

## Case Study:

### *Distillation & Recovery of Hydrochloric Acid*

Mech-Chem Associates engineered, fabricated and installed a distillation system designed to drive off and recover Hydrochloric Acid for the processing of a mixed acid solution.

Our customer faced two needs: First, their source of chemistry was no longer available due to the fact that their supplier was discontinuing production of the main catalyst needed in their chemical process. This meant our customer now had to bring the manufacturing of this chemical in house. Second, their current equipment was incapable of producing the necessary quantities of product, at the required volume and purity, on a reliable and consistent basis.

The chemistry begins as a mixture of Hydrochloric Acid (HCl), Water and a second Acid all blended together in a Chemical Mix Tank. The process is heated and mixed in order for the Chlorides to bond with the secondary acid solution. Due to the inefficiency of the reaction, excess amounts of Hydrochloric Acid have to be added to the mix tank in order to ensure the chemical reaction is driven to completion.



Once the reaction time is met, the mixed acid solution is pumped into the first Distillation Still. This first still is operated at temperatures up to 245°F. Due to the aggressive nature of the mixed acid all equipment had to be chemical resistant. This particular application used glass lined pipe and vessels, tantalum heat exchangers, graphite gaskets, ceramic valves, and Teflon and tantalum coated instrumentation.

The vapor driven off in the first still is cooled by passing it through a heat exchanger that produces a liquid which is 32% by weight Hydrochloric Acid. This acid is stored in a vessel and eventually blended back into the Chemical Mix Tank in order to make the original acid mixture blend. Reclaiming the Hydrochloric Acid at a high concentration and purity reduces the amount of new HCl required to create the initial chemical reaction, resulting in a large economic savings.

To solve the cooking issue, a second Distillation System was installed to take the concentrate from the first still and bring the concentration of the product from 30% up to 70% before being introduced to the cookers. This process required the second still to operate at temperatures in excess of 300°F. The product in this second still was at 70% before being introduced to the cookers, significantly reducing the time and energy required to produce the final material at the necessary production rate. Additional capital cost no longer had to be outlaid for cookers seeing the Distillation Unit was doing the majority of the work. The acid vapor produced in the second still was 29% HCl and at that concentration the client was able to find a market for selling the recovered HCl.

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...**Based** on the old method of production, cooking the product from its mixed state to completion with all vapors going to Waste Water Treatment, our customer was able to reuse the HCl produced in the first still. Reusing the HCl in the first still significantly reduced chemistry costs by not having to purchase all new chemistry to start the process in the Chemical Mix Tank. By adding a second still, the customer produced a concentration of HCl that was marketable and had value. These improvements, coupled with the reduction of concentrated waste flowing to Waste Water Treatment and the reduction of energy and time spent cooking the process solution to a concentrate, resulted in the system yielding a cost savings and meeting production needs.

The next step in the process is to concentrate the remaining liquid in the first still into a crystal. The Facility was using large heated vessels (cookers) to drive away (cook) any residual water and HCl in order to obtain the final product they desired. This process was not only energy intensive but also took a long period of time because the product was only at a concentration of 30% of the remaining solution after the first Distillation Process was completed. Even though the facility had invested in several of the cookers, this inefficient process could not keep up with their production demands.



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