



Student Develops Effective Water Filter to Combat Microplastics

Description

A high school student in Virginia has successfully developed a filtration system that eliminates over 95 percent of microplastics from drinking water. This innovation employs a magnetic liquid known as ferrofluid to extract tiny plastic particles from water without using conventional filter membranes.

The emergence of microplastics, which are synthetic particles measuring between 1 nanometre and 5 millimetres, has garnered increasing concern, as they have been detected in various environments, including oceans and human organs. Although research continues into their health impacts, their pervasive presence is worrisome.

In Warrenton, Virginia, reports of water contamination, specifically due to polytetrafluoroethylene substances (PFAS) and microplastics, prompted residents to seek personal solutions for water filtration. This situation motivated Mia Heller, a student at Kettle Run High School, to explore alternative filtration methods.

Heller began her project at home, where her family had previously used a filtration system that required frequent maintenance. Frustrated by the need for constant filter replacements, she aimed to create a simpler and more efficient solution. Her invention evolved into a three-chamber system that separates water, ferrofluid, and microplastics, utilising a magnetic field to extract contaminants from the water. Importantly, the ferrofluid can be reused, eliminating the need for disposable components.

The alarming spread of microplastics is reflected in research that reveals their presence in over 1,300 species and even human tissues, including the brain and bones. A University of New Mexico study indicated a 50 percent increase in microplastic levels in human brain samples within a decade, raising questions about potential health risks.

Heller's prototype achieved a remarkable 95.52 percent removal rate of microplastics while reclaiming 87.15 percent of the ferrofluid. These results place her system on par with traditional water treatment plants, which typically eliminate between 70 and 90 percent of microplastics. However, challenges remain regarding the safe disposal of collected microplastics and the cost of producing ferrofluid at scale.

Heller envisages her system as suitable for domestic use, specifically under kitchen sinks, rather than in large treatment facilities. She plans to have her findings validated by professionals before determining the next steps in her project.

Vocabulary List:

1. **microplastics** //,maɪkroʊˈplæstɪks// (noun): very small pieces of plastic in water
2. **ferrofluid** //ˈfɛrəʊˌfluɪd// (noun): a liquid with magnetic particles inside
3. **filtration** //fɪlˈtreɪʃən// (noun): removing unwanted particles from a liquid



4. **contaminants** //kən'tæmɪnənts// (noun): things that make water dirty or unsafe
5. **prototype** //ˈprɒʊtə,taɪp// (noun): an early working model of a device
6. **disposal** //dɪ'spəʊzəl// (noun): getting rid of waste or unwanted materials

Comprehension Questions

Multiple Choice

1. What percentage of microplastics can the filtration system developed by the student eliminate?
Option: 90 percent
Option: 95 percent
Option: 95.52 percent
Option: 70 percent
2. What substance does the filtration system use to extract microplastics from water?
Option: Water
Option: Ferrofluid
Option: Polytetrafluoroethylene
Option: Magnetic field
3. What was the primary motivation for Mia Heller to develop her filtration system?
Option: Research purposes
Option: Personal water safety
Option: Dissatisfaction with existing systems
Option: Environmental protection
4. In what state did Mia Heller develop her filtration system?
Option: California
Option: New Mexico
Option: Virginia
Option: Texas
5. What is the size range of microplastics?
Option: 1 nanometre to 5 micrometres
Option: 1 micrometre to 5 millimetres
Option: 1 nanometre to 5 millimetres
Option: 1 millimetre to 5 centimeters



6. What percentage of ferrofluid can Heller's system reclaim?

Option: 95.52 percent

Option: 87.15 percent

Option: 50 percent

Option: 70 percent

True-False

7. Mia Heller's filtration system was developed at Kettle Run High School.

8. The filtration system uses conventional filter membranes to operate.

9. Microplastics have been found only in oceans, not in human organs.

10. PFAS substances prompted residents in Warrenton to seek personal solutions for water filtration.

11. Heller's prototype is less effective than traditional water treatment plants.

12. Heller plans to develop her system for use in large treatment facilities.

Gap-Fill

13. The filtration system eliminates over 95 percent of _____ from drinking water.

14. The student used a magnetic liquid known as _____ to extract tiny plastic particles.

15. Microplastics are synthetic particles measuring between 1 nanometre and _____.

16. Heller's project achieved a removal rate of microplastics of _____ percent.

17. The existing filtration system required frequent _____, prompting Heller to innovate.

18. Heller's system can be reused, eliminating the need for _____ components.

Answer

Multiple Choice: 1. 95.52 percent 2. Ferrofluid 3. Dissatisfaction with existing systems 4. Virginia 5. 1 nanometre to 5 millimetres 6. 87.15 percent

True-False: 7. True 8. False 9. False 10. True 11. False 12. False

Gap-Fill: 13. microplastics



14. ferrofluid 15. 5 millimetres 16. 95.52 17. maintenance 18. disposable

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. What process do plants use to convert sunlight into energy?
Option: Respiration
Option: Photosynthesis
Option: Digestion
Option: Fermentation
2. Which organelle is primarily responsible for photosynthesis in plant cells?
Option: Mitochondria
Option: Nucleus
Option: Chloroplasts
Option: Ribosomes
3. What is the role of NADPH in the photosynthesis process?
Option: Energy production
Option: Electron carrier
Option: Oxygen production
Option: Carbon fixation
4. What condition is characterized by redness, swelling, and pain as a response to injury?
Option: Infection
Option: Inflammation
Option: Metastasis
Option: Mutation
5. Which hormone is often released during stress and helps regulate metabolism?
Option: Adrenaline
Option: Insulin
Option: Cortisol
Option: Thyroxine
6. What treatment is commonly used to combat cancer by targeting rapidly dividing cells?



- Option: Radiation therapy
- Option: Chemotherapy
- Option: Immunotherapy
- Option: Surgery

7. What small plastic particles pose a significant environmental threat due to their prevalence in oceans?

- Option: Nanoplastics
- Option: Microplastics
- Option: Macrophages
- Option: Synthetic fibers

8. What term describes the spread of cancer cells from the original site to other parts of the body?

- Option: Invasion
- Option: Metastasis
- Option: Benign growth
- Option: Remission

9. What refers to the likelihood of developing a disease based on genetic or environmental factors?

- Option: Immunity
- Option: Resistance
- Option: Susceptibility
- Option: Infection

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

10. Chloroplasts contain structures called _____ that are essential for the light-dependent reactions of photosynthesis.

11. Research at the _____ level often involves studying materials and structures at the atomic or molecular scale.

12. Many people take dietary _____ to improve their health and fill nutritional gaps.

13. Efforts to _____ the effects of climate change have become increasingly important.

14. The strategy of _____ can sometimes prevent conflict but may lead to unresolved issues.



15. A single-celled organism known as a _____ can be beneficial or harmful to humans.
16. Some strains of bacteria have become _____ to traditional antibiotics.
17. Sometimes, attempts at resolving conflict can be _____ if not handled carefully.
18. Water treatment plants use _____ processes to remove contaminants from drinking water.
19. The _____ of a new drug is often determined through clinical trials.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

20. The degree of a person's openness to suggestions can vary significantly.
21. The storm began to as winds reached over 100 miles per hour.
22. The process by which your body converts food into energy is known as metabolism.
23. Sounds below the frequency of 20 Hz are referred to as infrasound.
24. Ferrofluid is a liquid that becomes magnetized in the presence of a magnetic field.
25. Proper waste is essential for environmental protection and public health.
26. There are several types of that can harm aquatic ecosystems.
27. Engineers often create a to test new designs before full-scale production.
28. Genetic can lead to variations in traits among organisms.
29. When tissues are damaged, they often exhibit signs of as part of the healing process.

Answer

Multiple Choice: 1. Photosynthesis 2. Chloroplasts 3. Electron carrier 4. Inflammation 5. Cortisol
6. Chemotherapy 7. Microplastics 8. Metastasis 9. Susceptibility

Gap-Fill: 10. thylakoids 11. nanoscale 12. supplements 13. mitigate 14. avoidance 15. bacterium 16.
resistant 17. counterproductive 18. filtration 19. efficacy

Matching sentence: 1. suggestibility 2. intensify 3. metabolism 4. infrasound 5. ferrofluid 6. disposal
7. contaminants



8. prototype 9. mutations 10. inflammation

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