DIY GEL ELECTROPHORESIS

SCIENCE WORLD
BRITISH COLUMBIA
WHAT IS GEL ELECTROPHORESIS?
A TOOL UTILIZED BY MOLECULAR GENETICISTS TO SEPARATE DIFFERENT PARTS OF MACROMOLECULES SUCH AS DNA, RNA, OR PROTEINS.
HOW DOES GEL ELECTROPHORESIS WORK?
MACROMOLECULES ARE NEGATIVELY CHARGED. IN AN ELECTRIC FIELD THE MOLECULES WILL MIGRATE TO THE POSITIVE END.
WHAT DO WE SEE?
The smaller and more negative the molecules are, the further they will migrate to the positive end. The dye separates by mass.
WHAT ARE APPLICATIONS?
FORENSIC INVESTIGATIONS, PATERNITY TESTS, AND MEASURING PROTEIN LEVELS FOR EXAMPLE.
Step 1: Make a buffer

The buffer solution will need to be a 1% solution of baking soda.

Combine 1/4 teaspoon of baking soda with 100 mL of distilled water in your mixing bowl.

Stir the solution well with a spoon.
Step 2: Make the Agarose Gel

Place 1/8 teaspoon of agar powder in the microwave safe bowl.

Add 50 mL of the buffer solution made in the previous steps to the agar powder in the microwave safe bowl.

In order to dissolve the agar powder, place the bowl in the microwave and turn it on for 1-2 minutes.

Watch out. It get’s hot.

Every 15 seconds, stop the microwave and stir the solution. Keep doing this process until the solution begins to bubble.

Once this happens, quickly and carefully remove the bowl from the microwave to avoid having the solution bubble over. The solution should be translucent.

Let it cool for 2min.
Step 3: Make the Foam comb

Trace out the gel comb from craft foam using the image below as an example. Measure the width of the plastic container. Cut out with scissors.

Put comb in plastic container (gel chamber) and slowly pour agar solution. Let agar solidify.
LET’S TRY IT OUT

Step 4: Assemble the batteries.

A positive terminal of one battery will be snapped into a negative terminal of another battery.

You need to continue this process with all the batteries until one positive and one negative terminal is not snapped to another battery.
LET'S TRY IT OUT

Step 5: Gently pour the rest of the buffer solution over the gel in the chamber.

The buffer solution should completely cover and submerge the gel.
Depending on the size of the chamber, you may not need to pour all of the remaining buffer solution.
Firmly grab onto the top of the gel comb and carefully pull it straight up and out of the gel.
The wells formed by the comb in the gel will hold the food coloring for this experiment.
Step 6: Make room for the wire electrodes.

Take a plastic knife and cut 2 lines (1 cm away from each end) across the width of the chamber on both ends.

Cut all the way down to the bottom of the chamber.

Place the wire electrodes back in the chamber.

It is highly important the entire length of the electrodes are under the surface of the buffer solution.

The hook of the electrode does not have to be submerged.
LET'S TRY IT OUT

Step 7: Add food coloring

One at a time, each of the different colors of food coloring will need to be placed in its own well with the pipette.

Only one drop of each dye is needed.

The less dye placed in the well, the clearer the results of the experiment will be in the end.

Rinse out the pipette after each colour is deposited.

Tip:

Place the tip of the pipette loaded with food coloring beneath the surface of the buffer solution and slightly inside the well before you push the plunger to release the dye.
LET'S TRY IT OUT

Step 8: Run the electrophoresis
Place one clip of one of the alligator leads on the exposed positive battery terminal.
Place the other end of this same lead onto the positive electrode.
The positive electrode should be the wire farthest away from the wells.
Take the other alligator clip lead, one clips should be clipped onto the exposed negative battery terminal, the other end on the negative electrode.
The negative electrode should be the wire closest to the wells.

Tip:
You should be seeing bubbles bubbling up from the electrodes in the buffer solution because the current is passing through them.
LET'S TRY IT OUT

Step 9: The food coloring will migrate from the side of the chamber with the negative electrode to the end with the positive electrode.

Keep the gel running until food coloring bands have clearly separated away from each other.

Check every 5 to 10 minutes.

This process takes around 15 to 20 minutes.

Results:

Dye contains different sized macromolecules which will separate at different speeds, resulting in bands at certain locations down the length of the gel.

The same process occurs with DNA and other macromolecules. The phosphate backbone of the DNA and RNA molecule is negatively charged, therefore when placed in an electric field, DNA fragments will migrate to the positively charged electrode.
Want to learn more about DIY Electrophoresis?

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Genome BC, a non-profit research organization, leads genomics innovation on Canada’s West Coast and facilitates the integration of genomics into society.

Genome BC continues to support the formal education system province-wide, through the Geneskool educational outreach program.

Interested in learning more about our programs? Get in touch with Amanda Brown, Educational Outreach Coordinator at abrown@genomebc.ca
- grade 8-12
- volunteer role models
- rural and urban communities

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