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ANALYSIS OF MICROPLASTIC IN DRINKING WATER

Comparative Study of Bottled Water, Filtered Water, and Tap Water

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BACKGROUND & MOTIVATION

At the start of this year California banned single-use plastic bags and replaced them with paper ones. Personally, I am not a big fan of this decision—paper bags tear, handles break, and in a survey I believe most Californians would prefer plastic bags over paper.

Despite California being an environmentally friendly state, this shows how much we as individuals and as a society depend on plastic and often choose convenience over the common sense of how harmful it is to the environment.

PLASTIC BAGS

- ✓ Durable
- ✓ Water-resistant
- ✓ Convenient
- ✓ Reusable

PAPER BAGS

- ✗ Tear easily
- ✗ Handles break
- ✗ Not water-resistant
- ✗ Less convenient

We need to balance convenience with the environment and make informed choices for a healthier future.

WHY MICROPLASTICS MATTER

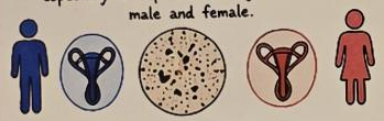
Plastic is everywhere—in the packaging we use and the bottles we drink from.

When we drink from plastic bottles, we are not only drinking the liquid, but also tiny plastic particles called microplastics.

Microplastics (< 5 mm) and even nanoplastics (< 1 μm) can enter the human body.

Health Concerns

Research shows microplastics can accumulate in human organs and may cause serious health issues, especially to reproductive organs of both male and female.



RESEARCH OBJECTIVE

To compare and quantify microplastics in:

- Bottled water (plastic bottles)
- Filtered water (household filtration system)
- Tap water

And to evaluate whether household filtration systems reduce microplastics.

KEY FACT

1 micrometer (μm) = one millionth of a meter ($1\ \mu m = 10^{-6}\ m$)

MATERIALS & EQUIPMENT

- Microscope (for observation and characterization)
- Cellulose Nitrate Filter Papers (0.45 – 1 μm pore size)
- Vacuum Filtration System
  - Buchner Funnel (porcelain/plastic)
  - Filter Flask / Beaker
  - Vacuum Pump & Tubing
- Glass Beakers
- Water Samples
  - Bottled Water – Filtered Water – Tap Water
- Hydrogen Peroxide (30%) – for digestion of organic matter (bacteria, etc.)

AT A GLANCE: OUR PROCESS

- Filter the water samples.
- Capture anything left on the filter paper.
- Examine under a microscope.
- Count and compare microplastics.
- Understand the impact and find solutions.

METHODOLOGY: VACUUM FILTRATION & SAMPLE PREPARATION

1 Seat the Filter Paper

Place the filter paper on the Buchner funnel and turn on the vacuum for a few seconds. Add a few drops of distilled water to help the filter paper seal to the funnel and prevent loss of microplastics.

2 Pour the Sample

Pour the water sample onto the funnel and let it drain completely into the flask.

3 Complete Filtration

Allow all the water to pass through. Microplastics will be retained on the filter paper.

4 Disconnect Properly

First, disconnect the vacuum hose from the funnel, then turn off the vacuum valve. This prevents backwashing of the solution into the vacuum system.

5 Remove Filter Paper

Use tongs to carefully remove the filter paper and place it onto a glass Petri dish.

6 Digest Organic Matter

Add 10 mL of 30% hydrogen peroxide to the filter paper to digest bacteria and any other organic matter. Hydrogen peroxide (30%) is a powerful oxidizing agent that beraks down organic material, including microorganisms.

7 Dry the Filter Paper

Allow the filter paper to dry at room temperature for 24 hours before microscopic analysis.

DID YOU KNOW?

Cellulose nitrate filter papers are hydrophilic (water-loving) and have millions of tiny pores. Water flows through quickly, while microplastics, bacteria, and other particles are trapped on the surface—much like a coffee filter, but at a microscopic level!

RESULTS & OBSERVATIONS

1. Bottled Water (No Visible Microplastics)

Microscope view: No visible microplastics

2. Spiked Sample (Boiled Plastic in Water)

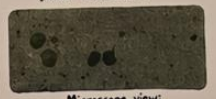
Microscope view: Spiked water – (Microplastics visible

Microscope view: Fewer microplastire captured on filter paper

3. Filtered Water (After Filtration of Spiked Water)

Microscope view: Fewer microplastics captured on filter paper

4. Tap Water (After Filtration)



Microscope view: Some microplastics obrsent

SUMMARY OF FINDINGS

- No microplastics detected in bottled water (Sample due to very low concentration or size).
- Microscopic analysis of spiked water confirmed the presence of microplastics that are invisible to the naked eye.
- Vacuum filtration effectively captured microplastics on the filter paper.
- Filter paper analysis provided clear evidence of microplastics.

CONCLUSION

This study demonstrates that microplastics can be present in our drinking water and are undetectable without microscopic analysis. Vacuum filtration using cellulose nitrate filter papers is an effective method for isolating microplastics for observation.

Future work will include quantitative comparison between bottled water, filtered water, and tap water to evaluate the effectivenecs of household filtration systems in reducing microplastics.

IMPLICATIONS

Microplastics are a hidden but serious threat to human health and ecosystems.

We must reduce plastic use, improve waste management, and continue further research.

OUR GOAL

Clean water is a basic necessity—let's protect it for a healthier future.

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