

●●○ MEDIUM

👤👤 7 – 12

🕒 1 – 1½ HRS



1 Learn about the work of Percy Julian

2 Find out how firefighting foams work

3 Try making your own model fire extinguisher

STORIES IN CHEMISTRY

FANTASTIC FIREFIGHTING FOAM

Illustration: Percy Julian



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INTRODUCTION

Percy Julian was an American chemist who discovered ways to produce human hormones such as oestrogen and testosterone from yams and soya beans.

Percy Julian was the grandson of slaves and one of six children. His parents always encouraged education as a way to reach a better future.

During the 1920s, very few African American students were admitted to university but Percy was! Percy had to overcome many racial barriers in his studies. He was not allowed to live in the college dormitory with the other students while he studied for his degree. When he started working towards a PhD, his funding was withdrawn due to his skin colour. When Percy finally completed his PhD, he was one of the first ever African Americans to receive a doctorate in chemistry.

Percy Julian went on to develop a method to produce pure soya protein from soya beans. At the start of WW2, this soya protein was used to develop Aer-O-Foam, which the US navy used as a firefighting foam. This invention saved thousands of lives.



DID YOU KNOW?

For a fire to burn, three things are required – fuel, oxygen (from the air), and a source of ignition or heat. Firefighting foams use two main principles to extinguish fires. Firstly, water or liquid foam has a cooling effect so there is not enough heat for the fire to keep burning. Secondly, they coat the material on fire to prevent contact with the air which smothers the fire until it is extinguished. This means no oxygen can reach the fuel.



SAFETY

- **Avoid any known food allergens.**
- **An adult should operate the blender and light the candle. Keep matches out of children's reach.**
- **Keep people and pets a safe distance away.**
- **This activity should be supervised by adults at all times.**

ACTIVITY

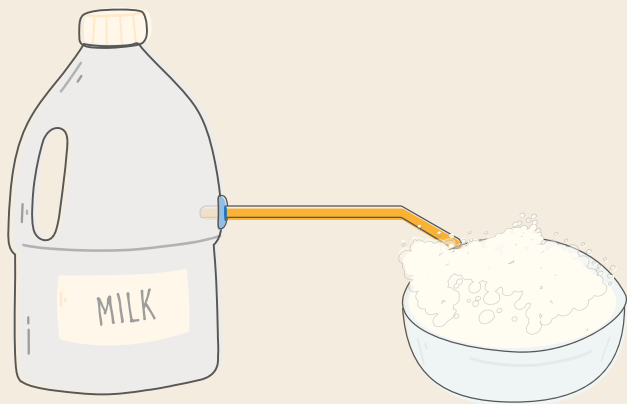
USING SOYA PROTEIN TO MAKE A MODEL FIRE EXTINGUISHER

To commemorate the work of Percy Julian, the experiment below will show you how to use soya protein known as tofu, to make a model fire extinguisher.

INSTRUCTIONS

ACTIVITY 1 – Making a firefighting foam from tofu

1. Add 200g tofu, 400ml warm water and 4 teaspoons of washing up liquid to a blender. You can also use a whisk. Blend until smooth. This is a basic firefighting foam.
2. Blow into the mixture with the straw. Observe the soya residue on the side of the container and touch the bubbles. Can you see that the soya protein in the tofu makes the bubbles hard to burst!



ACTIVITY 2 – Making a model fire extinguisher

1. Ask an adult to make a small hole $\frac{2}{3}$ of the way up the milk bottle. Enlarge the hole until it is a good fit for the straw. Insert the straw into the hole so that about 1cm of straw is inside the bottle and the remainder of the straw is sticking out like a hose. Use a small piece of blue tac to seal any gaps.
2. Pour the firefighting foam from activity 1 into the empty milk bottle. Place next to the baking tray.
3. Ask an adult to light the tealight and place it in the baking tray.
4. Add 60ml or 4 tablespoons of vinegar to the milk bottle. Next, quickly add 4 teaspoons of bicarbonate of soda to the milk bottle and screw on the lid tightly. Aim the straw 'hose' at the lit candle. A stream of foam should start to come out. What happens to the candle?

YOU WILL NEED

- 200g tofu firm / extra firm
- Vinegar (white or malt)
- Bicarbonate of soda
- Washing up liquid
- A clean empty two pint milk bottle with lid
- Measuring jug
- Blender or whisk
- Straw (preferably bendy type)
- Teaspoon
- Tea light candle (and matches)
- Deep baking tray/roasting pan
- Blue tac
- Scissors



WHAT'S HAPPENING?

Aer-O-Foam contains pure soya protein mixed with water. We can use tofu as a substitute because it is formed from soya bean protein.

The reaction between vinegar and bicarbonate of soda creates lots of bubbles of carbon dioxide gas, just like the compressed gas in a fire extinguisher. This jet of bubbles forms the firefighting foam and creates pressure, making the foam shoot out of the 'hose' of the extinguisher.

Firefighting foams made from soya protein form stable bubbles. These bubbles are resistant to the effects of heat, and form a long-lasting foam blanket to smother any fire. Making a foam allows it to be light enough to float on both oil or petrol and water. As soya protein makes stable bubbles in both fresh and sea water, this made Aer-O-Foam perfect for use in the navy.