

A TINY PLANT THAT CAN 'DIGEST' LOW DENSITY PLASTIC SHEETS

Relevant for: Environment | Topic: Biodiversity, Ecology, and Wildlife Related Issues

Useful plant: An alga variety - *Uronema africanum* Borge - commonly found in Asia, Europe and Africa, seen under the light microscope. | Photo Credit: [Sanniyasi Elumalai](#)

Researchers from University of Madras and Presidency College, Chennai, have isolated an alga species that shows promise as an agent of biodegradation of plastic sheets. It is a preliminary study that has been published in *Scientific Reports* and needs further research and development before it can be translated to the industry.

According to the Central Pollution Control Board's annual report for the year 2011-12, the plastic waste generated in a year amounted to 5.6 million metric tonnes. Only 60% of the plastic used in India was collected and recycled. The metros alone contributed some 21.2% of the total waste, led by Delhi, followed by Chennai, Kolkata and Mumbai.

The usual means of disposal of plastic waste involves incineration, land-filling and recycling. These methods have limitations and also sometimes produce side-effects that are hazardous to the environment. Hence, researchers are on the lookout for biodegradation methods that are safe and environment friendly. It is in this context that the present study gains importance.

In earlier studies, species of bacteria that degrade plastic have been studied. In the present study, this role is played by the microalga *Uronema africanum* Borge. This is a species of microalgae that is commonly found in Africa, Asia and Europe. In Rangoon, Burma, it was noted to be an epiphyte, attaching itself to other algae and plants.

Sanniyasi Elumalai, Professor in the Department of Biotechnology, University of Madras, and his graduate students Preethy P. Raj and Dinesh Kumar Gunasekar, along with post-doctoral fellow Rajesh Kanna Gopal from Presidency College, came upon a plastic bag which was colonised by, as they came to know later through study, three species of microalgae.

"We collected a polyethylene carry bag colonised by green, luxuriously grown photosynthetic microalgae and samples of water," says Prof. Elumalai. "Viewing the collected polyethylene sample under a light microscope showed that it was colonised by microalgae... Abrasions were seen on the surface of the polyethylene sheet at different magnifications."

The samples were collected at the Kallukuttai lake area near Taramani railway station, in Chennai. When they did a closer examination of the microalgal growth, they found one species, *Uronema africanum* Borge, showed potential to degrade plastic.

They first had to identify which species the alga belonged to, and in this they were helped by Dr. B. Babu of Madras Christian College, Chennai, whom they acknowledge in the paper.

In the experiments, they tested the microalga on low-density polyethylene, in sheets which are highly resistant to degradation, into simpler molecules. "We saw that the isolated algae *Uronema africanum* produced enzymes, hormones, and some polysaccharides which slowly degrade [the sheets], and the structural integrity of the polymer [breaks down] and it disintegrates into monomers," says Prof. Elumalai.

After incubation of the algae in the polyethylene sheet for thirty days, they noticed under the microscope that there were aberrations, grooves, ridges and furrows in the material of the sheets. Following it up with gas chromatography and mass spectrum analysis, they found that there was a huge difference in the composition of supernatant fluids of controls and experimental sample.

“The microalgae produce different kinds of extra cellular polysaccharides, enzymes, toxins such as cyanotoxins, hormones which react with the polymer sheets (polymer bonds) and break them up into the simpler monomers which will not have harmful effect in the atmosphere,” says Prof Elumalai.

In their analysis, the researchers used the facilities of Central Leather Research Institute, Chennai, and Vellore Institute of Technology, Vellore.

The researchers are planning to collaborate with industry to take up this technology in to a pilot scale and finally large-scale study.

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