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Abstract

This project investigates whether the particle size of activated carbon—powdered or granular—affects its ability to purify contaminated drinking water. Using ink as a visible contaminant, the filtration efficiency of powdered and granular activated carbon was compared by assessing the colour intensity of water before and after filtration. The results showed that powdered activated carbon, with smaller particles and larger surface area, removes impurities more effectively than granular activated carbon. Safety precautions were observed by avoiding inhalation of powdered carbon and not drinking the test samples.

Introduction

Water is essential for life, yet many sources contain impurities that make it unsafe for consumption. Filtration is a common method to remove such impurities from water. Activated carbon is widely used in household filters due to its porous nature, which adsorbs contaminants. The particle size of activated carbon varies from granular to powdered forms, influencing its surface area and adsorption capacity. This project explores how the particle size of activated carbon impacts its effectiveness in purifying contaminated water, providing insights into better filtration choices.

Methodology and Procedure

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
- Lab notebook

Procedure:

1. Prepare three water samples labeled as “0 drops ink,” “15 drops ink,” and “30 drops ink” by mixing 12 oz tap water with corresponding ink drops and stirring well.
 2. Divide each sample into three 4 oz portions, resulting in 9 cups.
 3. Label cups for each filter type and ink concentration:
 - GC (Granular Carbon): 0, 15, 30 drops
 - PC (Powdered Carbon): 0, 15, 30 drops
 - NC (No Carbon): 0, 15, 30 drops
 4. Add 3 g of the appropriate activated carbon type to each filter setup.
 5. Stack 4 coffee filters on each cup and secure with rubber bands.
 6. Pour water samples through the filters and allow filtration to complete naturally.
 7. Measure and record the colour intensity before and after filtration on a 0–10 scale.
 8. Repeat for three trials and calculate average colour ratings.
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Data Analysis

Carbon Type	Ink Concentration	Avg. Color Rating Before	Avg. Color Rating After	% Improvement
NC (No Carbon)	0 drops	0	0	0%
NC (No Carbon)	15 drops	8	8	0%
NC (No Carbon)	30 drops	10	10	0%
GC (Granular Carbon)	15 drops	8	5	37.5%
PC (Powdered Carbon)	15 drops	8	3	62.5%
GC (Granular Carbon)	30 drops	10	6	40%
PC (Powdered Carbon)	30 drops	10	4	60%

The data indicate that powdered activated carbon removes more colour (impurities) than granular carbon, confirming better filtration efficiency.

Result

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

The experiment confirms that particle size significantly affects activated carbon's filtration efficiency. Due to smaller particles, powdered activated carbon has a greater surface area, allowing more contaminants to adsorb onto its surface, resulting in clearer filtered water. The control group with no carbon showed no improvement, proving the filtration effect is due to activated carbon. This aligns with adsorption principles in physical science and highlights the importance of surface area in filtration processes.

Conclusion

The hypothesis is supported: powdered activated carbon, with its smaller particle size, is more efficient at purifying contaminated water compared to granular activated carbon. Its greater surface area facilitates better adsorption of impurities. This insight is useful for choosing effective household water filters to ensure safer drinking water.

References

- 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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