BIODOMES

INTEGRATION OF 2V GEODESIC DOME AND PHYTOREMEDIATION

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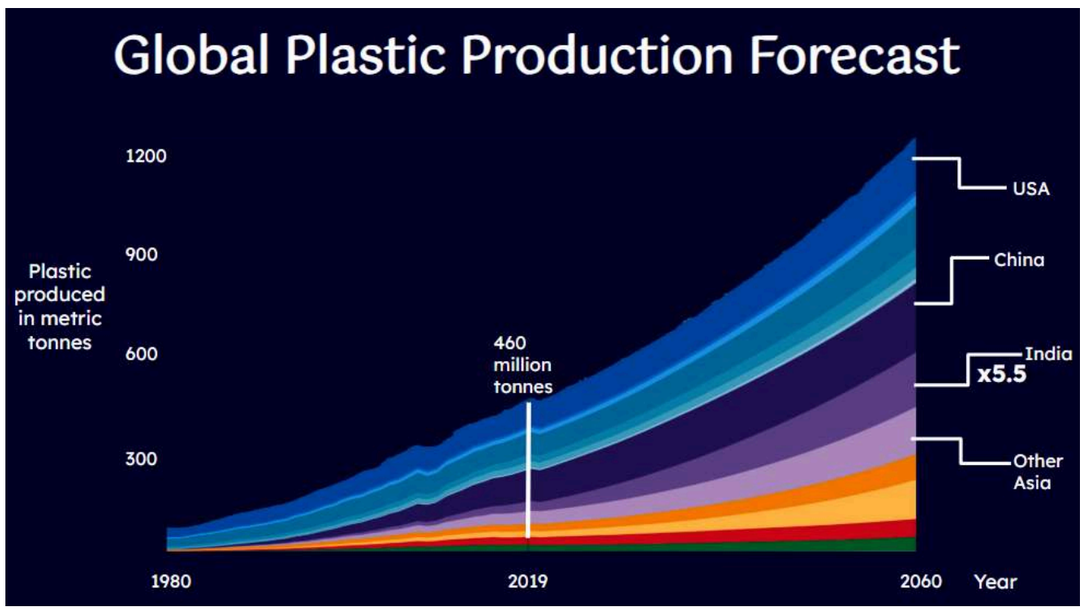
OBJECTIVE

REDUCE MICROPLASTIC PARTICLES IN WATER AND PRVENT ITS ENTRY INTO WATER FROM OTHER SOURCES

INTRODUCTION

Microplastics, which are generated when plastics physically degrade, have infiltrated almost all water bodies, enabling their seamless entry into the food chain. These miniscule particles **contaminate food and water** and therefore cause **health issues** ranging from endocrine disruption all the way to cancer. The growing **issue of microplastics** is further **backed by global plastic production forecasts**. Dangers of microplastics has been under-estimated, while in reality, it does the most damage to human health.



THIS IMAGE SHOWS THE GLOBAL PLASTIC PRODUCTION FORECAST. INDIA IS PROJECTED TO PRODUCE 5.5 TIMES MORE PLASTIC IN 2060 THAN IN 2019.

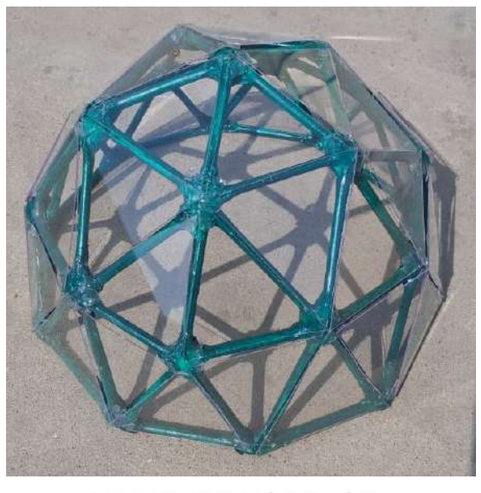
Indian rivers have the second-highest levels of microplastic pollution in the world!

Water body	Items per m³
Netravati River	288
Adyar River	330
Kosasthalaiyar River	670
Perungudi Lake	7000

THIS TABLE SHOWS THE NUMBER OF MICROPLASTIC PARTICLES IN VARIOUS WATER BODIES OF SOUTH INDIA.

MATERIALS

Materials : Paper, Polycarbonate sheet - 1 millimeter thickness (online vendor), 3M double sided transparent tape, Masking tape, Glass bowl, *Lemna minor* - duckweed (Vendor - MyOwnGarden)
Miniature model of a 2V geodesic dome : 35 struts of length 9 centimeters and 30 struts of length 8 centimeters



MINIATURE MODEL OF THE 2V GEODESIC DOME

DUCKWEED - LEMNA MINOR CULTURED IN A GLASS CONTAINER

PROPOSED METHODOLOGY

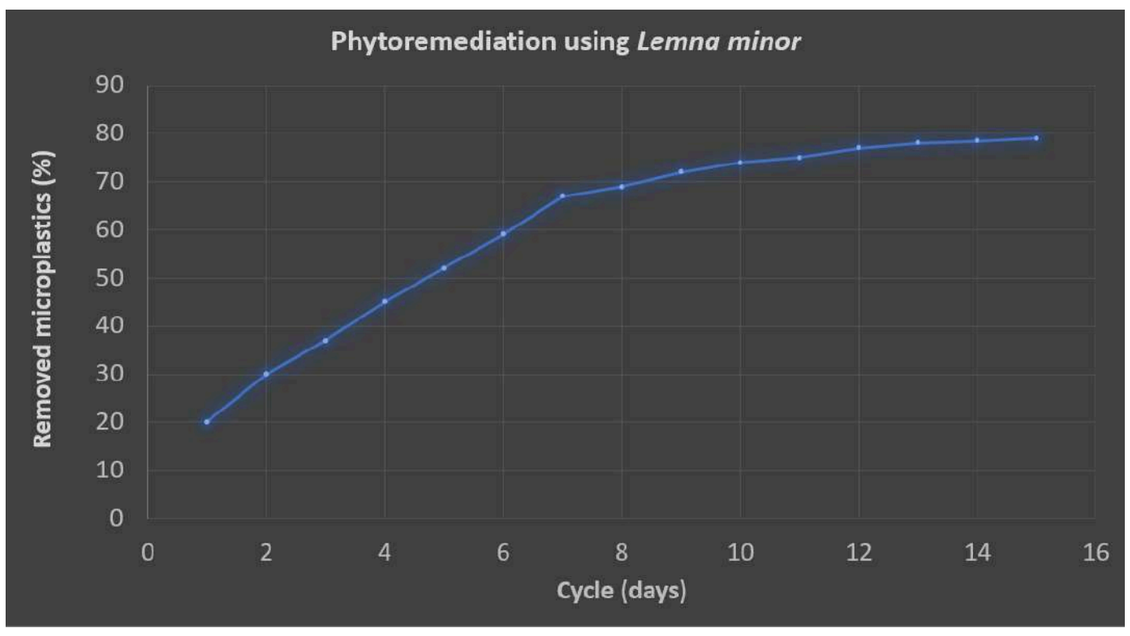
Collect 1.6 litres of microplastic contaminated water from a water body using glass container. Set aside 100 millilitres water for testing the initial number of microplastic particles in it. Separate the remaining 1.5 litres of water into 15 samples of 100 millilitres. Add 120 fronds of *Lemna minor* in to each sample and leave it undisturbed for 24 hours. Test one of the water sample for the number of microplastic particles. In remaining 14 samples, replace the old duckweed with a new batch of 120 fronds of duckweed. Repeat the process of testing one sample each day and replacing the duckweed in all other samples for a total of 15 days. Keep all other conditions such as temperature constant on all days. Observe the roots of duckweed under a microscope to view if they have adsorbed particles. Test these particles to ensure that they are microplastic particles.

Methods proposed to test for microplastic levels:

- **Laser diffraction analyzer** – Size and number of particles per mass
- **Optical microscope** – Shape
- **Field-emission scanning electron microscope (FE-SEM)** - Morphology
- **Fourier-transform infrared (FTIR) spectroscopy** - Chemical composition

PREDICTED RESULTS

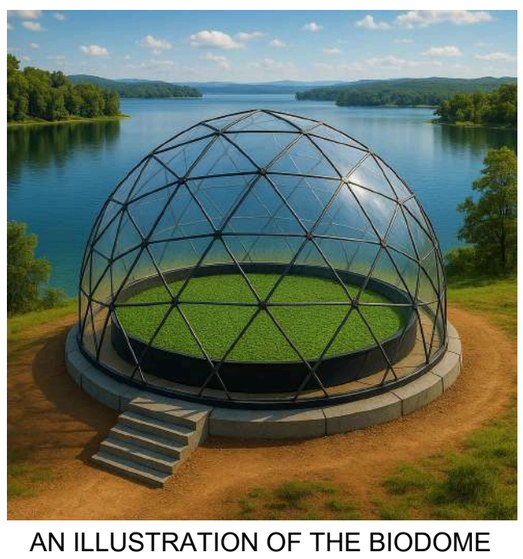
It is predicted that the **removal of microplastics by the duckweed** would **increase linearly** in the **first eight cycles** after which the **rate** of removal of microplastics **reduces gradually every day**. Based on the experimental data for the last four cycles, 100% of microplastics would be removed from water after 53 cycles.



GRAPH - RATE OF REDUCTION OF MICROPLASTICS IN WATER TREATED WITH DUCKWEED

ANALYSIS

- Adhesion of some microplastic particles to the roots of the duckweed may not be strong. Hence, there exists a possibility of microplastics falling back into the water.
- There may not be effective contact between roots and the heavy density microplastics making phytoremediation slightly ineffective.
- However, for approximately ₹8.3 lakhs, the Biodome can effectively remove 79% of microplastics from water through phytoremediation and also prevent the re-entry of microplastics into the ecosystem.
- The biodome occupies space which could instead be used for agricultural or residential purposes. To remove this issue the biodome can also be made floating with extraction methods to obtain the treated water
- Frond size, plant concentration, water movement, adherence of microplastics to *Lemna minor* needs to be standardized.
- Damage to polycarbonate sheets due to bird pecking.



AN ILLUSTRATION OF THE BIODOME

CONCLUSION

Microplastic pollution threatens to ignite **global health crisis by 2050.**

By implementing the B**iodome** we can **enhance countless lives** in the future.

The Biodome is our frontline defense, targeting microplastics at one of their major sources - water.

THIS INNOVATIVE SOLUTION ISN'T JUST A CHOICE; IT'S A NECESSITY!

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