PROJECT DETAILS

Project ID: NSF-SCH-2025-53

Project Title: Filtration Material Leads To The Best Drinking Water

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Class: 8th

Level: School Level

Category: Physical Science

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1. Selection of Project

2. Water is vital for life, but many sources of water contain impurities that make it unsafe for consumption. Activated carbon filters are commonly used in household filtration systems to remove such impurities. This project investigates whether the **particle size of activated carbon**—powdered or granular—affects its ability to purify contaminated drinking water.

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2. Abstract

Do you filter your tap water before drinking? Many commercials claim these filters make your drinking water cleaner and safer. The cleaning power comes from **activated carbon**, a material with a large surface area that adsorbs impurities.

This experiment studies how **particle size** (granular vs. powdered activated carbon) influences the efficiency of water purification. Ink is used as a visible contaminant to simulate dirty water. By comparing the color of water before and after filtration, we can determine which form of activated carbon works best.

Safety Note: Avoid inhaling powdered carbon and do not drink the filtered or unfiltered samples.

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3. Introduction

Clean water is essential for all living beings. Filtration is one of the main methods to remove impurities such as dirt, chemicals, or microorganisms from water.

Most household filters contain **activated carbon (activated charcoal)**, a highly porous form of carbon that traps impurities by **adsorption**—the process by which molecules stick to the surface of another substance.

Activated carbon comes in various forms: **granular, powdered, foamed, or block types.** The **smaller the particle**, the **greater the surface area**, which may increase adsorption efficiency.

This project explores whether the **particle size** of activated carbon influences how effectively it cleans contaminated water.

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4. Observation

- Powdered activated carbon appears fine and light, easily forming a uniform layer.
- Granular activated carbon consists of larger, irregular particles.
- When water containing ink passes through the filters, the colour lightens—indicating impurity removal.

- The powdered form tends to remove colour faster and more completely.

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5. Questions

1. What are common uses of activated carbon?
2. Why does the form and particle size of activated carbon matter for filtration?
3. How do carbon filters remove contaminants from water?
4. In what other scientific processes does surface area or particle size affect efficiency?

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6. Hypothesis

If the particle size of activated carbon is smaller, then the water filtration efficiency will be higher because smaller particles have a greater **surface area to volume ratio**, allowing more impurities to be adsorbed.

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7. Objective

To investigate how the **particle size of activated carbon** (powdered vs. granular) affects its **filtration efficiency** for cleaning contaminated water.

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8. Variables

Type	Description
Independent Variable	Particle size of activated carbon (powdered vs. granular)

Type	Description
Dependent Variable	Filtration efficiency (measured by colour intensity of filtered water)
Controlled Variables	Volume of water, amount of carbon used, ink concentration, filter paper layers, filtration time

9. Materials Required

- Black ink (10%), 30 mL
- Activated charcoal (granular), 30 g
- Activated charcoal (powdered), 30 g
- Coffee filters (4 per filter setup)
- Plastic cups (27 total)
- Digital scale
- Measuring cup
- Rubber bands
- Marker or labels
- Spoon
- Tap water
- Timer
- Paper towels
- (Optional) Camera
- Lab notebook

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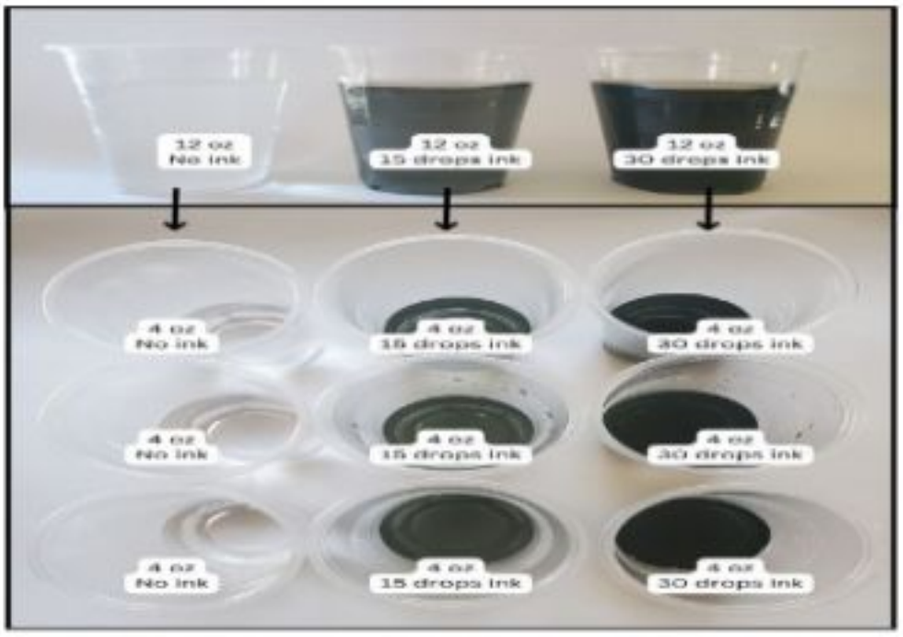
10. Procedure

1. **Prepare Contaminated Water Samples**

- Label 3 cups: "0 drops ink," "15 drops ink," and "30 drops ink."
- Add 12 oz tap water to each.



Add corresponding ink drops and stir well.

- Divide each sample into three 4 oz portions (total 9 cups).

2. **Prepare Filters**

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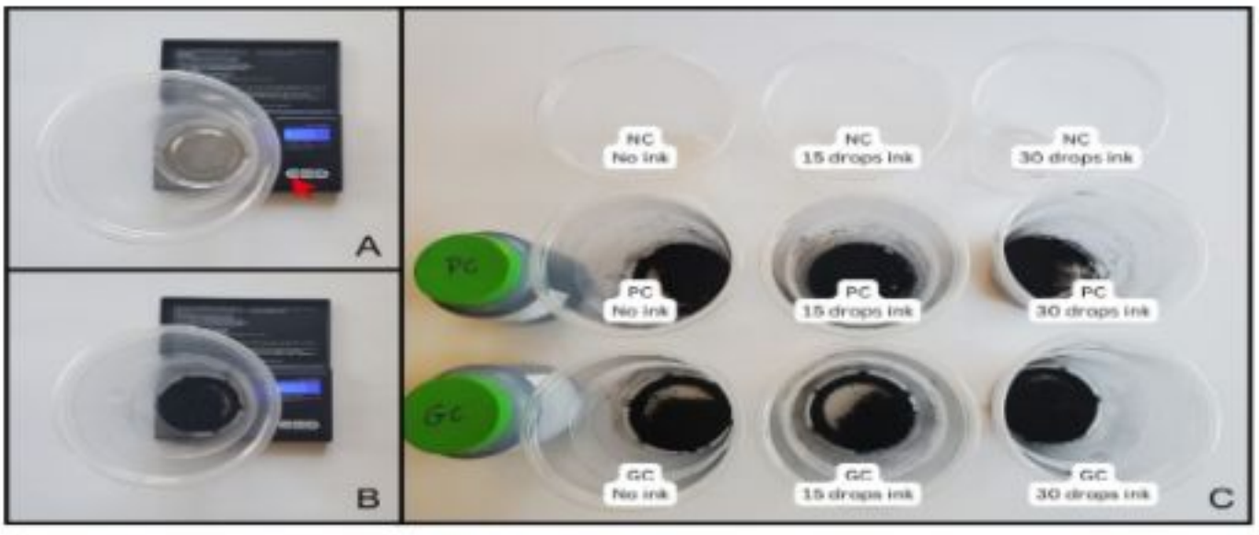

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- Label 9 cups for each carbon type and ink concentration:
  - GC (Granular Carbon): 0, 15, 30 drop
  - PC (Powdered Carbon): 0, 15, 30 drops

- NC (No Carbon): 0, 15, 30 drops

- Add 3 g of the correct carbon type to each filter setup.
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3. **Set Up Filtration**
   - Stack 4 coffee filters on each cup, secure with a rubber band.
   - Pour the prepared water samples through the appropriate filters.
   - Let filtration complete naturally.

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4. **Record Observations**
   - Compare colour intensity (0–10 scale) of filtered vs. unfiltered samples.
   - Repeat for three trials and calculate average readings.

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11. Data Analysis

Carbon Type	Ink Concentration	Avg. Colour Rating Before	Avg. Colour Rating After	% Improvement
NC	0 drops	0	0	0%
NC	15 drops	8	8	0%

Carbon Type	Ink Concentration	Avg. Colour Rating Before	Avg. Colour Rating After	% Improvement
NC	30 drops	10	10	0%
GC	15 drops	8	5	37.5%
PC	15 drops	8	3	62.5%
GC	30 drops	10	6	40%
PC	30 drops	10	4	60%

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12. Interpretation of Data

The powdered activated carbon produced clearer water than the granular carbon for both 15- and 30-drop ink samples. This confirms that **smaller particles** have higher adsorption efficiency due to their **larger surface area**. The control group (no carbon) showed no improvement, verifying that activated carbon is responsible for the cleaning effect.

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13. Islamic Perspective: Filtration and Purity

In Islam, **cleanliness (Taharah)** is an essential part of faith. The Qur'an emphasizes purity of both body and spirit:

"And We made from water every living thing." — *Surah Al-Anbiya (21:30)*

Ensuring the purity of water used for drinking and ablution (wudu) is vital. Using natural filtration materials such as **charcoal, sand, and clay** aligns with the Islamic principle of **avoiding waste and promoting cleanliness**.

Activated carbon, derived from natural sources, is a sustainable and effective means of achieving clean water—reflecting the Islamic teaching to **use the blessings of nature responsibly**.

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14. Graph

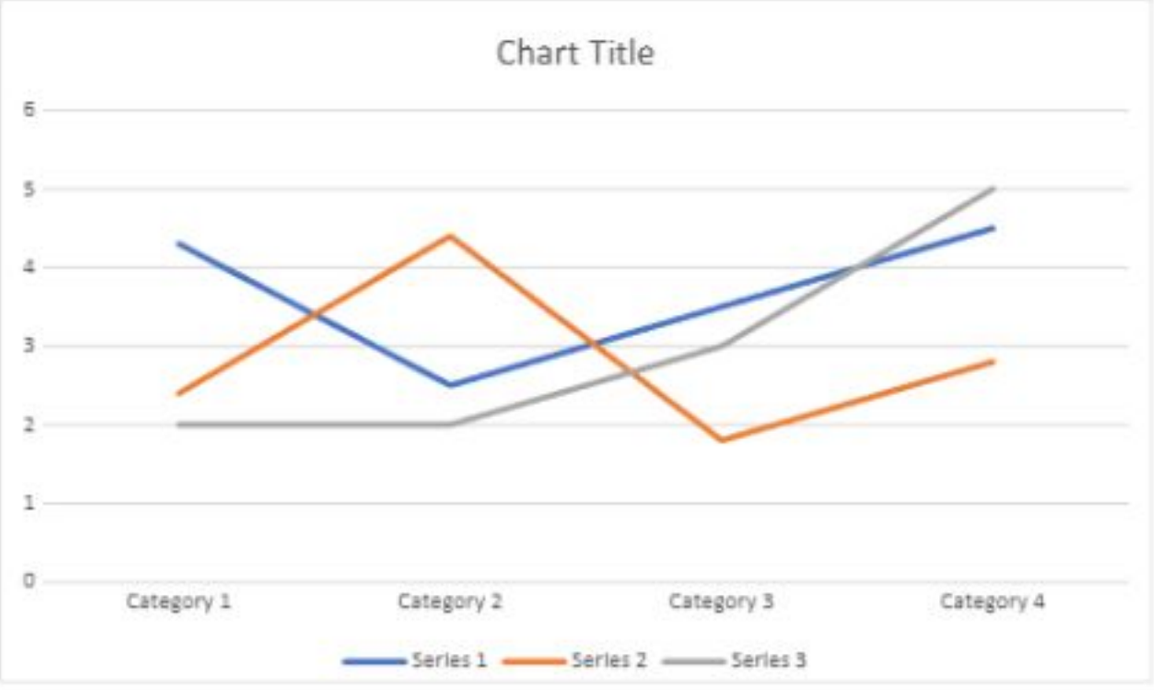
(Example illustration — you can plot using your actual readings)

X-axis: Ink Concentration (0, 15, 30 drops)
Y-axis: Average Color Rating (0–10)
Two lines:

- Blue = Granular Carbon
- Red = Powdered Carbon

→ The red line (powdered) shows a sharper decline, indicating better purification.

(lower colour intensity = cleaner water).



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15. Result

- Powdered activated carbon filters removed more color (impurities) from water compared to granular activated carbon.
- This shows that **smaller particle size = higher surface area = better adsorption efficiency.**

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16. Conclusion

The experiment supports the hypothesis. **Powdered activated carbon** is more efficient in cleaning contaminated water because its smaller particle size provides a greater surface area for adsorption.

Thus, when choosing a water filter, using fine activated carbon can result in cleaner, safer drinking water.

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17. Application

- Used in **household water filters** and **industrial purification systems**.
- Helps remove **chlorine, odors, colours, and chemical pollutants**.
- Applicable in **air purifiers**, **medical toxin removal**, and **environmental cleanup**.
- Demonstrates key principles of **surface area**, **adsorption**, and **sustainability**.

ACKNOWLEDGEMENT

- I think Almighty for the blessing showed on us in every step of this venture.

I am very much grateful to my science department, MS Creative High School ,Hyderabad ,Telangana. Under. whose active guidance and constant supervision this project "Tactics behind making slime" has been carried out. They were a source of continuous inspiration to us and this project would not have been successful with out their creative guidance and support.

Bibliography

- Science News. (2006, November 8). *Activated-Carbon Filtering Pitcher Significantly Reduces Chemicals in Tap Water.* Science Daily. Retrieved January 17, 2017.
- Lemley A., Wagenet L., Kneen B. (1995, December 3). *Activated Carbon Treatment of Drinking Water*. Water Treatment Notes, Cornell Cooperative
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