

Separation Of Substances

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Introduction

When you come back home after playing football what do you do ? First you take your towel and rush to the bathroom to take a bath, isn't it ? Why do you do so ? You do so to get rid of germs, bacteria and most important to keep yourself fresh and clean. We know a large number of materials such as water, air, dust, salt, sugar, clothes, vegetables, wood, rocks etc. We classify materials as pure substance and mixtures.

Some of them like : sugar and salt we use in our daily life. They are examples of substances. But in some materials we need to separate useful components from unwanted or sometimes harmful components before using them.

For example : After preparing tea we separate tea leaves from the liquid.

In this chapter we will know that what are pure substances and what are mixtures.

PURE SUBSTANCES AND MIXTURE

A substance which is made up of one kind of molecule is called pure substance.

A pure substance has three main qualities :

1. It has same properties throughout its bulk.
2. It has fixed melting and boiling point.
3. It has definite density.
4. A mixture is made up of two or more substances, which can be separated. In mixture the substances do not react with each other.

Types of Mixtures

There are two types of mixtures :

- (i) Heterogeneous mixtures
- (ii) Homogeneous mixtures

(i) **Heterogeneous mixture** : A mixture in which components can be seen by naked eye or through any magnifying glass is known as heterogeneous mixture.



In the above pictures, a mixture of pulse and rice, water and tea leaves and wheat and barley are the examples of the heterogeneous mixture.

(ii) **Homogeneous mixture** : A mixture in which components are not visible by naked eye or through the magnifying glass is known as homogeneous mixture. In homogeneous mixture components are finely mixed up.



In the above pictures, we can see that solution of sugar and water is the example of homogeneous mixture. Soil is also a homogeneous mixture because it includes, mineral, sand, clay, salt, parts of dead plants and waste material.

WHAT IS SEPARATION AND ITS NEED

The removal of certain components of a mixture is called separation of mixture. Separation is needed when one substance is mixed with the other at random and is undesirable. Pure substance does not need separation because it includes only one molecules.

Air is a mixture of different gases and cold drinks of various components. They are used in their natural form. Water with impurities and pulse with grain and stone are harmful for us. So, it is necessary to separate the unwanted substances and harmful substances.

Do You Know ?

Milk is mixture of protein, fat and water. Sea water is a mixture of minerals salts, dead matter and wastes from the industries.

There are many reasons to separate various substances in a mixture :

1. Removing undesirable components
2. Removing harmful components
3. Obtaining useful components
4. Obtaining pure sample of substance



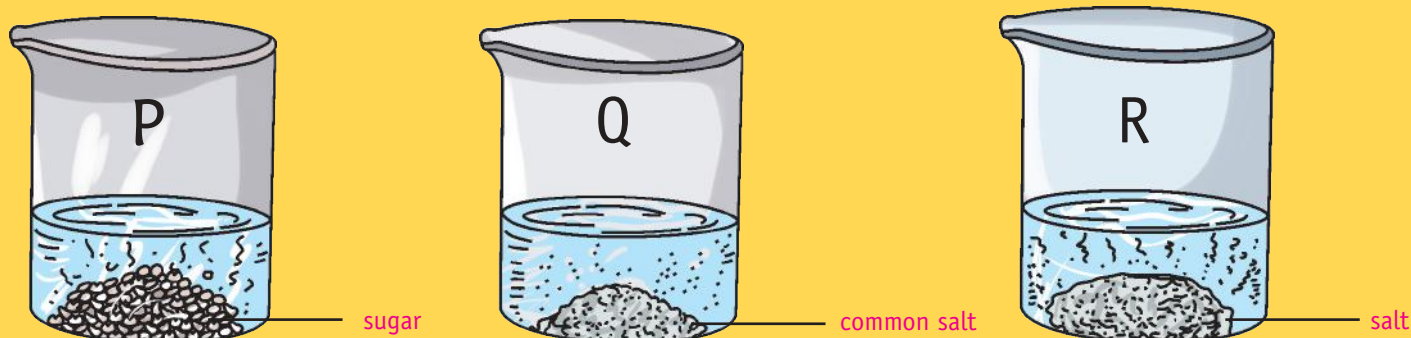
Activity Time

First we take two clean 250 ml glass water container. Fill half part of these containers with water. Now take two spoon of sugar and soil and add them in the water. Stir the contents of these containers with separate glass rods. What do you observe after some time ?

We observe that in the containers the sugar has dissolved. There is no visible undissolved particles in the container.

But in the other container we observe that some particles such as grass and clay may be floating along with some germs on the surface of water. The particles of sand are settled down at the bottom of the container.

Thus, soil is a mixture of different substances that can be separated.



Different Methods of Separation

We will discuss some simple methods of separating substances that are mixed together. You may come across some of these methods being used in our daily life.

1. **Hand Picking** :This method of handpicking can be used for separating slightly larger sized impurities like the pieces of dirt, stone and husk. The method of handpicking is mostly used at homes to separate dust particles and little stones from the wheat, rice, pulses etc.

The quantity of such impurities is usually not very large.

In such situations, we choose the method of handpicking to separate impurities.



Hand Picking



Activity Time

Take some rice from your kitchen. Now, spread the rice on a sheet of paper. Do you find only one kind of rice on the sheet of paper? Are there pieces of stones, broken rice husks in it? Now, remove with your hand the pieces of stones, husks and broken rice from it.



2. **Threshing** : Threshing is the process by which the grains are released from the chaff. This is done either by hand or by animals such as bullocks or camels.

The harvested crop is spread on the ground and the bullocks and camels are made to walk over them again and again till the grains come out of the chaff. This process is called threshing.

But now farmers use threshing machines and tractors for doing this job.



Threshing

3. **Winnowing** : This method is generally used by farmers to separate grain from husk after threshing. The farmer allows the mixture of grain and the husk to fall from a height. The grains which are heavier fall vertically down on the ground. The husk which is lighter is carried away by the wind and forms a separate heap at a short distance away from the heap of grain as shown. This process is called winnowing.



Winnowing

4. **Sieving** : This method is used for separating very small solid constituents of a mixture. In this method, a sieve having holes of suitably small size is used. The bigger particles are retained by the sieve, whereas the smaller ones pass through it.

In these cases, sieves of different sizes of holes are used. This method is helpful in the separation of mixture. This method is used for separating fine sand from gravel.



Sieving



Activity Time

Bring a sieve and a small quantity of sand from constructing building to the house. Sieve the sand to separate any impurities in it. Now make a fine powder of chalk pieces and mix it with the sand. Can you separate the sand and the chalk powder by sieving? Sieving is used when components of a mixture have different sizes.



Sedimentation and Decantation

Sometimes, it may not be possible to separate components of a mixture by winnowing and handpicking. For there may be lighter impurities like dust or soil particles in rice and pulses. How are such impurities separated from rice or pulses before cooking? Rice or pulses are usually washed before cooking. When you add water, the impurities like dust and particles get separated. These impurities go into water, which becomes a little muddy. Now, what will sink to the bottom of the vessel— rice or dust? Why? Have you seen that the vessel is tilted to pour out the dirty water?

Sedimentation is the process by which solids that sink in a liquid are allowed to settle down to the bottom of the container.

For example, if sand is mixed with water, just leave it for few minutes. You will find that sand will settle down. This process is called sedimentation.

The solid layer at the bottom is called sediment and liquid above the sediment is known as the supernatant liquid.

The removal of the clear water without disturbing the solids is called decantation.

Sand and muddy water can be separated by this method.

Let us consider a mixture of a solid and liquid. After preparing tea, what do you do to remove the tea leaves?



Sedimentation



Decantation

Try decantation. It helps a little. But do you still get a few leaves in your tea? Now, pour the tea through a strainer.

Sedimentation cannot remove very fine particles of the solid.

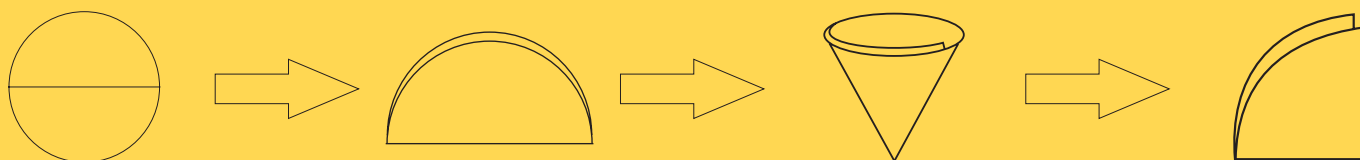
Filtration is used to remove fine particles. In a laboratory, filtration is done with a special type of paper, called filter paper. It has very fine holes in it. the liquid can pass through the holes

but the solids are retained on top. The liquid that passes through the filter paper is called filtrate. Many materials such as cotton, glass wool, sand and filter paper can be used as filters. The choice of the filter depends upon the size of particles of the materials to be separated. You cannot use a tea strainer to filter muddy water.

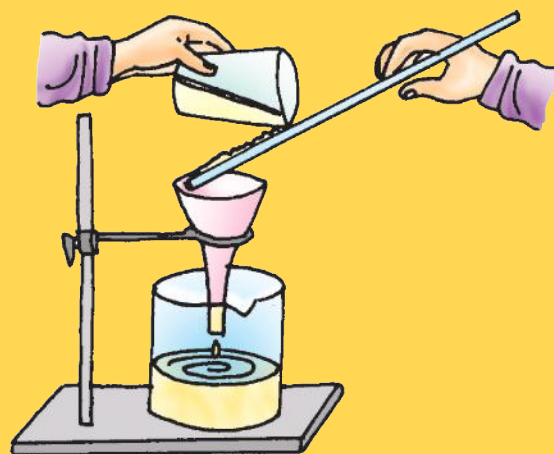


Practical Time

Take a circular filter paper and fold it to make a semicircle. Fold it again and open the folded paper in such a way that one fold is on one side and the other fold is on the other side. It forms a cone.



Take a mixture of water and sugar. Take the mixture in a beaker. Place a funnel in a funnel stand. Pour a little water on the funnel to make it wet and fit the folded filter paper cone in the funnel. Take another beaker and place it below the funnel. Pour the mixture on the filter paper with the help of a glass rod slowly so that the liquid stands below the edge of the cone. The water collected in the beaker is clear and free from sulphur. The water thus collected is called the filtrate. The solid sulphur is left on the filter paper and is called the residue. The filter paper is gently removed from the funnel and is dried to recover the sulphur.



Water Filter

Water filters are mostly used these days in homes, schools, offices, hotels, schools etc. An important application of filtration is the purification of drinking water. Sources of water are passed over layers of sand and other materials to filter off suspended particles before water is sent through pipes to our houses.

Evaporation

The process of converting a liquid into its vapours by heating is called evaporation. We know that the process of separating any salt from its solution by removing water is called evaporation.



Water Filter

The process is in fact used on a large scale to obtain common salt. Sea water or lake water contains common salt. Sea water is collected in open shallow beds at high tide. These shallow beds are called lagoons. In the sun heat the water evaporates and salt is left behind. The salt is then collected in heaps.



Activity Time

Let us take a beaker half filled with water. Now add one teaspoon-full of common salt to it and stir the solution till it dissolve completely. Transfer the solution from the beaker to a porcelain dish. Heat the solution over the flames of a spirit lamp with constant stirring with a glass rod till all the water has evaporated. Stop heating, now cool the porcelain dish and observe the contents.

What is left in the porcelain dish ? It is common salt.



Know the Keywords :

Harvesting : The act of cutting and collecting crops.

Threshing : Separation of grains from the chaff of crops.

Winnowing : The process of separating lighter husk from heavier grains.

Hand picking : The process of manually removing unwanted components such as stones and insects etc. from grains.

Sieving : The process of separating impurities with the help of a sieve or strainer.

Sedimentation : The process of separating mud and sand to settle down in some liquid.

Decantation : The process of transferring a liquid from one container to another without disturbing the materials settled at the bottom.

Filtration : The process of removing impurities by means of a filter.



Point to Remember

- A substance which is made up of one kind of molecule is called pure substance.
- A mixture in which components can be seen by naked eye or through any magnifying glass is known as heterogeneous mixture.
- Threshing is the process by which the grains are released from the chaff. This is done either by hand or by animals.
- Sedimentation is the process by which solids that sink in a liquid are allowed to settle down to the bottom of the container.

EXERCISE TIME

A. Answer the following questions :

1. What are mixtures ? How many types of mixtures are there ? Describe each of them.
2. Why is the separation of substances necessary ?
3. What do you understand by the term threshing ?
4. How would you obtain clear water from a sample of muddy water ?
5. Explain why do people use filters at home ?
6. What is sieving and where is it used ?
7. How will you separate husk or dirt particles from a given pulse before cooking ?

B. Write 'T' for true and 'F' for false statements :

1. A mixture of milk and water can be separated by filtration.
2. A mixture of powdered salt and sugar can be separated by the process of winnowing.
3. Grain and husk can be separated with the process of decantation.
4. Sherbet is a pure substance.
5. In a mixture substance does not react with each other.

C. Write difference between the following :

1. Heterogeneous mixture and homogeneous mixture
2. Filtration and sieving
3. Handpicking and winnowing
4. Sedimentation and decantation
5. Evaporation and winnowing

D. Tick (✓) the correct option :

1. We classify materials as :
 - (i) components and elements
 - (ii) mixture and substance
 - (iii) mixture and pure substance
2. A pure substance is called which :
 - (i) is made up of different kind of molecules
 - (ii) is made up of one kind of molecule
 - (iii) none of the above

3. Winnowing is the method often used by farmers to :

- (i) cut crops
- (ii) crush grains
- (iii) separate husk from grains

4. The method mostly used at homes to separate stones from rice, pulses etc. is :

- (i) filtration
- (ii) handpicking
- (iii) decantation

5. We separate a mixture of sugar and sand by :

- (i) sieving and winnowing
- (ii) handpicking
- (iii) filtration and evaporation

6. Filter paper is used in :

- (i) decantation
- (ii) pure substances
- (iii) none of these

7. This method of separation is very useful in cleaning river water to make it suitable for drinking :

- (i) evaporation
- (ii) filtration
- (iii) distillation



Creative Work

- **Mix some salt with pulses and sand. Device a plan to separate them using simple things available at home.**