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## Very special (Easter) eggs

What does vinegar do to the shells of Easter eggs, and can toothpaste protect them?

### What you'll need

- 2 eggs
- a saucepan full of water
- vinegar
- 2 glasses
- a spoon
- toothpaste
- a permanent marker

### Instructions

- Boil an egg for around 10 minutes.
- Using a permanent marker, draw a line round the middle of the egg, dividing it into two halves.
- Cover one of the halves with a thick layer of toothpaste.
- Place this egg in a glass full of vinegar.
- Place the second (uncooked) egg in another glass of vinegar.
- Now watch what happens. Check the eggs after about an hour, and again after a couple more hours.
- After around 24 hours, lift both eggs out of the vinegar with a spoon, rinse them and examine them. Is there a difference between the half you covered with toothpaste and the one you didn't? What about between the two eggs?
- Once you have removed all of the remaining shell, you can drop the uncooked egg onto a plate from a height of around 20 cm (be careful though, it might splash!).
- These eggs can no longer be eaten – they would taste horrible.

### What happens and how does it work?

- As soon as we put the eggs in the vinegar, tiny bubbles form all over the unprotected shell. No bubbles form on the half protected by toothpaste.



- The vinegar reacts with the calcium in the eggshell, producing water-soluble calcium acetate and carbonic acid, which breaks down to form water and carbon dioxide. This carbon dioxide makes up the bubbles you see on the egg.
- At first, the toothpaste protects the egg against the action of the vinegar, but as it is gradually washed off, the vinegar begins to act on that part of the shell, too.
- After 24 hours, the vinegar has completely dissolved the eggshells. All that remains around the uncooked egg, which was fully exposed to the vinegar from the beginning, is a thin membrane. (We found a white patch on our egg, which probably corresponds to where it was resting against the bottom of the glass).
- The boiled egg, which had toothpaste on one half, still has a thin layer of shell left (you may be able to see the line you drew with the permanent marker, which also gave the shell some protection).
- The uncooked egg is now very elastic. You can drop it onto a plate from a height of around 20 cm and it will just bounce around.
- You should be able to see the yolk inside this egg. You can shine a flashlight through it for a particularly cool effect.



### Still curious?

We use vinegar to get rid of limescale marks in the bathroom, too. Vinegar-based cleaners dissolve limescale deposits from hard tap water in just the same way as the vinegar dissolved the eggshell.

