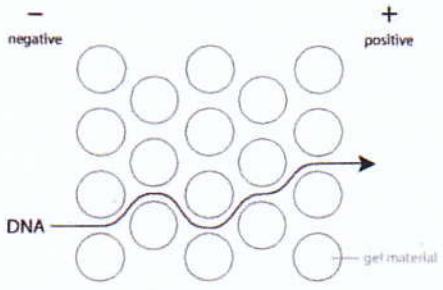
Bright Minds™ Resource Activity

Gel electrophoresis in a butter container

Background

Gel electrophoresis is a procedure which enables the sorting of molecules based on size and charge. Using an electric field, molecules (such as DNA) can be made to move through a jelly (gel) made of agar. The molecules being sorted move through the spaces in the gel material. The gel is placed in an electric field so that a negatively charged molecule will move towards the positive terminal – conversely, a positively charged molecule will move to the negative terminal. Larger molecules will move slowly through the gel while smaller molecules will move faster. The different sized molecules form distinct bands on the gel.



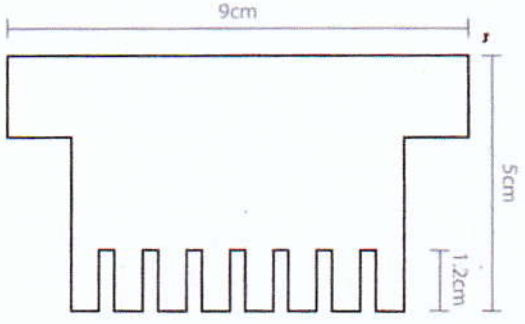
In this activity, gel electrophoresis is used to separate the colours found in food dyes and coloured marking pens, to illustrate how this procedure works.

Materials

- Rectangular butter or margarine container (500g *Devondale* or similar)
- 2 strips of aluminium foil, each 50 cm x 80 cm
- 2 leads and alligator clips
- food dyes
- *Crayola* marking pens (colour change pens work well)
- Filter paper or coffee filter
- Five 9V batteries
- Icecream container to make plastic comb
- 0.1% bicarbonate buffer (0.2g of sodium bicarbonate in 200ml of water)
- 1% agar (1g of agar in 100ml bicarbonate buffer)

Procedure

1. Cut a butter container down to approx. 3cm sides (container usually about 10cm x 5cm). Use a container with a fairly flat bottom.
2. Fold a piece of foil over one short end of the container so that it covers both the outside and inside end of the container and reaches to the bottom of the inside of the container. Repeat for the other end of the container. Make a comb from a plastic icecream container (thinner comb) or styrofoam meat tray (thicker comb) so that it fits neatly into the width of the butter tub at one end and has 2 lips which hang over the sides of the tub to keep the comb in place. The bottom of the comb should not touch the bottom of the tub. Cut 6-8 teeth/comb. Each tooth should be about 5-6mm wide and 12-15mm long.



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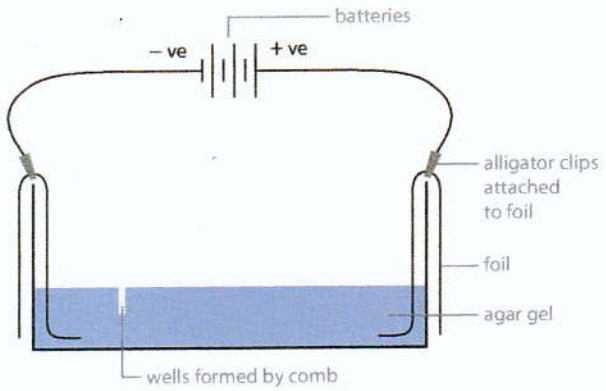
Procedure Cont.



3. Mix 1g of agar in 100ml of 0.1% bicarbonate buffer and heat to boiling in a microwave. Low quality agar tends to boil suddenly so watch it carefully. It should boil in less than one minute –try 30 seconds then 10 second pulses until it boils. Allow the agar to cool to hand heat. While the agar is cooling, prepare samples.

4. Sample preparation: Spot food dyes or coloured pens onto filter paper. A spot 1cm in diameter is sufficient.

5. Fill the container with agar gel to a depth of 1cm and insert comb so that the top of the agar solution is just below the top of the teeth of the comb. The comb should be placed approx 2cm from one end of the container.

6. Leave the gel to set for at least 15min. Be careful not to knock or bump it. Gel can be made the day before and kept refrigerated, covered with plastic wrap.

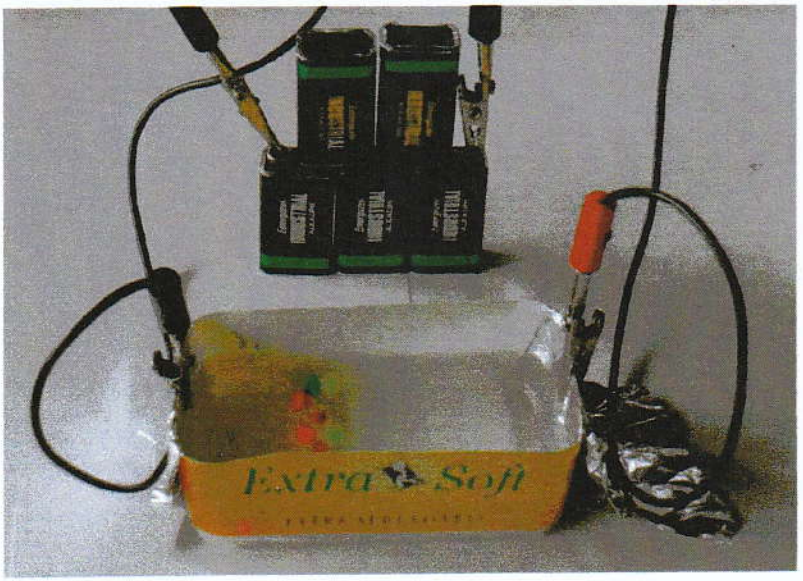
7. When the gel is set, carefully remove the comb.

8. Loading samples: Cut out small rectangular pieces (3mm x 4mm) of each of the colours spotted onto paper in step 5 and fully insert into wells formed by the comb using fingers or tweezers.

9. Carefully pour bicarbonate buffer over the top of the gel so that buffer completely covers the gel (requires approx 100ml buffer). If any of the paper in the wells is above the gel the colour will bleed into the buffer, but this will not affect the samples running in the gel.

10. Hook the gel up to five 9V batteries connected in series, using leads and alligator clips, making sure that the end of the tank with the samples is connected to the negative terminal of the battery. The alligator clips attach to the foil at each end of the tub. Fewer batteries can be used but the samples will take longer to run and may diffuse into the gel.

11. Run for approx. 45min until separation of samples is achieved.



Each colour is a different pen or food dye. Even after 10 mins of electrophoresis, different migration patterns can be seen.

For Questions and Answers relating to this activity, for further information on using this activity to run DNA, and for other activities, useful teacher tips and science games for students, please check out the ***Bright Minds***™ website at ***www.brightminds.uq.edu.au***

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