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Parengyodontium: A Plastic Eating Fungi

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In 1846, renowned German chemist Christian Schonbein made the discovery of plastic. Actually, plastics were discovered by accident. Nitric acid and sulfuric acid were accidentally spilled by Christian as he was experimenting in his kitchen. The word "plastic" comes from the Greek word "plastikos," which means "to mold." Due to the widespread use of plastic products in our daily lives, polymers are produced on a vast global scale. The annual global production of plastic exceeds 150 million tonnes on average. The Plastic Overshoot report projects that in 2023, 158,943,925 tons of plastic products would be generated, with 43% of that debris being mishandled. This indicates that 68,642,999 tonnes of plastic will find their path into the environment. With 9.3 million tons of plastic trash produced annually roughly one-fifth of the world total India is the leading plastic polluter in the world. . The second and third largest emitters of plastic are, respectively, Nigeria and Indonesia. Just 60% of plastic generated is recycled; the remaining 9400 tons of plastic are left in the environment unchecked, polluting the air, water, and land. Researchers from all around the world have produced studies on microplastic, bioplastic and bioplastic degrading fungi and bacteria; however these are not the main solutions to this issue. Scientists have just found the fungus genus *Parengyodontium album*, also known as *Engyodontium album*, which naturally dissolves plastic. In this post, we'll go into great detail regarding this fungus.

Systematic Position

Domain:	Eukaryota
Kingdom:	Fungi
Division:	Ascomycota
Class:	Sordariomycetes
Order:	Hypocreales
Family:	Cordycipitaceae
Genus:	*Parengyodontium*
Species:	*P. album* (Limber) C.C. Tsang

Morphological characters

The fungus genus *Parengyodontium album*, sometimes known as *Engyodontium album*, is characterized by fluffy, white colonies with transparent, colorless undersides. The fungus's basic growth structure, slender vegetative hyphae, may be seen in addition to fertile hyphae that divide and produce conidiogenous cells, which are specialized cells from which spores are produced, under a microscope. The actual spores are translucent, round, and smooth. Ustilaginomycetes, Agaricomycetes, Tremellomycetes, Microbotryomycetes and Tritirachiomycetes are among the eleven classes of the fungal division Ascomycota which includes other plastic degrading fungi. Mucoromycota, on the other hand, contains only one class of plastic deteriorating fungi.

Researches on plastic degrading micro organisms

Lacerda studied plastisphere fungi in the watery habitats of the area of Antarctic Peninsula and South Atlantic. A detailed summary was provided of the enzymes and microorganisms which can break down a range of commonly used synthetic polymers. To improve the decomposition rate of low-density polyethylene (LDPE) without the need for a co-substrate or, Sáenz experimented with *Aspergillus niger* and *A. terreus*. Kale studied microbial degradation of plastics. Still, a thorough investigation into fungi that degrade down plastic in various kinds of settings both marine and terrestrial has just been conducted. *Aspergillus nidulans, , Aspergillus oryzae, Aspergillus nomius, Penicillium griseofulvum, Aspergillus favus, Aspergillus glaucus Bjerkandera adusta, Phanerochaete chrysosporium, Cladosporium cladosporioides* and a few other saprotrophic fungi, like *Pleurotus eryngii, Agaricus bisporus, Pleurotus ostreatus* and *Pleurotus abalones* are notable species that degradation on plastics effectively. Many historical structures, museums, libraries and tourism destinations have reported on the diversity of *Parengyodontium*. It means that the fungus is found all across the world. It has been discovered in a Cuban museum in Central America (Borrego and Molina, 2019) a display cave in North America (Vaughan *et al*., 2011), and a Chilean world heritage site in southern America. In addition, the fungus has been isolated from Portugal to Russia in Europe; reports of its occurrence have also been made in England, Spain, France, Germany, Italy and Poland. Lastly, *P. album* has also been found throughout Asia and Africa, though not in settings connected to cultural heritage. Mechanism of action of a common microbe that efficiently degrades plastic. According to some research, plastics degrade more effectively when photo-degradation, thermo-oxidative processes are engaged in biodegradation process at the same time. Microbial enzymes influences on the plastics' surface are a one of the biodegradation mechanism. The fungi and bacteria adhere to the plastic surface; deactivate the enzymes and enabling the vegetative growth of microorganisms by using it as a substrate and energy of nourishment. As a result, the polymers gradually depolymerize and the degradation process is concluded by mineralization, producing end products such as water, carbon dioxide, and methane (CH2). A handful of the enzymes also have a role in the degradation of plastic.

- Cutinase
- Lipase
- Protease
- Esterases
- Laccase (Munuru Srikanth *et al* .,2022)

Plastic degrading mechanism *in Parengyodontium album*

The fungal biomass of *P. album* serves as the energy source for this bioremediation process, which transforms the carbon produced from PE. By using microorganisms, fungus, or plants, bioremediation breaks down contaminants in soil, water, air and transforms them into non-toxic chemicals through organic biological processes. For this process to occur, PE must first undergo photo-degradation in UV radiation. The fungus turns beneficial in breaking down the plastic that floats in the ocean. *Parengyodontium album* breaks down polyethylene amount of approximately 0.05 percent every day in the lab, and sunlight has a major impact on this process. This makes the breakdown of polyethylene by *Parengyodontium album* extremely noteworthy. Researchers found that the fungus only dissolve down polyethylene that has been presence under Ulta Violet light, indicating that in natural settings, *P. album* likely degrades plastics floating near the ocean.

Conclusion

Plastic wastes are the major pollution-causing agent, not only for air but also for water, and other pollutants are also created by these plastic wastes. Scientists discovered many numbers

of plastic-degrading microorganisms in the ecosystem. But no one is effective in the environment. They all worked well in only laboratory conditions. The fungus named *Parengyodontium album* is the effective fungus and shows better results in living environments, especially in the marine ecosystem. It shows the healing nature of the environment. So future research are needed for improving this fungus for effective and eco-friendly management of plastic wastes.

References

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