BEST CONDITIONS FOR MUSHROOMS AND HOW THEY DISSOLVE TRASH

New Mexico

Supercomputing Challenge

Final Report

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Team: 3

McKinley Middle School

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Executive Summary:

This project is focused on researching best conditions for mushrooms and how they dissolve trash. This project is important because it is critical to take toxic plastic pollution and the chemicals that are created by plastic trash and create a way to dissolve/remove it from the planet.

> “The most important action you can take to combat the plastic problem is reducing plastic consumption. However, plastic-eating mushrooms provide an organic solution to removing the plastic that is already polluting our environment.” (Kayla Vasarhelyi, 2021)

Almost all plastic will have to decompose on its own for about 400 years. Oyster mushrooms on the other hand, are able to break down plastic in a matter of months, resulting in organic matter or compost that can be recycled.

In real terms this project will be demonstrating through coding how oyster mushrooms can dissolve plastic trash. The coding will focus on expressing how the oyster mushrooms can eat the trash through modeling the best conditions of decomposition of plastic trash.

The project is important because of the plastic trash and the GREAT PACIFIC GARBAGE PATCH. Are collecting un-recycled plastic pollution. I propose my solution will be an organic proposal to the plastic problem and you can eat the fruiting bodies !!! called the mushrooms and feed people with them.

> “Unfortunately traditional industrial methods of recycling this waste and cleaning/remediating this waste aren't up to speed with the rapid rate in which humans are creating this toxic waste. Traditional methods being used today are missing the connection of using the most resilient natural organisms on this planet that have been evolving for thousands of millions years to decompose the most complex molecules and organic matter on planet Earth.” (Crosby, 2017)

Statement of the Problem:

Since the 1960s, over 8.3 billion tons of plastic have been produced. 40% of this production has been for packaging that is used once and discarded. Landfills receive about 27 million tons of plastic every year in the United States alone. To solve the growing problem of plastic pollution researchers have begun to look for methods by which plastic can be decomposed. This led to the discovery of plastic eating mycorrhizal threads of the oyster mushrooms.

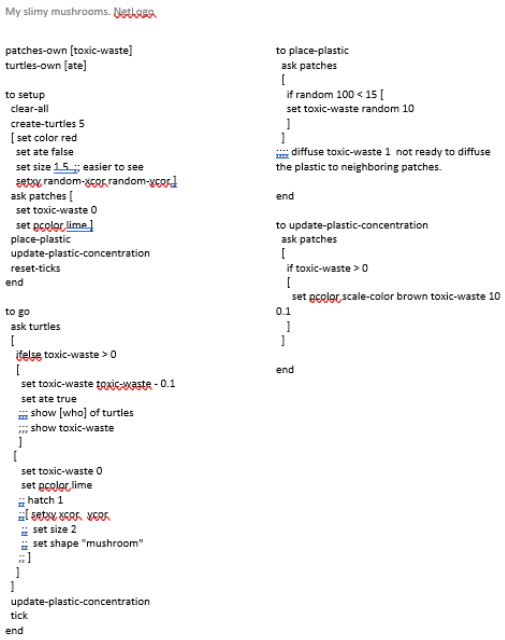
In fact, the Pestalotiopsis microspora mushrooms are the only ones on the planet that can survive on plastic. This fungi consumes polyurethane and converts it into organic matter, which reduces waste in the environment. The mycorrhizal threads break down the plastic by secreting enzymes called lipase and esterase. They also used pro-oxidants to break down the plastic. Mycorrhiza threads of the oyster mushrooms can obtain their nutrition from metabolizing nonliving organic matter. “Fungi have a unique propensity for breaking down chemical pollutants (including oil and pesticides) by producing **ENZYMES** (Ali & Di, 2017).”

This project focuses on humidity and temperature for optimum plastic decomposition. Through research it has been found that Pestalotiopsis (pes-ta-low-tee-op-sis) fungi can decompose plastic. The oyster mushroom is capable of decomposing plastic and it’s edible. In our first experiment we grew oyster mushrooms and found they grow inside a plastic container and the plastic started becoming foamy, so it was decomposing the plastic. This experiment was over three weeks, so if we did more weeks I think the plastic would have changed. “PETA turns garbage into food.” (Hildebrant, 2020) Microbial life can be used to eat plastic through supercharging bacteria and create mutation by using supercomputers to redesign enzymes.

Description of the Method: (coding)

Through Netlogo I developed this coding that would show how mushrooms can eat toxic waste and plastic. My model is not completed, but I will continue to work on it until the Expo.

We have created Mycorrhizal threads that eat plastic and it turns black when it decomposes the plastic. We plan to add humidity and temperature sliders so we can see what is the best condition for decomposing plastic outside.



```
My slimy mushrooms. Netl ogo

patches-own [toxic-waste]
turtles-own [ate]

to setup
  clear-all
  create-turtles 5
  [ set color red
    set ate false
    set size 1.5  ;; easier to see
    setxy random-xcor random-ycor ]
  ask patches [
    set toxic-waste 0
    set pcolor lime ]
  place-plastic
  update-plastic-concentration
  reset-ticks
end

to go
  ask turtles
  [
    ifelse toxic-waste > 0
    [
      set toxic-waste toxic-waste - 0.1
      set ate true
      ;; show [who] of turtles
      ;; show toxic-waste
    ]
    [
      set toxic-waste 0
      set pcolor lime
      ;; hatch 1
      ;; [ setxy xcor  ycor
      ;;   set size 2
      ;;   set shape "mushroom"
      ;; ]
    ]
  ]
  update-plastic-concentration
  tick
end

to place-plastic
  ask patches
  [
    if random 100 < 15 [
    set toxic-waste random 10
    ]
  ]
;;;; diffuse toxic-waste 1  not ready to diffuse
the plastic to neighboring patches.

end

to update-plastic-concentration
  ask patches
  [
    if toxic-waste > 0
    [
      set pcolor scale-color brown toxic-waste 10
0.1
    ]
  ]

end
```

Results of Your Study:

At this time, we haven't finished our model. We plan on continuing to work on the model up until the Expo. By the time we are finished we expect to have humidity and

temperature data from our model. At that time we expect to be able to say the optimum temperature and humidity for plastic decomposition in the field.We plan to have a graph of our results.

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Most Significant Achievement on the Project:

My most significant achievement on the project was learning how to code Netlogo and write a research report. I feel this is the most important because it helps me learn about coding and writing reports like a scientific report. I will use these skills in future projects and expand my knowledge of Netlogo for my project next year.

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