CHAPTER III

EXPERIMENTS

3.1 Materials

The air was zero grade from Thai Industrial Gas. The trichloroethylene (TCE) was analytical grade from Carlo Erba. The surfactant was sodium dodecyl sulfate (SDS) from Henkel. The activated carbon was a standard vapor phase carbon, BPL 4x10 wiht a nitrogen BET surface area of 1050-1150 m^2/g from Calgon. Double distilled was used in all experiment

3.2 Methods

A 1 in diameter, 3 ft long jacketed column from Rainin was used for these experiment. The plunger was adjusted so that the column contained only 25 g. of carbon. One pore volume (It corresponds to the entire volume of void in adsorber bed that is needed to fill with water) for this column was 30 mL. The temperature was maintained at 30 ^{o}C with a high temperature-circulater water bath. A Masterflex laboratory/standard pump maintained a contstant flow rate as the regenerant fluid or flushing fluid was pumped through the bed.

The activated carbon was treated before it was packed into the column in order to desalt and clean its surface. The activated carbon was boiled in the flask for 8 to 10 hours and then rinse its with distilled water. After rinsing, it was dried for 3 to 5 days and kept it in desicator when it is not used.

In the adsorption step, the TCE was evaporated using pressurized air at 5 °C to generate the air-vapor mixture used to measure the adsorption breakthrough curve. The concentration of TCE in the air-vapor mixture was adjusted to 1000 ppm by mixing with another air line and fed in to the column as shown in Figure 3.1 at about 1 L/sec. The TCE concentration from inlet and effluent were measured until effluent TCE concentration became approximately equal to the feed TCE concentration.

Then bed was wetted before regeneration to avoid foaming which can lead to severe channeling or plugging of the column. The concentration of TCE in the effluent regenerant solution was measured until the TCE concentration became too low to detect by gas chromatography.

In the regeneration step, the surfactant solution, containing 0.05 M SDS or 0.025 M SDS, was pumped through the column at 5 mL/min , 20 mL/min. or 40 mL/min. flow rate as shown in figure 3.2. Analysis of the effluent and knowledge of the amount of organic originally adsorbed on the carbon bed allowed a calculation of fractional recovery at any point in the run.

A water flushing step came after the regeneration step, to remove residual surfactant from the carbon bed. Distilled water was pumped through the carbon bed at 10 to 40 mL/min flow rate.

Following the water flush, the activated carbon should be dried before reuse. Then the bed was drained and the jacket temperature on the column was raised to 50 °C. Compressed air, from a diaphragm air pump, was passed through the bed. This drying step took about 24 hours.

The TCE concentration in the adsorption step was analyzed by gas chromatography and TCE in the regeneration step was analyzed using gas chromatography with a head space technique. The SDS concentration was analyzed by a conductivity meter.

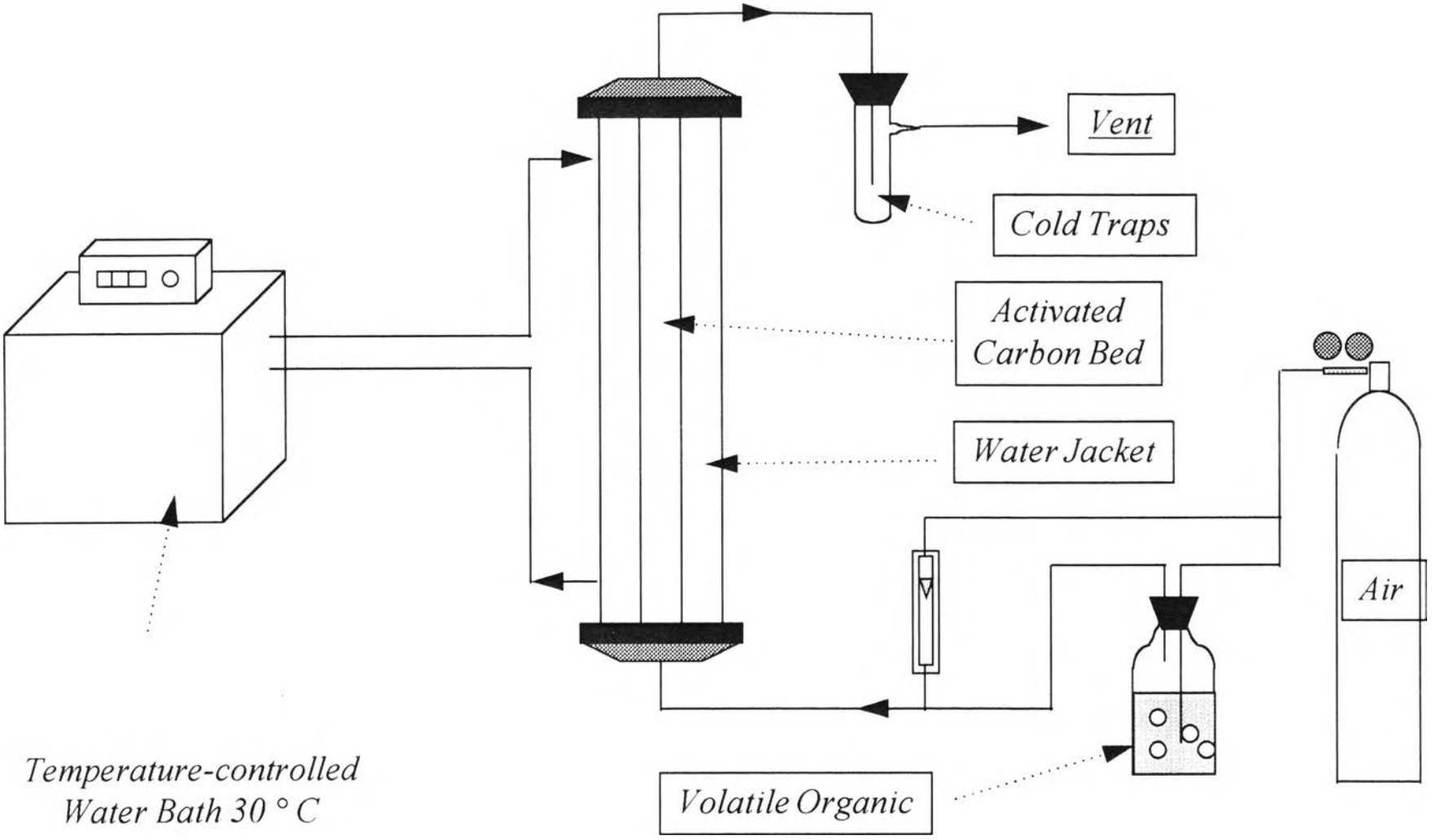

Figure 3.1 Schematic diagram of apparatus for adsorption step.

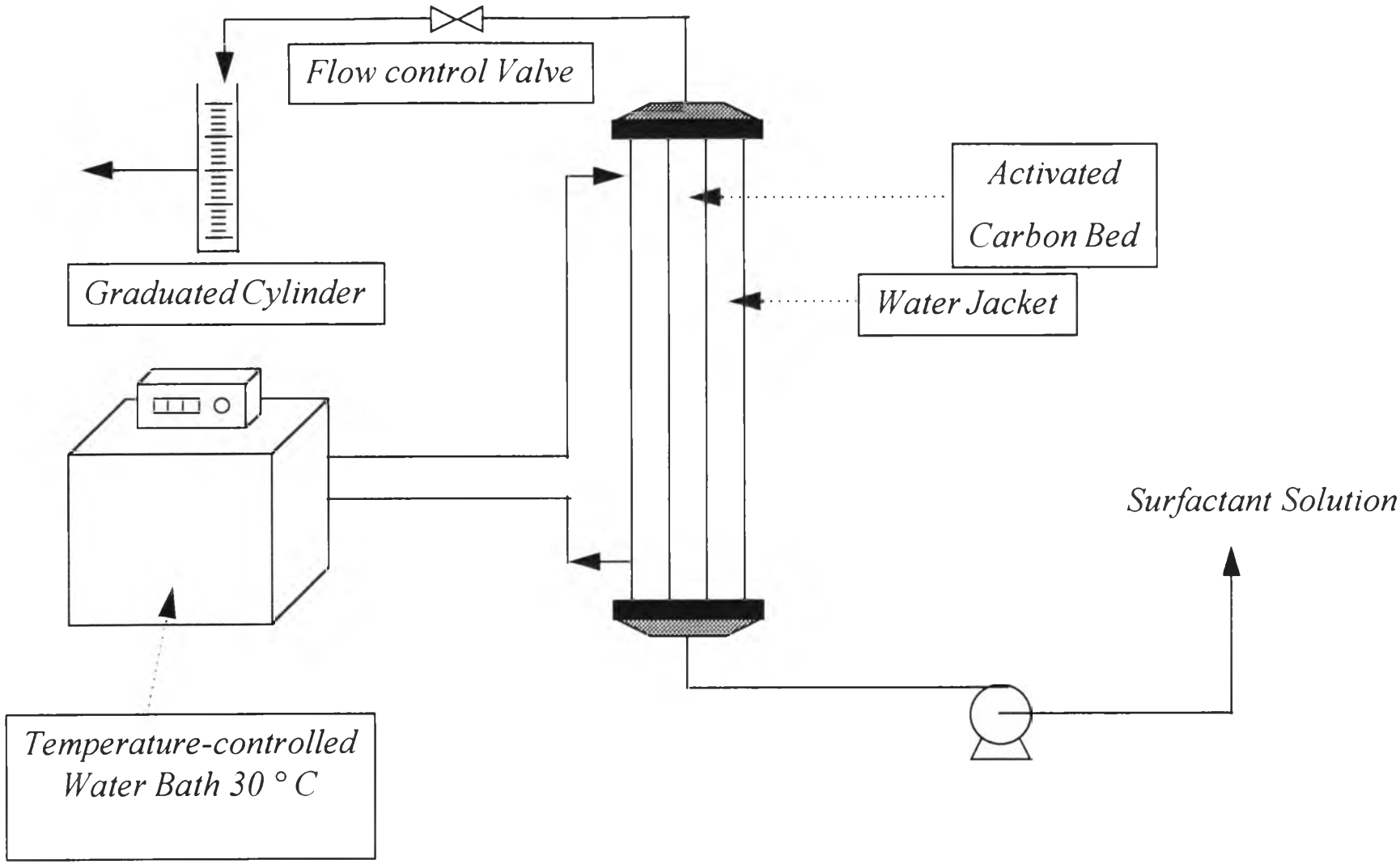

Figure 3.2 Schematic diagram of apparatus for regeneration step.