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Researching Methods to
Remove Microplastics from Water

Cassava

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Our water may look clean, but many tiny pieces of **microplastics** have contaminated it. After viewing natural water purifying processes, I did some research for fun and eventually came across the microplastic problem and its adverse effects. After learning about the microplastic problem, I decided to do research to identify a possible efficient solution to remove the microplastics.

Microplastics are an environmental and health hazard. They go undetected through water purification processes because of their small size. My project investigated three different natural **coagulants** for a potential solution. Coagulants cause the microplastics to aggregate into clumps. These clumps can be easily removed by using simple filtration processes. The coagulants I tested were Nirmali seeds, Shrimp shells, and Cassava peels. I tested the coagulants' efficiencies on four different microplastics: high-density polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP), and polystyrene (PS). I tested them using three different methods: microscopy, a **turbidity** tube test, and spectroscopy. In the microscopy, I analyzed the samples under a microscope and recorded the number of microplastics presented in each sample. In the turbidity tube test, I used the secchi depth method to determine the turbidity levels of each sample in which a testing tube with a secchi disk (black circle) was inscribed at the bottom. To conduct the test, I gradually poured a sample into the tube and marked the level at which the secchi disk was no longer visible. The secchi disk disappears at lower volumes for samples with higher turbidity levels. In the final method, the spectroscopy, I created a homemade **spectrometer** by using a black box with a USB-equipped webcam with a **diffraction grating** installed inside. The webcam was connected to a computer software program that recorded how much light was able to pass through the samples. The tests were conducted on the water samples with only microplastics and with microplastics and coagulants. The results were compared before and after adding the coagulants and were also compared to a water sample with no microplastics. The three methods allowed me to determine which of the three tested coagulants reduced the turbidity levels the most and removed the most amount of microplastics from the samples.

The results of my research showed that the most effective coagulant was the Cassava peels.

Nirmali seeds

Meet the Scientist

I have had a big passion for science from a young age. Since kindergarten, I have always participated in the class science projects and presented my projects at the New Haven Science fair multiple times. Even with this interest in science already, my passion for science further grew after doing my first ever independent science project in 5th grade. In my spare time, I like to read novels, watch films, play board/card games, and hang out with my friends.

Snigtha Mohanraj has received numerous awards for her science research, including the Connecticut Science and Engineering Fair's top award for the Urban School Challenge – Middle School Division and for the honor received from the Connecticut Academy of Science and Engineering recognition for her research project, "Effectiveness of the Organic Polymers for Removing Microplastic in an Aqueous Solution." At the time of the award, Snigtha was a grade 7 student

SKILLS & KNOWLEDGE

Before doing this project, I truly had no prior knowledge about this topic. I just wanted to find a solution to a problem that was negatively impacting us, other organisms, and the environment. But, through doing this project, I developed a lot of skills, such as how to effectively research, how to organize my information, how to manage my time, and how to identify what I needed to learn more about. Specific to my project's topic, I also learned a lot of important information about microplastics and coagulants, including what they both are, what they do, and why they're important.

Words To Know

Microplastics - Microplastics are nondegradable pieces of plastic less than 5 millimeters in size.

Coagulants - In this project, coagulants are substances that aggregate microplastics into clumps that settle, allowing their safe and easy removal.

Turbidity - Turbidity is the cloudiness of a liquid, which can help indicate the quality of water.

Spectrometer - A spectrometer is a scientific tool/device that is used to separate and measure the spectral components of a tested item.

Diffraction grating - In this project, the diffraction grating is what allowed the spectrometer to separate/split the light.

hyperlinks

- US Department of Commerce, and National Oceanic and Atmospheric Administration. "What Are Microplastics?" NOAA's National Ocean Service, 13 Apr. 2016, https://oceanservice.noaa.gov/facts/microplastics.html
- "Flocculants and Coagulants." ChemTreat, Inc., www.chemtreat.com/coagulants-flocculants/
- "Coagulants In Wastewater Treatment." Enva, https://enva.com/case-studies/coagulants-in-wastewater-treatment
- Hancock, Nicole. "Conventional Water Treatment: Coagulation and Filtration." Safe Drinking Water Foundation, Safe Drinking Water Foundation, 10 Jan. 2017, www.safewater.org/fact-sheets-1/2017/1/23/conventional-water-treatment

For Students and Teachers Making Curriculum Connections, see the following:

Connecticut State Department of Education (CSDE) - Common Core State Standards (CCSS): Mathematics
- CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them
- CCSS.Math.Practice.MP3 Construct viable arguments and critique the reasoning of others
- CCSS.Math.Practice.MP5 Use appropriate tools strategically

CSDE - Next Generation Science Standards: Scientific and Engineering Practices
- Asking questions and defining problems; developing and using models; planning and carrying out investigations; analyzing and interpreting data; using Mathematics and computational thinking; constructing explanations and designing solutions; engaging in argument from evidence; and obtaining, evaluating, and communicating information.

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