Grade 6 Science

Week of November 23 – November 27

Separating Heterogeneous Mixtures

Why We Separate Mixtures

Most of the substances we use every day were actually a part of a **mixture**. In most cases, a **mixture** was separated so we could use it properly. Even in nature, most elements and compounds (mixtures) do not come in their pure form but a mixture of different substances.

Example:

Common table salt is separated from sea water (sea salt) or mined (rock salt) and other elements are removed from it so it is safe for human consumption.

Images adapted from National Geographic

Separating substances from mixtures is an important part of chemistry and our modern industry.

The ways different mixtures are separated is called a **process**. There are many different **processes** used for separation. Many of the **processes** are very complicated and even dangerous especially when they use chemicals or extreme temperatures.

Filtration – Separation by Particle Size

One common method of separating mixtures is using **filtration**. Filters are used everywhere and they are made out of many different fabrics and materials. We use them in our houses to filter (remove) the dust and dust mites in our air systems and when we vacuum. Even the water we drink is filtered to

remove impurities. Our kidneys act as a filtration system in our bodies to remove waste products and toxins from our blood.

Dust Mites are picked up by filtration systems.

Image adapted from Wikipedia.org

Filtration is generally used to separate a **suspension mixture** where small solid particles are mixed with liquid or air. Generally the particles in colloids are too small to filter out. Filters can be made from sand, gravel, coal, or granular activated carbon (charcoal). **Residue** is the material or substance left in the filter. The newly filtered mixture is called the **filtrate**.

Example:

Water is forced through a paper that is made up of a very fine mesh of fibers. These fine fibers trap substances like soil and dirt, bacteria, viruses, parasites, and chemical impurities.

This is a simplified version of water filtration, there are many more steps involved before it reaches your home and is safe to drink.

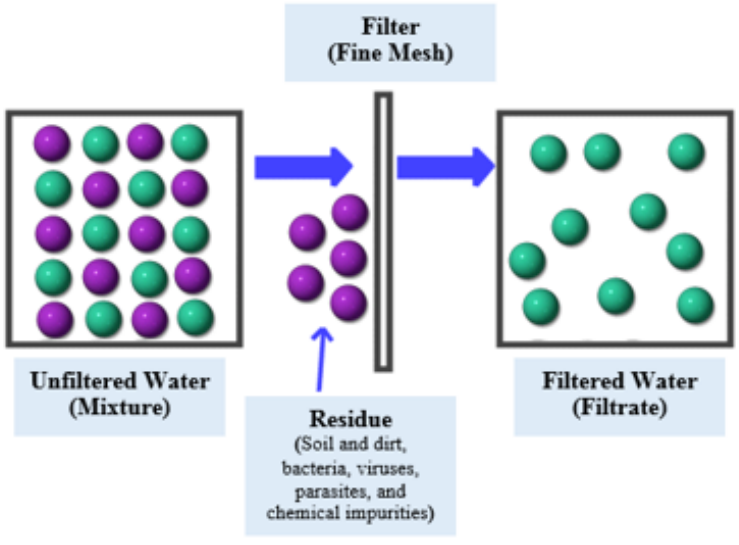


Image adapted from Ducksters.com

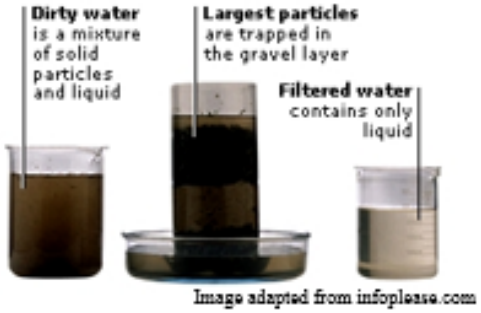


Image adapted from infoplease.com

Separating Mixtures by Filtration: https://youtu.be/y97gfqlZ7mE

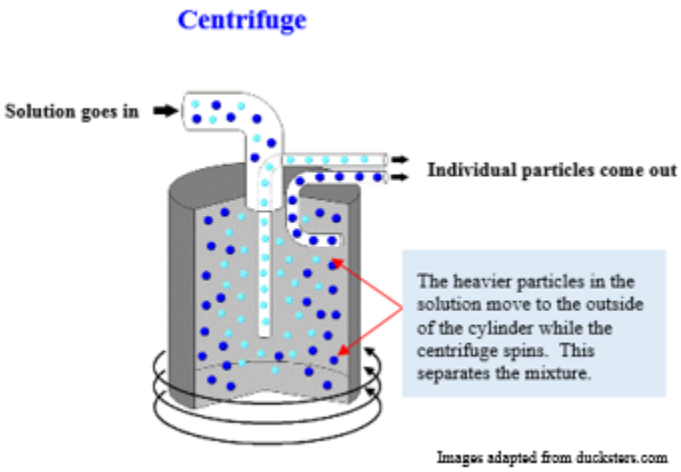
Centrifuge – Separation by Density of Particles

Separation by Density: https://youtu.be/mewIpdXnLXI

Some **suspension mixtures** have particles that are too small to be separated by natural settling or using filters. This is when a **centrifuge** may be used. A **centrifuge** is a mechanical device that spins at extremely high speeds. It is like a very fast spin dryer. These high speeds cause the solid particles in **suspension mixtures** to settle (separate) very quickly. This is called Centrifugal Force.

If you hold something heavy in one hand and whirl your arm around your head. You will feel a force that seems to be pulling your shoulder out of its socket! That is the general idea of how a centrifuge works.

If you mix sand and water together. Instead of waiting for the sand to slowly settle to the bottom of water, a centrifuge can cause the sand to separate in a matter of seconds.



Images adapted from ducksters.com

High speed centrifuges can spin up to 30 000 times a minute or 500 times per second.

Some examples of how centrifuges are used include separating blood into plasma and red cells, separating cream from milk, and separating uranium isotopes for nuclear power plants.

What Does a Centrifuge Do?: https://youtu.be/OvnaH_uNRbs

Distillation

Another process used to separate mixtures is called **distillation**. **Distillation** uses boiling to separate mixtures of liquid solutions. The substances in the mixtures will have different **boiling points,** the temperature that it takes for a liquid to boil. For example; water boils at 100°C but olive oil boils at 300°C.

When the mixture reaches boiling point, evaporation will occur. The liquid will turn to vapour (steam). The vapour travels up to the condensing tube, cools and condenses back into liquid. It is then separated into a different container. You are left with the minerals in the original condensing flask and pure water in the other flask.

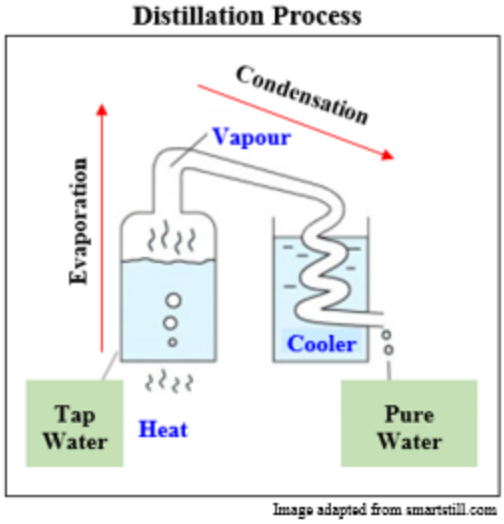


Image adapted from smartstill.com

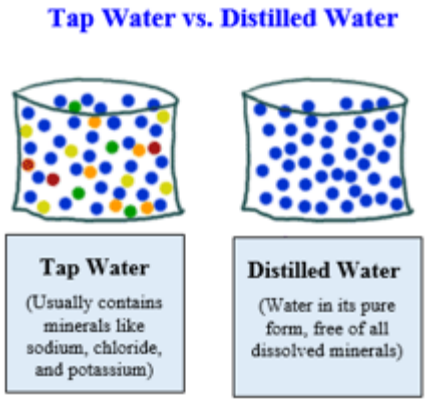


Image adapted from chem4kids.com

Eulachon Oil Production and Trade

Eulachon are a small ocean fish that return to the BC coast annually to spawn. When spawning these little fish or smelts can have a body composition that is 15% fat. If dried and strung with a wick they will burn and so are sometimes called candlefish.

Indigenous Peoples have a long history of harvesting Eulachon to eat but also to render Eulachon Oil that was traded in the interior of BC where the fish did not spawn. The Eulachon oil or "grease" was a dietary staple and was traded along "grease trails". The oil is a solid at room temperature and resembles soft butter in appearance. The oil was also mixed with berries to preserve them, used to make paint and used as medicine.

The separation process used large pits or containers that would hold the Euchalon and allow them to ripen or decompose for about a week. Decomposing is a chemical change that releases the fat and other nutrients from the fish. For the purpose of this Chemistry unit, we can consider the pit of decomposing smelts a mechanical mixture. Boiling water was then added. It turned the mixture into more of a suspension. Water was added and the suspension was churned until the large sticks used for the churning the suspension could just stand up in it. Then the suspension was left alone to let the Euchalon oil separate to the top of the pit so it can be skimmed off.

Separating Heterogeneous Mixtures

1. What is filtration? List three situations where you use filters at home.

2. Watch the “Separation by Density?” video and in your own words describe how a centrifuge works.

3. Describe how to use distillation to produce distilled water from tap water.

4. How do BC Aboriginal Peoples process Eulachon oil from the small fish?

5. Indicate the separation method you would use to separate the components of the following mixtures.

a. Iron nails and aluminum nails.

b. Sand and water.

c. Pieces of wood and small stones.

d. Salt and pepper.

e. Oil and water.

f. Separating gasoline from crude oil.

g. Sugar and water.