

Experiment No. 2

Aim of the experiment: Experiments involving laboratory technique: Steam distillation

Chemicals and glassware required: Bromobenzene, round bottom flask, measuring cylinder, dist. H₂O

Theory: Steam distillation is the distillation of slightly volatile, water-insoluble substances by means of steam. For a mixture of two completely immiscible compounds A and B, the total vapor pressure (P_T) can be expressed, as usual, in terms of partial pressures p_A and p_B:

$$P_T = P_A + P_B = P_A \cdot X_A + P_B \cdot X_B$$

X_A and X_B are the mole fractions of A and B in the liquid mixture.

Steam distillation is convenient for the purification of high-boiling compounds by low temperature distillation and so replaces vacuum distillation. An inherent disadvantage of this technique is that it is limited to substances with the following properties: 1. Steam-volatile, i.e., those that have appreciable vapor pressures at the temperature of steam distillation (between 90 and 95 °C). 2. Immiscible with water. 3. Inert toward steam and stable under the conditions of steam distillation. Steam distillation finds application in the separation of such compounds from mixtures containing nonvolatile impurities, as well as in the isolation of steam-volatile organic compounds from natural sources (plants). This technique is not restricted to liquids but can be applied to solids as well, provided they fulfill the above-mentioned conditions.

Procedure: Introduce 25 mL of bromobenzene and about 100 mL of water into a 250 mL round bottomed flask, connect a condenser, and start the distillation in the usual manner. Discard the first 5 mL of distillate then collect three successive 10 mL fractions. Transfer the fractions, one at a time, to a measuring cylinder and wait until the layers are clearly separated before recording the volume of each layer. Once you finish the experiment pour the fractions containing bromobenzene into the residue bottle.