss	16.00
Methanol	800.00	Ethyl acetate recovery	475.00
Ethyl acetate	500.00	Ethyl acetate loss	10.00
Water	400.00	Effluent water	481.56
		(Water-400,Methanol-12, Di sodium sulfide-47.56, generated water-22)	
		Organic Residue	38.34
		(organic impurities-11.34, Methanol-12, Ethyl acetate-15)	
Total	1980.9	Total	1980.90

Material balance of Triclabendazole Stage-5 Batch Size:200Kg			
Name of the input	Quantity in Kg	Name of the out put	Quantity in Kg
Stage-4	200.00	Triclabendazole	200.00
Di methyl sulphate	82.50	Methanol Recovery	760.00
Sodium hydroxide	46.50	Methanol Loss	16.00
Methanol	800.00	Effluent water	481.56
Water	400.00	(Water-400,Methanol-12, Di sodium sulfide-45.16, Methanol- 30.55)	
		Process emission	56.71
		(Oxygen-55.55, Hydrogen-1.16)	
		Organic Residue	14.73
		(organic impurities-2.73, Methanol-12)	
Total	1529.00	Total	1529.00

Table: Water Consumption Details

S. No	Purpose	Water Input KLD
1	Process	3.00
2	Washings	0.50
3	Boiler make up	18.00
4	Cooling towers make up	12.00
5	Scrubber	0.50
6	Domestic	1.50
7	Gardening	3.00
	Total	38.50

Table: Hazardous Waste & Solid Waste Generation Details

S. No	Name of the Hazardous Waste	Quantity Kg/Day	Disposal Method
1	Organic waste (Process residue-46, Solvent Distillation Residue-74)	120.00	Sent to Cement Industries
2	Spent Carbon	6.00	Sent to Cement Industries
3	Inorganic Waste	3.50	Sent to TSDF
4	MEE salts	257.00	Sent to TSDF
5	Used Oils	500 Ltrs/Annum	SPCB Authorized Agencies for Reprocessing/Recycling
6	Detoxified Containers	200 No's/Month	After Detoxification sent back to suppliers/SPCB Authorized Parties
7	Used Lead Acid Batteries	2 No's/Annum	Send back to suppliers for buyback of New Batteries
Solid Waste Details			
8	Coal ash from boiler	3525.00	Sent to Brick Manufacturers

Table: Stack Emission Details

Particulars	Units	3.0 TPH Coal fired Boiler
Type of Fuel	--	Indian Coal
Coal Consumption	TPD	7.5
Ash Content	%	47
Sulphur Content	%	0.8
Nitrogen Content	%	1.07
No. of Stacks	No	1
Height of stack	m	30
Diameter of Stack	m	0.60
Temperature of Flue Gas	°C	100
Velocity of Flue Gas	m/s	7.5
Particulate Matter at outlet of Bag filter (Based on 115 mg/Nm ³ at outlet)	gm/sec	0.24
Sulphur dioxide emission	gm/sec	0.69
Oxides of Nitrogen emission	gm/sec	0.93

Table: Stack Emission Details for DGSet

Capacity In KVA	Emission of SPM in mg/Nm ³	Emission Of SO ₂ in mg/Nm ³	Emission of NO _x in mg/Nm ³	Stack dia. In m	Flue Gas Temp. in °C	Stack Height in m	Flue gas Velocity In m/sec.
320 KVA	70.0	135.0	160.0	0.30	290	10	20.50

Table: Process Emission Details

S. No.	Name of the Gas	Quantity In Kg/Day	Treatment Method
1	Oxygen	27.31	Dispersed into the atmosphere
2	Hydrogen	2.01	Diffused by using Nitrogen through Flame arrestor.
3	Sulphur dioxide	7.11	Scrubbed by using C.S.Lye Solution
4	Hydrogen chloride	37.46	Scrubbed by using chilled water media

Table : Wastewater Details

S.No	Purpose	Effluent KLD
1	Process	3.44
2	Washings	0.50
3	Boiler Blow down	3.00
4	Cooling towers Blow down	2.00
5	Scrubber	0.50
6	Domestic	1.20
	Total	10.64

Table : Water Balance

S. No	Purpose	Water Input KLD	Loss/ Consumption KLD	Effluent KLD
1	Process	3.00	(+) 0.44	3.44
2	Washings	0.50	0.00	0.50
3	Boiler make up	18.00	15.00	3.00
4	Cooling towers make up	12.00	10.00	2.00
5	Scrubber	0.50	0.00	0.50
6	Domestic	1.50	0.30	1.20
7	Gardening	3.00	3.00	0.00
	Total	38.50	28.30	10.64

LIST OF RAW MATERIALS PRODUCT WISE**1. CLOSANTEL AMINE (INTERMEDIATE OF CLOSANTEL BASE)**

S.No.	Raw Material	Consumption/ Batch in Kgs	Consumption/ Day in Kgs
1	4-Chloro -1-methy -2-nitro -benzene	62.00	41.33
2	Para Chloro Benzyl Cyanide	55.00	36.67
3	Methanol	500.00	333.33
4	Sodium sulfide	28.20	18.80
5	Sodium bicarbonate	30.50	20.33
6	Potassium hydroxide	10.00	6.67
7	Toluene	500.00	333.33

2. CLOSANTEL SODIUM

S. No.	Raw Material	Consumption/ Batch in Kgs	Consumption/ Day in Kgs
1	4-Chloro -1-methy -2-nitro -benzene	56.00	28
2	Para Chloro Benzyl Cyanide	50.00	25
3	Methanol	1000.00	500
4	Sodium sulfide	26.00	13
5	Sodium bicarbonate	28.00	14
6	Potassium hydroxide	10.00	5
7	Toluene	1100.00	550
8	2-hydroxy -3,5-diiodo-benzoic acid	121.00	60.5
9	Phosphorus trichloride	43.00	21.5
10	Sodium Hydroxide	50.00	25
11	Activated carbon	5.00	2.5
12	Hyflow	3.00	1.5

3. NICLOSAMIDE

S. No.	Raw Material	Consumption/ Batch in Kgs	Consumption/ Day in Kgs
1	5-Chloro Salicylic Acid	115.00	19.17
2	Thionyl chloride	77.50	12.92
3	Mono Chloro Benzene	1100.00	183.33
4	2-Chloro 4-Nitro aniline	110.00	18.33

4. RAFOXANIDE

S. No.	Raw Material	Consumption/ Batch in Kgs	Consumption/ Day in Kgs
1	Iodine	97.00	16.17
2	Chlorine gas	27.00	4.50
3	Salicylic acid	50.00	8.33
4	MDC	1000.00	166.67
5	1,2 –Di chloro -4-nitro-benzene	75.00	12.50
6	4-chloro -phenol	50.22	8.37
7	Potassium hydroxide	22.00	3.67
8	Methanol	500.00	83.33
9	Iron powder	20.45	3.41
10	Hydrochloric acid	10.00	1.67
11	Toluene	1500.00	250.00
12	Phosphorus trichloride	47.55	7.93
13	Acetone	500.00	83.33
14	Acetic acid	20.00	3.33

5. TRICLABENDAZOLE

S. No.	Raw Material	Consumption/ Batch in Kgs	Consumption/ Day in Kgs
1	3,4-Di chloro-phenyl amine	120.00	40.00
2	Acetic anhydride	76.00	25.33
3	Nitric acid	45.00	15.00
4	Potassium hydroxide	40.00	13.33
5	2,3-Di chloro -phenol	110.50	36.83
6	Toluene	500.00	166.67
7	Methanol	3100.00	1033.33
8	Hydrogen	1.50	0.50
9	Raney nickel	10.00	3.33
10	Carbon di sulfide	46.90	15.63
11	Sodium hydroxide	95.50	31.83
12	Ethyl acetate	500.00	166.67
13	Di methyl sulphate	82.50	27.50