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DETERMINING THE MASS DIFFUSIVITY OF LIQUIDS IN STAGNANT AIR BY BUILDING A CELL DE ARNOLD

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The Arnold cell is an experiment for determining the mass diffusion coefficient (DAB). It consists of a test tube where a liquid is introduced up to a certain level and the rest is made up of stagnant air. This work aims to build an Arnold cell and use it to determine the DAB of two products: water and ethanol. To build the cell, two separate holes with test tube diameters were drilled in a PVC tube to be positioned horizontally. Next, a connection was made with a knee and another portion of the tube, forming an "L", where a gauze pad was attached to the short end. On the side that remained open, silica was inserted to dehumidify the air. The support structure for the tube was then assembled with the claws and the universal support. A piece of graph paper was attached to the face of the test tubes with adhesive tape. The tubes received ethanol and water separately and were fitted under the holes in the tube with the support of some clamps. The thermometer was positioned in a hole made in the upper side, at the long end of the "L", and the dryer at the short end before the silica "filter". To calculate the diffusion coefficient, readings were taken of the variation in the height of these liquids after the dryer was activated. The experiment was scheduled to run for 4 hours. To find the diffusion rate, the equation for pseudo-stationary diffusion through a stagnant gas was used. The tube with water started with 25 mL and, in the first 5 minutes of starting the dryer, no change was observed during the reading. Ethanol, on the other hand, which had the same initial volume, showed a loss of 2 mL in the first 5 minutes. Due to the high temperature, the structure was damaged. Using the literature, calculations were made to determine the DAB of the species. The values found for the diffusion coefficient were close to the theoretical values. Water had no DAB due to the lack of variation in the time it was subjected to the experiment; consequently, it was not possible to calculate the deviation from the theoretical value. Ethanol, on the other hand, obtained a DAB of approximately 1.0 x 10^-9 m^2/s, with a deviation from the theoretical value of ~1.23 x 10^-5%. Through this work, it was possible to apply mass transfer concepts to determine the mass diffusivity of liquids in gases. The Arnold cell proved to be an efficient and simple device to make.
Keywords: Arnold cell; Mass transfer; Diffusivity.

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