Reduce the volatile organic compound losses occurring during the production of isoxazole.

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Abstract

VOC's presence in atmosphere at high quantity could prove to be degrading and cause various health problems. Further more inside the manufacturing area continuous VOC emissions produce a serious threat to the operators .The VOC's emission produces a volatile region and causes a risk of fire. The main area of work was surrounding the recovery section of a plant . here we taking example if a plant uses ethyl acetate as a solvent which is then recovered after distillation. But during the processes considerable losses are there thus about 88% of the product is distilled. The rest 12% are various losses. Considerable losses are due to the production of VOC's emitted from ethyl acetate. Solvent exiting from reaction vessels and various streams considerable loss and increase the cost of the product.

Literature Review

1.1) Motivation:

- I focused on it's integral sustainability policy and lays emphasis on safety.
- By reducing the VOC's losses considerable potential savings could be done
- The working conditions would improve and hazard of possible fire will decrease due to decrease in emissions of highly volatile ethyl acetate.

1.2) Method of Execution

- Study the production process, equipment's, effluent streams or residue .
- Complete mass balance of the process taking one batch as the bases for it. Balancing out the solvent required per batch and that recovered by distillation.
- Taking in consideration residual solvent present in effluent streams.
- The difference thus give the solvent loss as VOC's .

Quantifying the voc losses

1. vent sampling was also done for a minimum of 6 hours(Liquid Sampling) :

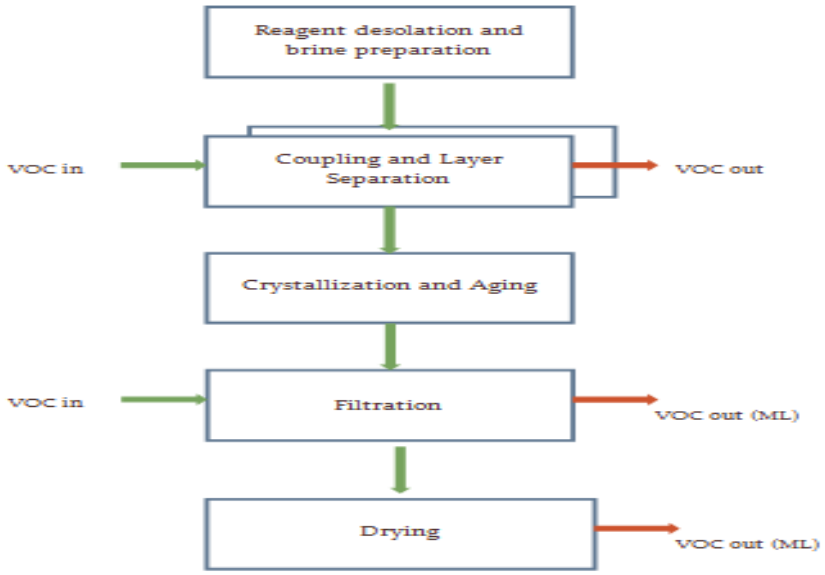
In order to determine the composition of the output water stream locations, were identified from where samples could be taken. These locations included process and recovery streams. The samples were initially subjected to Karl Fischer Titrations to determine the VOC concentration in each stream.Liquid sampling was done for 5 consecutive batches and the values averaged out in order to eliminate the error due to a single inconsistent batch.

2. Ambient Air Sampling

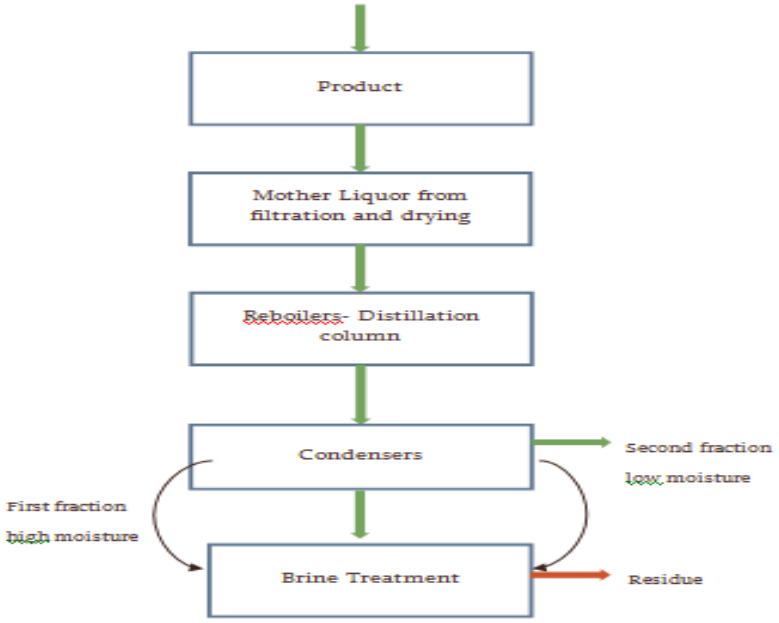
For ambient air sampling Photoionization detectors were used. Ambient air sampling was done for a minimum period of 6 hours (the cycle repeats itself every 6 hours). Ambient air of rooms where identifiable concentrations of VOC were present, identification was done on the basis of smell.

3. Vent sampling

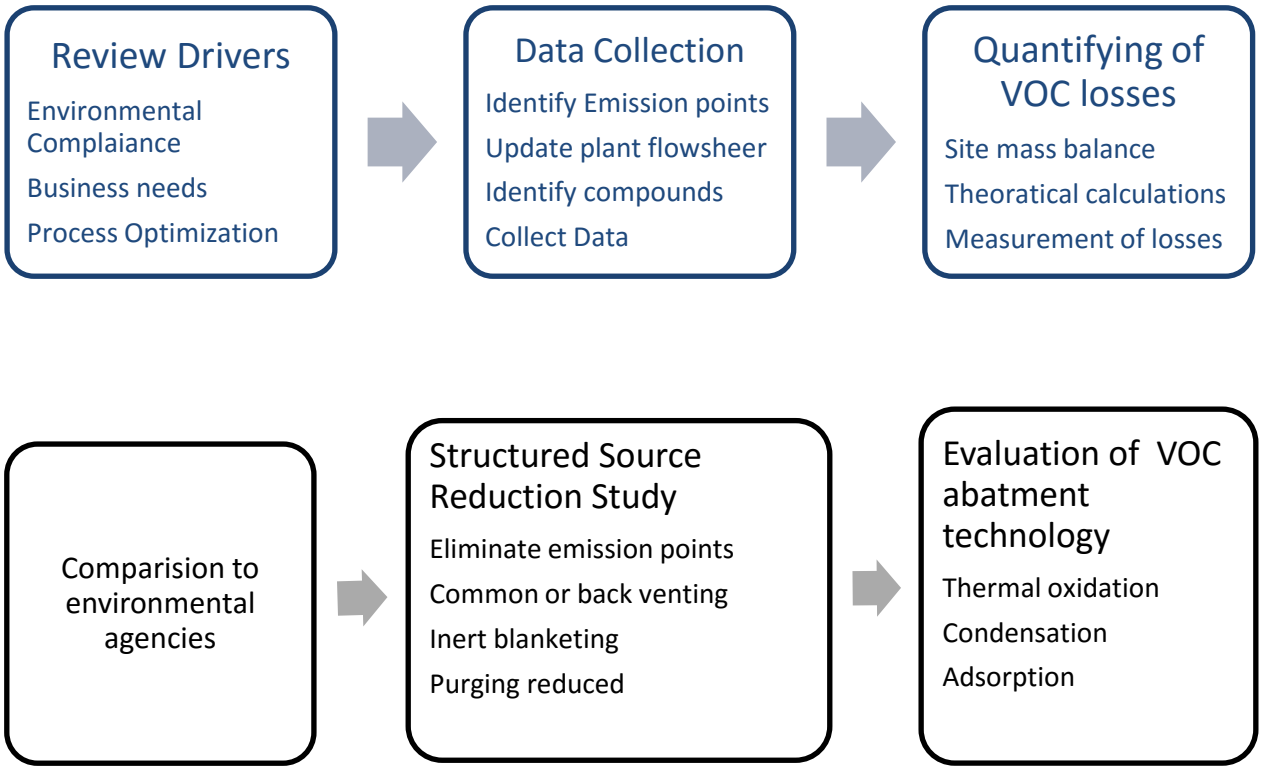
Initially the vents were identified where sampling could be done; some vents could not be quantified because of presence of moisture in the vent outputs. For vents, again the photoionization detector was used (tough quantification was not feasible), the vents causing maximum losses were identified and the the vent sampling was also done for a minimum of 6 hours.



Process Flow for Isoxazoles



Methodology



(Plausible measures to mitigate and decrease VOC's losses)

- Introduction of a closed loop drying system for vents connecting vacuum dryers:

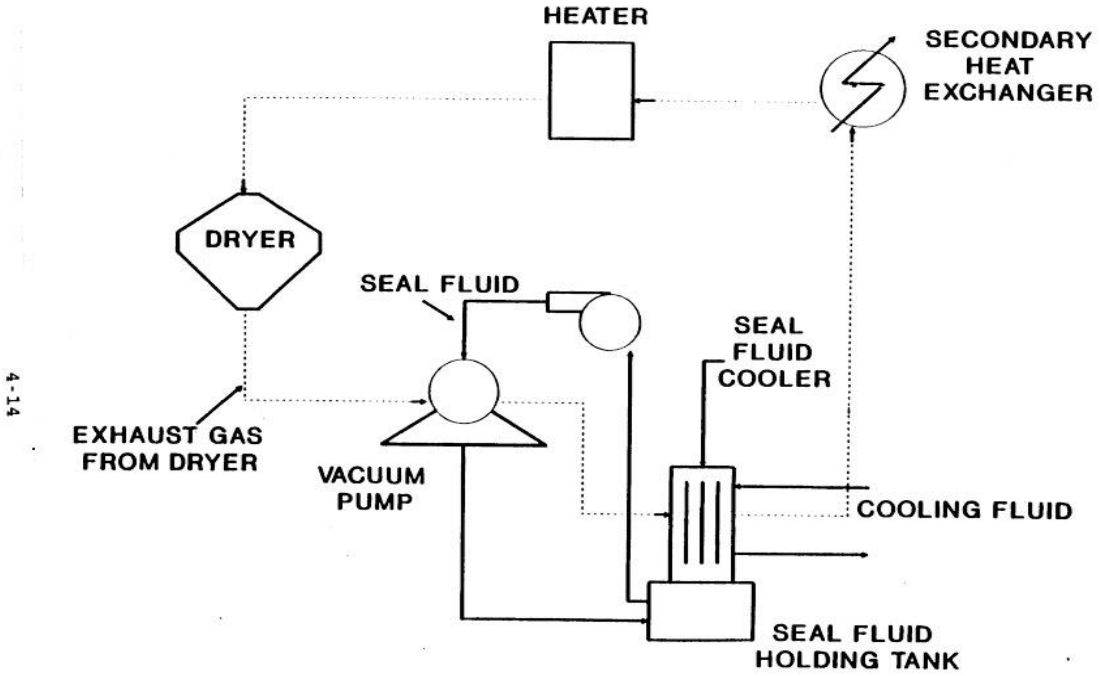


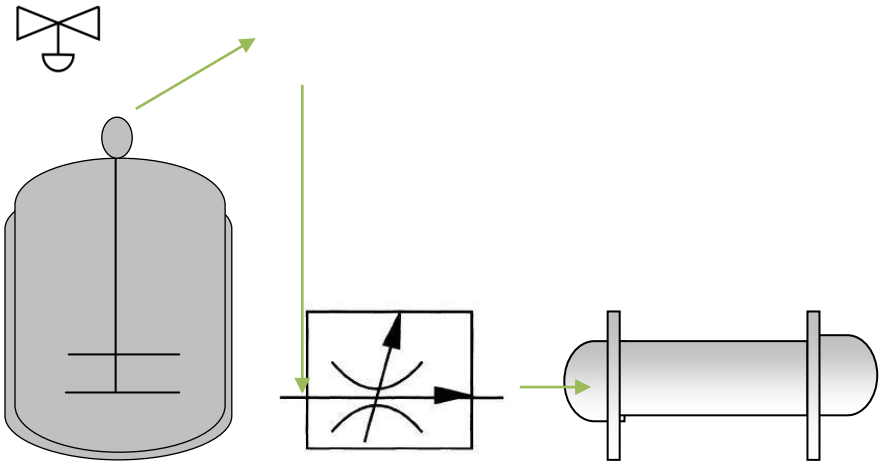
Figure 4-3. Closed-loop drying system.

In the above method exhaust gas from the dryer or filter press is drawn into the liquid ring vacuum pump, which compresses the gas essentially to atmospheric pressure. The gas contacts the pump seal fluid in the vacuum pump. At this point, the pump acts as a contact condenser because the pump seal fluid is chilled. Pump seal fluid and condensed vapours flow into the seal fluid holding tank.The basic equipment in a refrigerated condenser system includes a condenser, refrigeration unit(s) and auxiliary equipment (e.g., precooler, recovery/storage tank, pump/blower and piping).

Installation of control valves for vents connecting to release of Nitrogen:

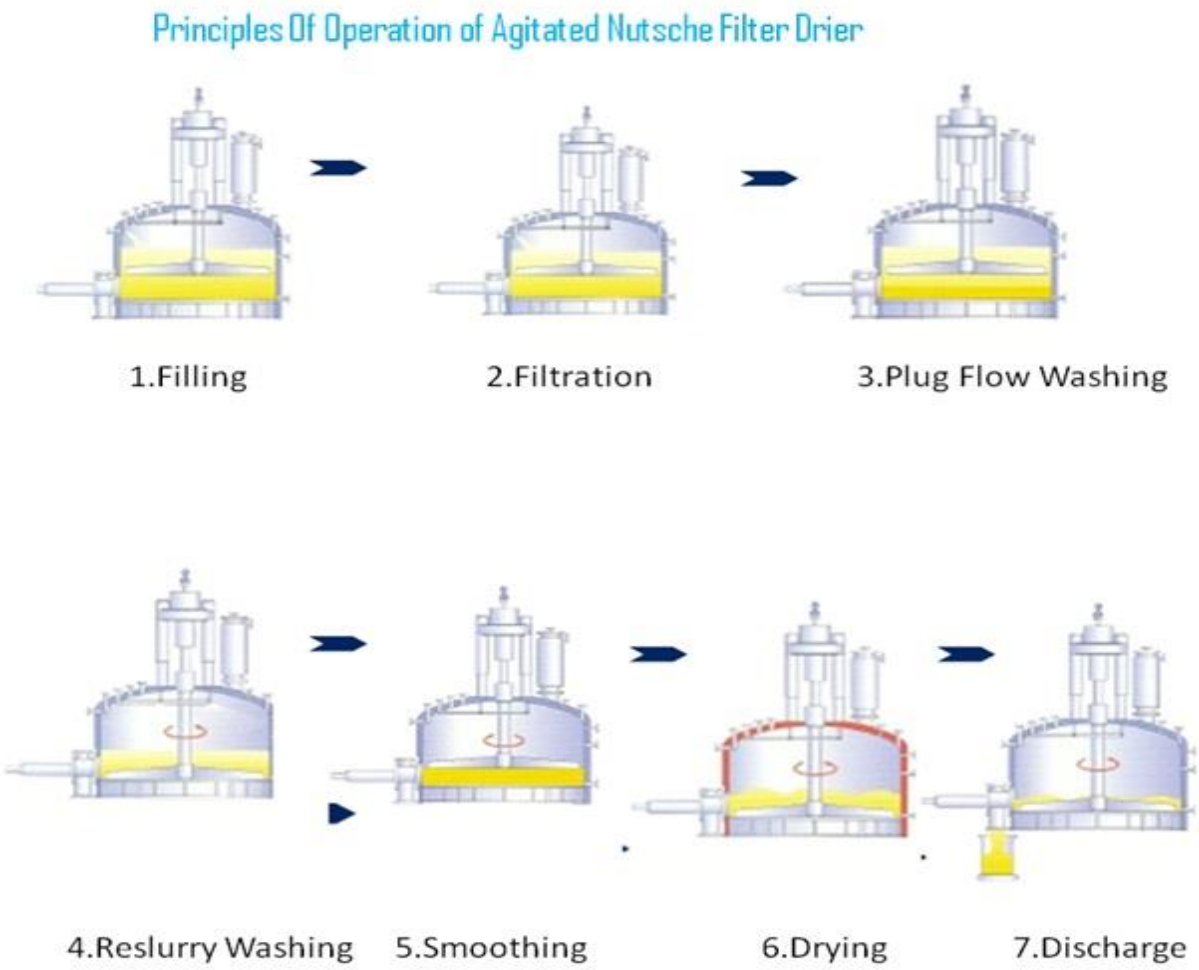
Currently the emissions through vent are spontaneous, even though the vents are connected to the heat exchanger due to the spontaneous release of exhaust from vessels, VOC are released to the atmosphere with Nitrogen. The solution to the above condition is plausible installation of ball valves above the vents. Thus, this would lead to controlled emissions of the exhaust gas thus providing time to the VOC to condense and be recovered as solvent thereafter.

Use of flow control to regulate the speed of flow of gases through the vents

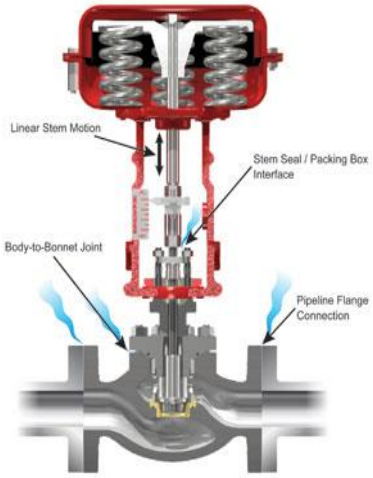


Coupling vessel---Control Valve------Flow totalizer------Heat exchanger

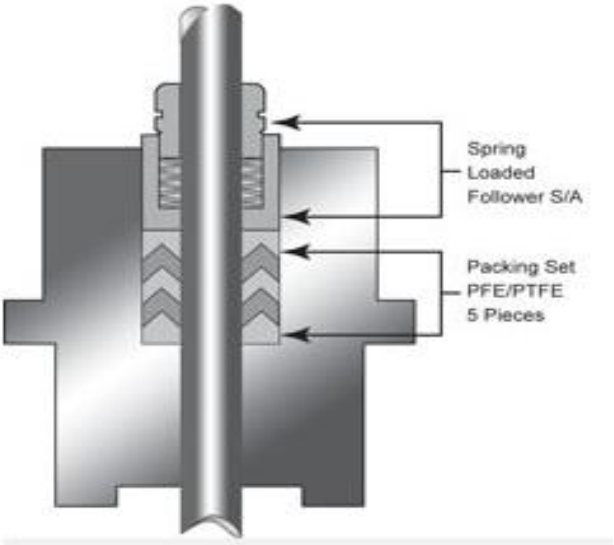
- Installing a closed system for transfer of wet cake from the agitated filter to the drying unit



- Improving the valve design to prevent emission from openings :The primary valve leak path is the stem-seal interface, which is typically sealed using packing installed within the valve bonnet. There are several static joints or locations interfacing with the valve body where external leakage is possible, including the pipeline-flange connections and the valve-body-to-bonnet joint. Leakage at these joints is uncommon because of the static nature of these joints and the fact they are typically sealed with gaskets and then bolted together. Leakage is still possible, however, so these joints should be monitored.The typical control valve in use at that time could emit anywhere from two to 10 times the acceptable levels



:Working of combined ANF drying system



Potential leak paths in globe-style valve

Low emission globe valvesfor globe valve

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