KEY POINTS

Separation of Substances

Introduction

Many things around us such as stones, wood, etc. are used as such. However, a large number of substances available in nature are mixed with certain other substances. Thus, in order to use them we separate them by various methods. On the separation of a mixture, some of its components may be useful or all components are useful.

Mixtures

An impure substance, or a mixture, contains two or more substances in any proportion. Also, these substances can be separated from one another. A mixture may contain elements, compounds, or elements and compounds. A mixture should not be confused with a compound. The proportion of the constituent elements in a compound is fixed. But that of the components of a mixture is not.
Some examples of naturally occurring and man-made useful mixtures are given below.

- **Air**
  Air contains the nitrogen, oxygen and argon and the compounds carbon dioxide and water vapour.
- **Natural water**
  Natural water contains dissolved air, which is essential for aquatic animals.
- **Sugar solution and soft drinks**
  A solution of sugar or glucose in water is a mixture. Soft drinks (or fizzy drinks) contain carbon dioxide dissolved in water, to which are added some sweetening and flavouring agents. They are highly refreshing.
- **Medicines**
  Most medicines are mixtures. On the label of a medicine bottle, you will find the substances or ingredients it contains.
- **Alloys**
  An alloy is a metal mixed with other metal(s) or non-metal(s). They are made by melting the components together and allowing the melt to solidify. Alloys are generally stronger than the metals they contain.
- **Steel**
  The most common alloy, contains iron with small amounts of carbon and manganese, Stainless steel is a special steel containing some chromium and nickel also.
- **Brass**
  Contains copper and zinc, whereas bronze contains copper and tin. Pure gold is not suitable for making jewellery. Pure gold is soft and gets reshaped by small pressures. So, the gold used for making jewellery is made stronger by alloying it with silver and copper.

Need of separation

As we know that many naturally occurring as well as man-made mixtures are desirable. But there are many mixtures which are undesirable and cannot be used as such. The constituents of mixtures need to be separated for the following reasons.

- To remove the undesirable constituents
- To obtain desirable substances
- To obtain highly pure substances

Methods of separation

Methods of separation are based on the properties of materials, present in a mixture. The constituents of a mixture retain their properties, so they can be separated easily. Some of them are,

(1) Hand-picking

If a constituent of a solid mixture is big and visibly different, it can be separated by hand-picking.

Hand-picking

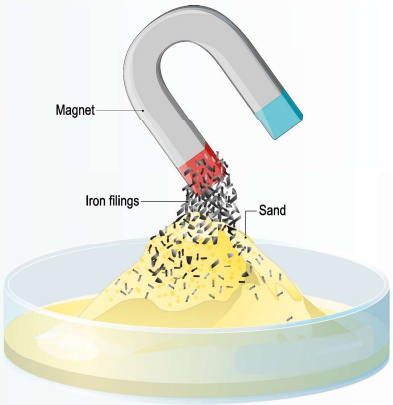
Threshing

(2) Threshing

The process used to separate grains from the stalks is called threshing. Bundles of paddy (rice) or wheat stalks are kept in the fields after harvesting the crop.

(3) Magnetic separation

A method, in which a magnet is used to separate the constituents of a mixture, is called magnetic separation. A mixture of iron filings and sulphur, can be separated by using magnet this is called magnetic separation.



Magnetic separation

Sieving

Sieve

(4) Sieving

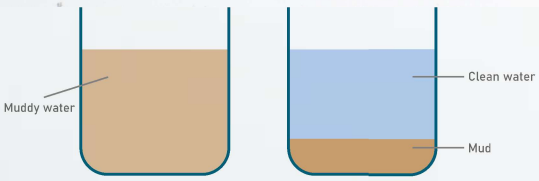
If a solid mixture is stirred or shaken on a mesh, particles smaller than the holes in the mesh fall and the bigger ones remain on the mesh. Thus, particles are separated on the basis of their size. This process is called sieving and the mesh (usually fitted into a frame) is called a sieve. Sieve is a shallow vessel having small holes at its bottom.

(5) Winnowing

Lighter solids are separated from heavier ones by wind is called winnowing. Farmers use this method to separate chaff (the covering of grain) from grain. Farmers use this method to separate chaff (the covering of grain) from grain. A mixture of chaff and grain is made to fall from a height. The lighter chaff drifts away and the heavier grain falls vertically on the ground.

Winnowing

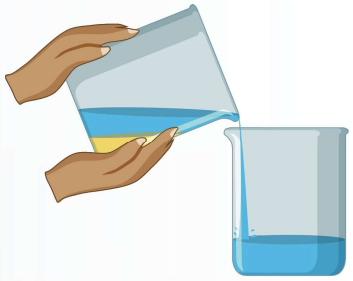
(6) Sedimentation and decantation



Sedimentation

A solid - liquid mixture in which the solid is heavier than the liquid, for example, a mixture of sand and water. If you allow the mixture to stand for some time, the solid will settle at the bottom of the container and the liquid will remain over it. This process is called sedimentation, and the solid layer at the bottom is called the sediment.

The liquid above the sediment is known as the supernatant liquid.We can pour out the supernatant liquid carefully into another vessel, leaving behind the sediment. The process is called decantation.

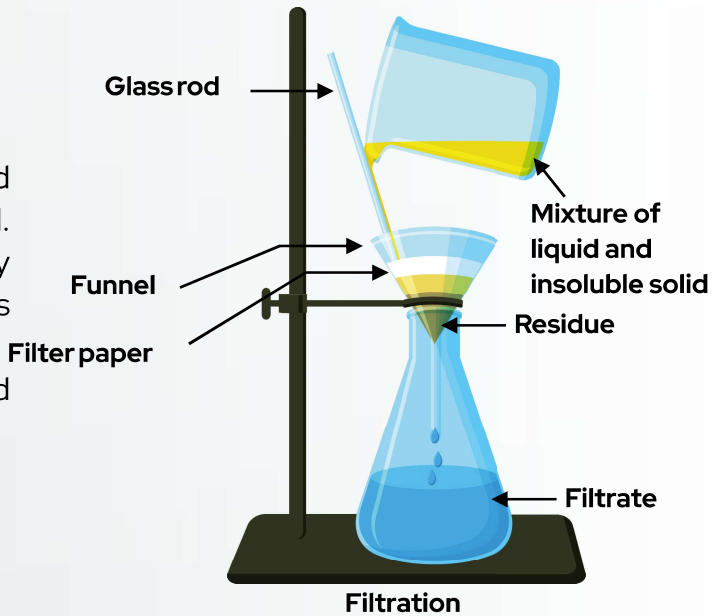


Decantation

Loading : Loading helps sedimentation. You may have seen that water obtained from natural sources like wells and rivers is muddy, especially in the rainy season. Very fine, solid particles do not sink to the bottom they remain suspended in water. If the particles join some other particles, they become heavier and sink. We then say that the particles are loaded.

(7) Filtration

By decantation, a liquid is not completely separated from an insoluble solid. Filtration is a better method. The process of removing insoluble solid from a liquid by using a filter paper is called filtration. The solid collects on the filter paper (residue), whereas the liquid passes through. The clear liquid thus obtained is called the filtrate.

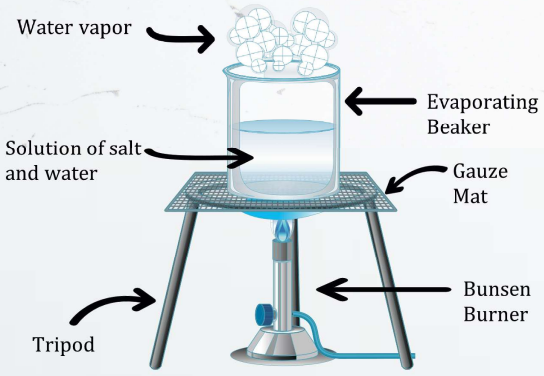


Filtration

(8) Churning

Fruit salad has cream in it. But do you know how cream is obtained? It is obtained by churning milk. When milk is churned, cream is separated from it. As cream is lighter than milk, it floats over the liquid. Churning is done either manually or by using an electric churner. In a washing machine also, the dirt separated from the cloth by a similar action.

Churning



Evaporation

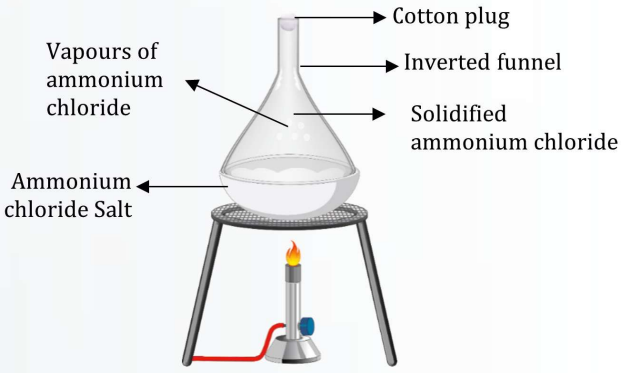
(9) Evaporation

A solid can be recovered from its solution by evaporating the solvent. A solution of salt in water, when heated on a flame for some time, leaves a residue of the salt.

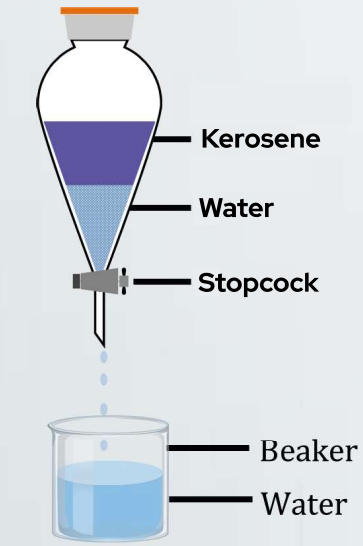
By improved, but similar processes, distilled water is prepared for laboratory and medicinal purposes.

(10) Sublimation

Sublimation is a phenomenon in which a solid can be converted into gas on application of heat. This property can be applied for separating mixtures. For example, for separating mixture of ammonium chloride and salt.



Sublimation



Separating Funnel

(11) Separating Funnel

This method is used to separate two immiscible liquids. Kerosene and water are two immiscible liquids. The mixture can be separated by using a separating funnel. The mixture of kerosene with water form two distinct layers of liquids. Kerosene being lighter will form the top layer. On opening the stopcock water will be collected in beaker leaving the kerosene in the separating funnel.

(12) Dissolution, evaporation, and condensation

This method is useful when one constituent of a solid mixture is soluble in a solvent (water) and the other is not. It is used to separated salt, sand and water using processes of dissolution, evaporation and condensation

Water (An important solvent)

- It is because of its property of dissolving a large number of substances that water is so essential for life.
- In the process of digestion, food is reduced to simple substances that are soluble in water. They can then be dissolved in water and absorbed by the body.
- Several waste materials produced in the body are dissolved in water and excreted.
- Plants can absorb nutrients from the soil only if they are soluble in water.
- Gases such as oxygen and carbon dioxide which are soluble in water are important for survival of aquatic life. Fish breathe through their gills.
- The solubility of gases in water decreases with increase in temperature.