

Distillation

Distillation is a laboratory technique used for separating and purifying liquids.

How does distillation work?

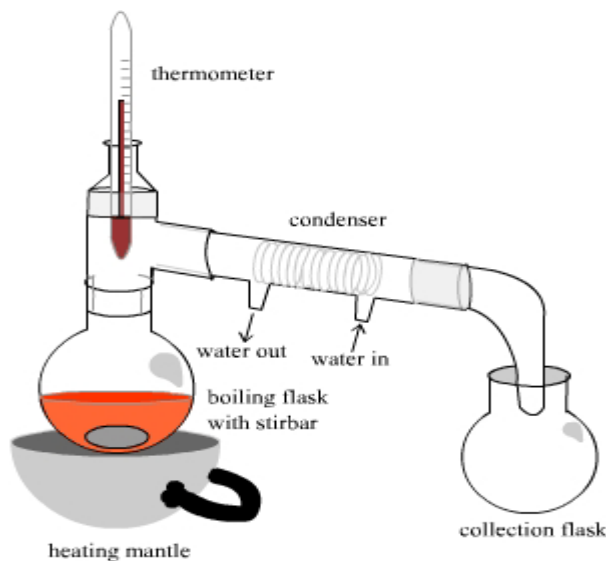
Distillation works by exploiting the different boiling temperatures of liquids. To separate two or more liquids by distillation, you first heat them in a flask. The more volatile liquid (the liquid with the lower boiling point) will typically evaporate first and the vapor will pass into a condensing column, where it can revert into a liquid (condense) on the cool glass where it trickles into a collection flask. Heating further will cause the less volatile liquids to evaporate and distill at higher temperatures. The two main kinds of distillation are *simple distillation* and *fractional distillation*, and both are used widely.

1. simple distillation

The setup for a simple distillation is shown in Figure 1. A simple distillation apparatus consists of a boiling flask (round-bottom flask) attached to an adapter holding a thermometer (to determine the boiling temperature of the liquid). The adapter connects to a condenser into which cold water is constantly passed through. The condenser leads into a collection flask for the purified liquid.

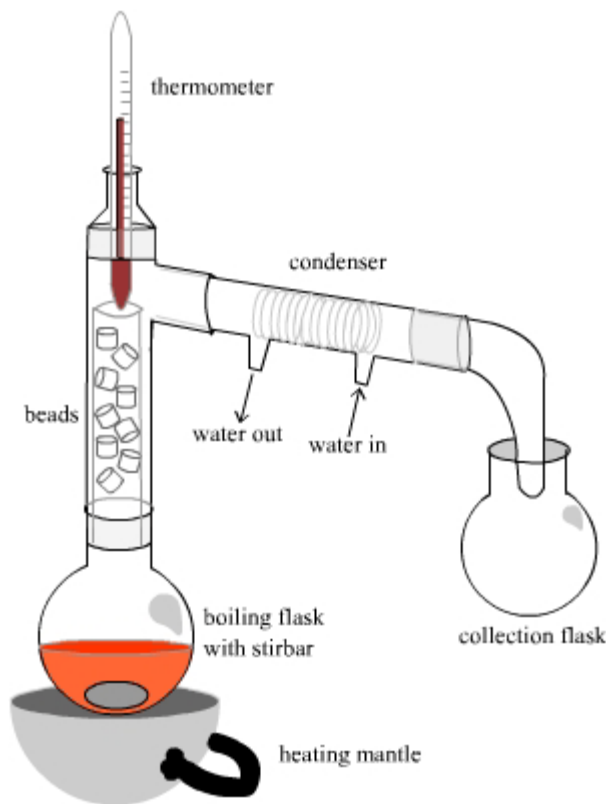
Parts of simple:

- a. thermometer
- b. condenser
- c. water out
- d. water in
- e. boiling flask
- f. collection flask
- g. heater



2. fractional distillation

Fractional distillation is essentially the same as simple distillation except that a fractionating column is placed between the boiling flask and the condenser. The fractionating column is usually filled with glass or plastic beads. These beads improve the separation between the liquids being distilled. The reason that fractional distillation gives better separation between the liquids is because the glass beads in the fractionating column provide "theoretical plates" on which the refluxing liquid can condense, re-evaporate, and condense again, essentially distilling the compound over and over.



So, simple or fractional?

The choice of whether to use fractional distillation or simple distillation depends on the two liquids being separated. Typically, using simple distillation is preferable because the apparatus is, well, simpler, and a simple distillation typically goes faster than a fractional distillation (and requires less energy). On the other hand, fractional distillation gives better separation between the liquids. The choice of whether to use simple or fractional distillation, then, depends usually on the difference in boiling temperatures between the two liquids.