

PROCEDURES OF PRODUCING Biz-(2-chloroethyl)-sulfide, distilled 96% Mustard Gas

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(October 22, 2006)

Abstract : Four steps of producing Biz-(2-chloroethyl)-sulfide 96% are described with adequate details to show the procedure but not for producing because some data such as weights of raw materials and operating conditions are not disclosed. The objective of this article is to fill up some information about the procedure of producing this chemical which can hardly be found on other websites.

Information about Biz-(2-chloroethyl)-sulfide can be found on various websites. But no step by step procedures of producing have been described by any article on the websites so far. Thus, this article is to fill up some information about the procedures of producing this chemical which can hardly be found on other websites.

1. Raw materials required to produce Biz-(2-chloroethyl)-sulfide

- 1) PS6 = Dichloromethane CH_2Cl_2 99%
- 2) PL5 = Ethanol $\text{C}_2\text{H}_5\text{OH}$ 96.5%
- 3) PS3 = Sodium Sulfide Na_2S (solid) 60%
- 4) PS8 = Thionylchloride SOCl_2 99.5%
- 5) PA1 = Sulphuric Acid H_2SO_4 (conc.) 98%
- 6) PW = Process Water H_2O (Demineralizer 10 MegaOhm)

2. Codes of Chemicals, Mixers, and Reactors

Step No.	Codes of Chemicals	Code of Mixer and Centrifuge	Code of Reactors
Step 1	Raw materials PA1, PW Intermediate PM5	Mixer M-40 (Glass Lined)	None
Step 2	Raw materials PL5, PS3, PS6 Intermediate PM5, PM6	None	R-40 (SS 316 L)
Step 3	Raw material PL5 Intermediate PM6	Centrifuge Z-41 (SS 316 L)	None
Step 4	Raw material PS8 Intermediate PM6		R-42 (Glass Lined)

- Notes:**
- 1) There are various vessels to receive distillate, intermediate and wastewater too.
 - 2) The mixer is equipped with agitator, temperature probe, pressure indicator, valves, nozzles and drain valve.
 - 3) All reactors are equipped with agitator, temperature probe, pressure indicator, valves nozzles, and a drain valve.
 - 4) The total volume of mixer and reactors for the production of 726 liters of Biz-(2-chloroethyl)-sulfide 96% in industrial scale are as follows:
M-40 = 630 lt., R-40 = 3000 lt., R-42 = 1470 lt.,

3. STEP 1 Preparation of PM5

Reaction Summary



Procedure

1. Pump X_{PW} kilograms of pure PW from the storage tank to M-40.
2. Pump X_{PA1} kilograms of PA1 from the storage tank slowly to M-40 while stirring the temperature of the mixer rises up. Cool down the mixer with cooling water.
3. The mixture in M-40 is PM5 is ready to dose into R-40 slowly by gravity.

4. STEP 2 Preparation of mixture in R-40 and perform chemical reactions

Reaction Summary



Procedure

1. Pump X_{PL5} kilograms of pure PL5 from the storage tank to R-40.
2. Transport X_{PS3} kilograms of PS3 from the silo slowly into the manhole of R-40 while stirring.
3. Pump X_{PS6} kilograms of pure PS6 from the storage tank to a vessel V-40 ready to be dosed into R-40 by gravity.
4. The temperature in R-40 rises up. Once reflux occurs, dose PS6 from V-40 by gravity slowly. When dosing PS6 has finished the mixture is boiled at reflux temperature for a while and keep the temperature of the mixture constant. Then cool down the reactor to room temperature.
5. Dose PM5 from M-40 into R-40 slowly by gravity. Waste gases will be evaporated from the mixture gradually until finished by evacuation. The remaining is suspension salt in R-40 which contains PM6.

5. STEP 3 Centrifugation

Procedure

1. Pump all suspension salt in R-40 into centrifuge Z-41 and keep the liquid in vessel V-41. Now we have PM6 in V-41 already.
2. Clean Z-41 with PL5 to remove all solids on it and make Z-41 dried. Solid and liquid wastes are put into plastic drum for disposal.
3. The empty R-40 will be cleaned with PL5. The waste is centrifuged in Z-41 and the liquid part (filtrate) is kept in V-41. The centrifuge is then cleaned and dried.
4. Pump X_{PM6} kilograms of PM6 (filtrate) from V-41 into R-40 and distill out water and PL5 at P1 milli bar pressure and at T1 degree Celcius. The remaining filtrate is pumped into R-40 to distill out PL5 and water at P2 milli bar pressure until finished and the resulting precut is obtained as PM6 to be filled in V-42 which is equipped with a dosing pump.
5. Liquid in R-40 will be cooled down and mixed with PL5. Heat up until reflux occurs for a while and cool down the reactor. Then, drain the waste into a plastic drum for disposal.

6. STEP 4 Making distilled Biz-(2-chloroethyl)-sulfide 96%

Reaction Summary



Procedure

1. Pump X_{PS8} kilograms of pure PS8 from the storage tank to R-42 which is clean and perfectly dry. Heat up R-42 to T2 degree Celcius and dose PM6 slowly with dosing pump into R-42 while controlling gas and regulate temperature of R-42 through out dosing of PM6. The waste gases are scrubbed in the waste gas scrubber.
2. After dosing finished then heat up the mixture slowly until the temperature reaches T3 degree Celcius. Then, excessive PS8 and other waste gases will be evaporated out. The distilled PS8 will be condensed and is kept in V-45. The last content of dissolved gases will be removed by evacuation. The product will be distilled at P3 milli bar and T4 degree Celcius.
3. The distilled product will be kept in V-44. The gas in this vessel must be regularly vented. Now we have Biz-(2-chloroethyl)-sulfide 96% in V-44.
4. The remaining mixture in R-42 will be cooled down and mixed with PL5. Then, heat up until reflux occurs for a while and cool the reactor down again. Then, clean R-42 with excess caustic soda and drain away to wastewater treatment plant.
5. R-42 will be dried by evacuation. All equipment will be cleaned with excess caustic soda.

REMARK:

Property and method of identification of Biz-(2-chloroethyl)-sulfide 96%

No color to yellow, M.P. = 14.4 C, B.P. 218 C (1ATM) , Refractive Index at 20 C 1.5218,
Cp,liq = 170 J/Mole K, Cp,gas = 150 J/Mole K, Vis. at 20C = 0.4 MPa sec, S.G. (20C) 1.7
Soluable in water = 0.8 gm/lit of water, Heat evap. = He = 59.8 kJ/Mole
Gas Chromatograph (column) OV1, 50m. (Capillary Column),
Method of Identification = NMR-spectrum 2 Triflates by diff. Shifts solvent acetone (D6)

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