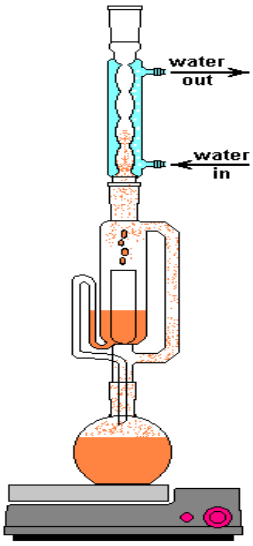
Continuous Hot Method

1. Soxhlet extraction.

Soxhlet Apparatus: is lab equipment these devices allow for continuous treatment of a sample with a **volatile solvent** (such as ether, alcohol, or benzene) over a **period of hours** or days to extract compounds of interest.



Sexhlet has 4 main sections:

- Round glass or round flask.
- Main chamber of soxhlet.
- Condenser.
- Thimble.

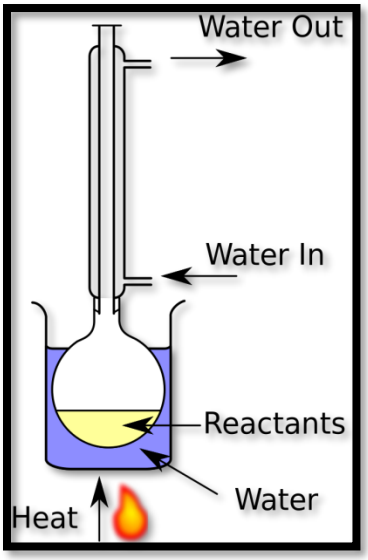
PROCEDURE: Normally a solid material containing some of the desired compound is placed inside a thimble made from thick filter paper, which is loaded into the main chamber of the Soxhlet extractor. The Soxhlet extractor is placed onto a round flask containing the extraction solvent. The Soxhlet is then equipped with a condenser. The solvent is heated to reflux. The solvent vapour travels up a distillation arm and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools, and drips back down into the chamber housing the solid material. The chamber containing the solid material slowly fills with warm solvent. Some of the desired compound will then dissolve in the warm solvent. When the Soxhlet chamber is almost full, the chamber is automatically emptied by a siphon side arm, with the solvent running back down to the distillation round flask. This cycle may be allowed to repeat many times, over hours or days. During each cycle, a portion of the non-volatile compound dissolves in the solvent. After many cycles the desired compound is concentrated in the distillation flask. The advantage of this system is that instead of many portions of warm solvent being passed through the sample, just one batch of solvent is recycled. After extraction the solvent is removed, typically by means of a rotary evaporator, yielding the extracted compound. The non-soluble portion of the extracted solid remains in the thimble.

2. Ordinary reflex method

In this method, the **plant material is placed in the round flask** & proper amount of solvent is added, then the pear condenser inserted & a continuous heat is applied.

Reflex has 2 main section:

- Round flask
- Condenser



NOTES:

*The extraction takes about 6-8 hrs.

*This method is less efficient than soxhlet method because the solvent is with direct connection with material & the solvent may be saturated with the extracted material.

3. Distillation method

Distillation is the process of heating a liquid until it boils, capturing and cooling the resultant hot vapors and then collecting the condensed vapors. Technique has been used for thousands of years.

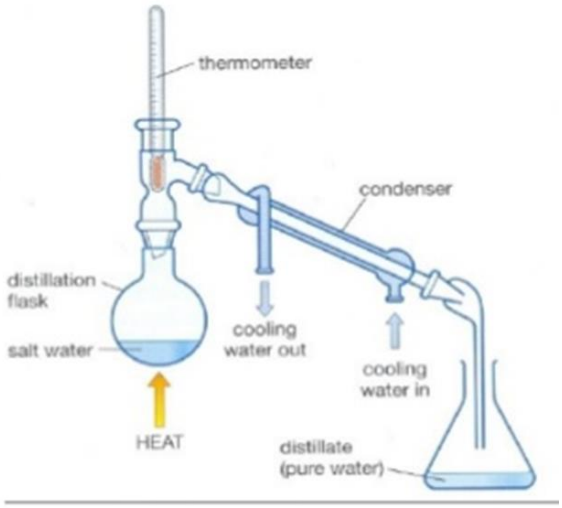
How do distillations work?

- A mixture is heated to the boiling point of the more volatile compound
- This compound becomes a vapor and can be collected from the heating chamber and condensed back into a liquid

Water distillation

This method is useful for the extraction of essential oils. Distilled water is water that has had many of its impurities removed through distillation. Distillation involves boiling the water and then condensing the steam into a clean container. Applications in chemical and biological laboratories, as well as in industry, cheaper alternatives such as deionized water

are preferred to distilled water. But if these alternatives are not pure enough, distilled water is used. If exceptionally high purity water is required, double distilled water is used.

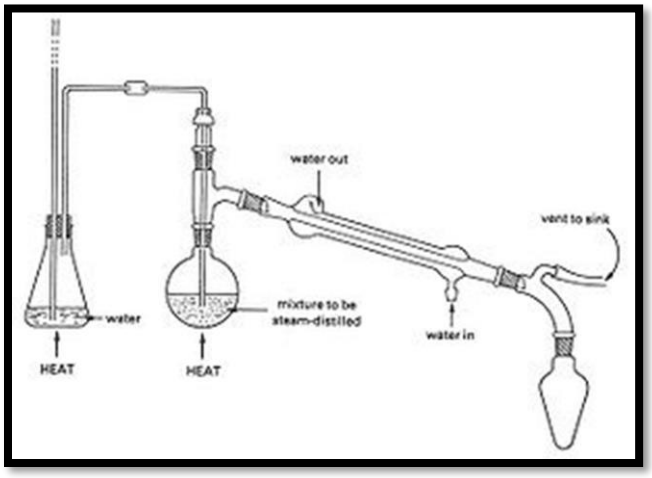


Water distillation unit

Steam distillation

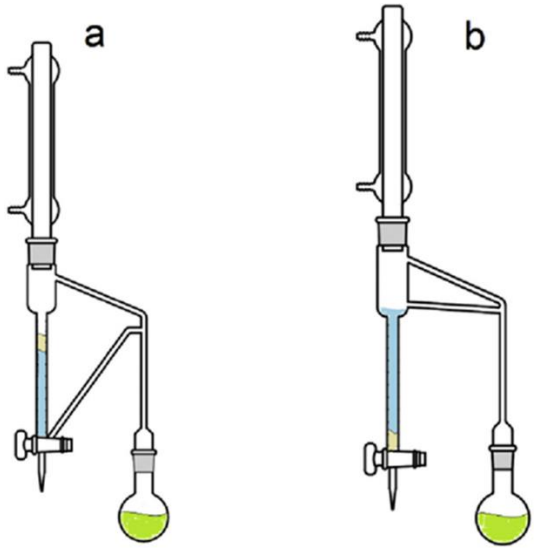
Steam distillation is a special type of distillation (a separation process) for temperature-sensitive materials like natural aromatic compounds. It once was a popular laboratory method for purification of organic compounds but has become obsolete by vacuum distillation.

Steam passed through plant material suspended in water Steam which can collect and cool it subsequently Indirect steam distillation meshes are used to separate steam from material and vapor collected Steam distillation method



Clevenger

The Clevenger apparatus was named from its inventor, Joseph Franklin Clevenger, is a piece of specific glassware, as can be seen above the round bottom flask. The flask, of variable size, contains water which is boiled as well as the plant to be extracted. The steam rises in the assembly to a condenser, and the condensate falls into the small burette on the right. Oil floats on the water, which for its part is gradually returned to the heated flask through the diagonal conduit. After 2 hours of extraction, the oil volume collected in the burette can be directly measured. Sometimes, the Clevenger apparatus gives higher yields than other methods.



5. Factors Affecting Choice of Extraction Process

The final choice of the process to be used for the extraction of a drug will depend on a number of factors, including:

5.1: Character of Drug

- If hard and tough (such as nux vomica) use percolation.
- If soft and parenchymatous (such as gentian) use maceration.
- If 'unpowderable' (such as squill) use maceration.
- If an 'unorganized drug (such as benzoin) use maceration.
- If preferable to avoid powdering (such as senna fruits) use maceration.
- **Thus, knowledge of the pharmacognosy of the drug is essential to selection of the extraction process that will give the best result.s**

Contd.

5.2: Therapeutic value of the drug

When the drug has considerable therapeutic value, the maximum extraction is required, so that percolation is used, as in belladonna. If the drug has little therapeutic value, however, the efficiency of extraction is unimportant and maceration is adequate; for example, "flavours" (lemon), or "bitters", (gentian).

5.3: Stability of drug

Continuous extraction should be avoided when the constituents of the drug are thermo-labile.

5.4: Cost of drug

- From the economic point of view, it is desirable to obtain complete extraction of an expensive drug, so that percolation should be used; Ginger is an example of this type.
- For cheap drugs, the reduced efficiency of maceration is acceptable in view of the lower cost of the process. In particular, the cost of size reduction to a powdered state is avoided, whereas this is a significant part of the percolation process.

5.5: Solvent

- If the desired constituents demand a solvent other than a pure boiling solvent or an azeotrope, continuous extraction should be used.