# Dissolution of blackcurrant lozenges

## Student worksheet

### Health and safety note

Wear eye protection.

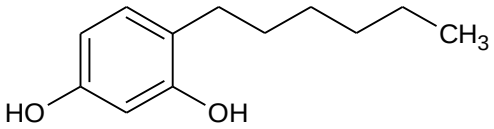


**Figure 1** Hexylresorcinol molecule.

### Principle

This activity provides practice in making a colorimetry calibration graph, measuring dissolution rate and investigating the effect of temperature on the rate. It uses the 'paddle method'. Typical instructions for using this method to investigate the rate of solubility of a medicinal drug are:

*Place the volume of dissolution medium in the vessel. Assemble the apparatus and place it in the water-bath. Allow the temperature of the dissolution medium to reach 37 ± 0.5 °C and remove the thermometer. Allow either one tablet or one capsule to be tested to sink to the bottom of the vessel before starting the rotation of the blade. Take care that no air bubbles are present on the surface of the tablet or capsule form. Withdraw a sample from a zone midway between the surface of the dissolution medium and the top of the rotating blade or basket, not less than 10 mm below the surface (4.5 cm is recommended) and at least 10 mm from the vessel wall, at the time or time intervals specified.* (Adapted from: *The International Pharmacopoeia Fourth Edition*)

Some people like to suck blackcurrant lozenges to soothe a sore throat. The lozenges contain a small amount of a local anaesthetic, usually hexylresorcinol (figure 1), which helps to reduce the soreness. Hexylresorcinol is also an antiseptic.

In this practical the reasonable assumption is made that the medicinal drug and the colouring agents in a lozenge are released at the same rate.

By putting a lozenge in water and measuring the increase in intensity of the solution's colour, the rate of dissolution of the colouring agents can be measured. By inference, the rate of dissolution of the active ingredient hexylresorcinol is also given.

### Equipment and materials

- Colorimeter and suitable filter
- 1 $dm^3$ beaker
- 1 $dm^3$ measuring cylinder
- Paddle stirrer
- 50 $cm^3$ burette (x 2)
- Blackcurrant lozenges
- Boiling tubes (x 10) and rack
- Stopwatch
- Dropper pipette
- Electric hotplate

### Method: Calibration Lgraph

1. Weigh a blackcurrant lozenge. Put it into a 1 $dm^3$ beaker containing 600 $cm^3$ of deionised water and stir until the lozenge has dissolved completely.
2. Measure the absorbance of the solution. If the absorbance is off the scale (too high) make a suitable dilution so that the absorbance of the solution is close to the maximum absorbance the colorimeter can measure. Note how much the solution was diluted. This final solution is standard 1.
3. Fill two burettes, one with standard 1 and the other with deionised water. Make a series of standard solutions in boiling tubes as follows:

| | Standard solution | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Volume of standard 1 /cm$^3$ | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Volume of deionised /cm$^3$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Concentration of lozenge /g/100 cm$^3$ | | | | | | | | | | |

4. Calculate the concentration of lozenge, in g/100 cm$^3$, in standard solution 1. Then calculate the concentration of lozenge in each of the other standard solutions. Record the values in the table.
5. Measure and record the absorbance of each standard solution.
6. Plot a graph of absorbance against concentration of dissolved tablet (g/100 cm$^3$). This is the calibration graph.

## Method: Rate of dissolution

1. Use a measuring cylinder to measure 600 cm$^3$ of deionised water into a 1 dm$^3$ beaker. Place a mechanical stirrer in the beaker so that its paddle or fins are well below the surface of the water. Switch the stirrer on and stir the water gently. Record the temperature of the water.
2. Drop a lozenge into the water (try to avoid splashing – hold the lozenge near to the water surface before dropping). Start the stopwatch.

   Note: Check that the lozenge has the same mass as one used for calibration.
3. Choose a spot about 4 cm below the water surface and about 2 cm from the side of the beaker from which to withdraw samples.

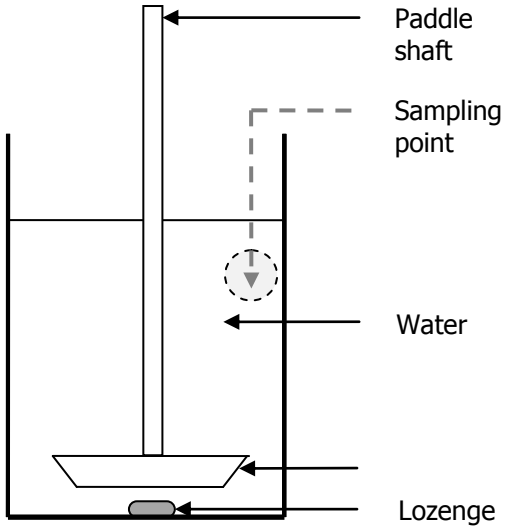


**Figure 2** Experimental set up.

4. After 5 minutes, use a dropper pipette to withdraw a sample from the beaker. Place the sample in a colorimeter tube, record its absorbance and quickly return it to the beaker.
5. Repeat this process every 5 minutes for 45 minutes. Use the calibration curve to determine the concentration of the lozenge in sample taken.

Repeat the experiment twice, heating the water to 40 °C and to 60 °C. In each case, when the temperature is steady, add the lozenge and carry out steps 3-6. Alternatively, share the work with other students, each making measurements at one of the temperatures (room, 40 °C and 60 °C).

## Processing data

1. Plot a graph of the concentration of lozenge in solution against the time the sample was taken for each temperature investigated.
2. Describe (a) the shape of the graphs obtained; and (b) the effect of temperature on the rate of dissolution.