

Determination of the amount of hardness in water using soap solution

Introduction

Soft water readily forms **lather** with soap, but it is more difficult to form lather with hard water. Hard water contains dissolved calcium or magnesium compounds. This can 'fur up' kettles, boilers and pipes, which wastes energy and can be dangerous if the flow of water is impeded. The calcium ions and magnesium ions in hard water react with the soap to form scum, so more soap is needed to form a lather.

Temporary hard water contains calcium and magnesium hydrogencarbonate. Temporary hard water becomes soft on boiling (forming limescale). Permanent hard water does not become soft when it is boiled.

Apparatus

100cm³ conical flask and stopper
dropping pipette
50cm³ measuring cylinder
water samples - **A, B, C, D**, boiled **A**, boiled **B**, boiled **C**, boiled **D**
stopwatch
soap solution

Method

1. Measure 50cm³ of water sample **A** into a conical flask.
2. Add 1 cm³ of soap solution, insert the stopper and shake vigorously for 5 seconds.
3. Repeat step 2 until a lather forms that lasts for 30 seconds. Record the total volume of soap solution added.
4. Repeat steps 1-3 with 50cm³ samples of all other types of water.

Analysis

1. Draw a bar chart of volume of soap solution against water sample.
2. Use your results to identify which samples are: soft water, temporary hard water and permanent hard water.