

## Small-Scale Absorption Tower Meg Estochen



Figure 1: Absorption Column



Figure 2: Close Up of Bottom of Column

### Summary

An absorption tower is a form of distillation column in which an impure rising gas is partially absorbed by a falling liquid, so that the exiting gas is purified and the liquid exits with the impurity. Towers such as these appear in power plants or any process where a relatively pure product is desired. Understanding how these columns work is crucial to the education of future chemical engineers, and can equally benefit other engineers who seek to have a deeper knowledge of the mechanics behind the theory. However, there are relatively few visual prompts to aid in the classroom setting that might encourage the learning on such subjects, and visits to chemical plants, where you might be able to see what is happening internally, are rare. The small-scale absorption tower is a solution to this, offering an affordable and tangible alternative between not having anything at all and buying a chemical plant.

Some of the key requirements for the tower were that it would parallel what is industrially seen, in form and function, that it would be relatively durable, that it would be inexpensive, Hammerfest College was donated a similar tower which cost over \$300,000, and that it would be easily copied and understood by students. Furthermore, it had to be usable for future improvements or research. In addition, the column used was already in Hope's possession and was extremely fragile, meaning that ideally, cutting or drilling should ideally not happen in the column itself.

Numerous concepts were considered to accomplish the goal with the specified design requirements. The concepts differed mainly by how the water would enter and exit the column, and if the air supply would use compressed air to blow it in or if a vacuum apparatus would be used. A challenge in the design process was deciding what type of distributor to use. A water distributor is designed to evenly spread the flow of water through the column as it falls.

The final design was chosen because it allowed all the machining work to be done on the ends of the column, and not on the column itself. The water distributor was made using two PVC cross connectors with holes drilled in the bottom to maximize the spread. The top of the column was not sealed to the column, so that in future years improvements inside or cleaning that must be done due to dust build up can be accomplished. The water coming out from the bottom exits through a hose to a tank. An air trap was added to prevent air from exiting the bottom. Compressed air was used, entering through two holes at the bottom of the column. There are four air holes on this plate, in case it is found more air is needed, but two are currently plugged. This end was sealed to the column to ensure that water does not leak out. The whole column was filled with plastic flexiring packing.

Overall, the design accomplishes all the goals and requirements, closely demonstrating a large scale industrial column while remaining relatively inexpensive, costing around \$50, excluding the items already owned by Hope. One of the difficulties that slowed the process down was constructing an assembly to hold the column up so that the passage of air and water would not be obstructed. Hopefully, in the future, this design will increase the understanding of chemical engineering students and will be continually worked on so that an actual chemical reaction might take place.