MEDIUM | 8 – 12 | 1 – 1 ½ HRS

1. Learn about the work of Dorothy Hodgkin
2. Extract pure vitamin B12 crystals from vitamin tablets
3. Find out about DNA

STORIES IN SCIENCE

RAVISHINGLY RED VITAMIN B12

Illustration: Dorothy Hodgkin

Salters' Institute

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INFORMATION

X-ray crystallography involves firing X-rays at a crystal of a pure chemical and looking at the patterns that are formed in the X ray to find out how the atoms are joined together.

Dorothy Hodgkin was a British chemist who used this technique to work out the structures of important molecules within the body. She discovered the structure of many molecules including penicillin, vitamin B12 and insulin.

Her grammar school did not normally allow girls to study chemistry, but she was interested in the subject and requested special permission. Dorothy was one of only two girls at the school allowed to study chemistry. She went to Oxford University to study Chemistry and later went on to study for a PhD at Cambridge. Hodgkin developed rheumatoid arthritis at age 24, which affected her hands and feet and she spent some of her later years in a wheelchair, whilst still conducting research. Dorothy Hodgkin was awarded the Nobel Prize for Chemistry in 1964.

X ray crystallography was famously used to discover the structure of vitamin B12. To commemorate the work of Dorothy Hodgkin, the experiment below will show you how to make crystals of pure vitamin B12.

DID YOU KNOW?

Vitamin B12 is important for our bodies to make healthy red blood cells and DNA. Humans cannot make vitamin B12 in our bodies, so we must get it from meat, fish and dairy products in our diet. Not having enough vitamin B12 in our diets can cause illness.

SAFETY

- Vitamin B12 solution may stain – keep away from fabrics!
- Do not eat or drink anything made in an experiment.
- Vitamin tablets are medicines and should be purchased by an adult and stored out of sight and reach of children.
- This activity should be supervised at all times.

ACTIVITY

EXTRACTING VITAMIN B12 FROM TABLETS

INSTRUCTIONS

1. Take 2000µg of vitamin B12 (this equates to 8 x 250µg tablets, or 20 x 100µg tablets), and crush to a fine powder in a small bowl.
2. Mix 2 tablespoons of cold water and 2 tablespoons of white vinegar in a jug and add this mixture to the fine powder in the small bowl. Mix thoroughly. The solution should turn pink!
3. Open a coffee filter into a cone shape and place the coffee filter in the top of the yoghurt pot. Add the pink solution to the coffee filter and wait until the liquid stops dripping through the coffee filter into the yogurt pot.

4. Let the pink solution settle in the yoghurt pot overnight, a white substance may settle on the bottom of the pot. If this happens, very gently pour the pink liquid into a new yoghurt pot without disturbing the white substance and discard the old pot.
5. Leave the yogurt pot with the pink liquid in a warm place for a few days until all the water has evaporated, leaving behind pure vitamin B12 crystals.
6. Look carefully at the ingredients on the packet of the vitamin tablets. Why do you think we dissolved the tablets in water and then filtered them through a coffee filter? What do you think has happened to the other ingredients?

YOU WILL NEED

- Vitamin B12 tablets (ask an adult to handle and store these)
- 50ml Vinegar (white vinegar works best)
- Teaspoon
- Tablespoon
- Small bowl
- Small jug
- 2 empty yoghurt pots (clean and dry)
- Coffee filter
- Access to a warm place

WHAT'S HAPPENING?

The chemical vitamin B12 is a deep red coloured crystal, which dissolves in water. When the crystals are added to water, a cherry pink coloured solution is made.

Most of the other ingredients in the tablets, such as the cellulose, magnesium stearate and silicon dioxide, will not dissolve in water. Dicalcium phosphate can dissolve in tap water, but cannot dissolve in acidic water, which is why acidic vinegar was added to the water. Using the coffee filter, we can separate out all the solids that have not dissolved from the liquid which contains just the vitamin B12. Leaving the yoghurt pot in a warm space allows the water to evaporate, leaving just the pure red vitamin B12 crystals!

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