Graphene Filtration Lab: Can Graphene Help Clean Water?

Objective:

To explore how a graphene coating can impact a material's ability to filter contaminants from water.

Background:

Graphene is a super-thin layer of material — just one atom thick — composed entirely of Carbon. It's known to be very strong, lightweight, and have a huge surface area. Scientists are studying graphene to find potential applications in many areas, including environmental cleanup. In this lab, you will be testing how well water with food coloring flows through columns (plastic tubes) packed with either plain plastic beads or beads coated with graphene. You'll compare how much color comes out of each by measuring the **clarity** of the filtered water.

Hypothesis:

Predict how the graphene coating will impact the filtration of food dye from the water.

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Materials (per group):

- 2 clear plastic tubes
- Plastic beads (uncoated)
- Graphene-coated plastic beads
- Funnel
- 250 mL of water
- Food coloring
- 2 collection cups or beakers
- Stopwatch
- Gloves and goggles
- Secchi disk
- Graph paper

Procedure:

1. Set Up the Columns:
    - **Column A**: Fill with uncoated plastic beads.
    - **Column B**: Fill with graphene-coated beads.
        - Place a clean cup or beaker under each tube to collect filtered water.
2. Prepare the Dyed Solution:
    - Add 4 drops of food coloring to 250 mL of water. Stir well.
3. Filter the Water:
    - Using the funnel, pour **125 mL** of the dyed water into each column.

- Start the stopwatch as you begin pouring and record how long it takes for all the water to pass through each column.

4. Measure Clarity with the Turbidity Tube:
    - Pour the filtered water into the turbidity tube until it's about halfway full.
    - Look straight down into the tube to find the point where you can **no longer** see the black-and-white Secchi disk at the bottom.
    - Slowly add more filtered water, checking after each addition.
    - Once the disk disappears from view, measure the **depth of the water (in cm)** at that point.
    - Record this number as your clarity measurement.
5. Record Observations:
    - Note any differences in water color, smell, or appearance between the two columns.

Data Table:

Column Type	Time to Filter (sec)	Depth Where Disk Disappears (cm)	Notes / Observations
Uncoated Beads			
Graphene-Coated Beads			

Graphing:

Create **two bar graphs**:

1. **Filtration Time** – compare how long it took each column to filter the water.
2. **Water Clarity** – compare the depth where the Secchi disk disappeared for each column.

Analysis Questions:

1. Which column filtered water more effectively?
2. Which column filtered faster?
3. What does the Secchi disk depth tell you about the clarity of the water?
4. Did the graphene coating make a difference? Why or why not?
5. How could this method of filtration be applied to real-world environmental problems?
6. What are some other contaminants besides dye that graphene might help filter out?

Conclusion:

Based on your results, summarize how the graphene coating affected the column's ability to filter dye from the water.

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