Fungi in the plastisphere: their ecological role and biotechnological valorization

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Plastic has become one of the most pressing environmental issues, being widely dispersed in the entire ecosystem. Every year, the marine environment receives more than 10 million tons of plastic. Microorganisms can adapt to this peculiar ecological niche and colonize the plastic debris. The co-occurrence of microorganisms creates a dynamic microbial community, which remains largely unexplored.

In the present study, the marine plastisphere coming from different locations (Italy, Denmark) was studied, unveiling a heterogeneous mycobiota. Although different techniques were used to enrich the number of isolated strains, metagenomic approaches were also applied to overcome the issue of unculturable microorganisms.

The fungal community varied according to the site, the plastic polymer, and environmental parameters, i.e., salinity. Hundreds of strains were isolated, mostly associated with the Ascomycota phylum. Despite filamentous fungi were very abundant as expected, yeasts were not negligible (10-30%).

Unveiling the hidden biotechnological potential of these marine fungi was of major interest, with a focus on their capability to transform plastic polymers. Some fungi belonging to the genera *Alternia* and *Samsoniella* were capable of degrading biopolymers. The extent and kinetics of such a process are currently under investigation via respirometry analysis. Moreover, the metabolome of these strains can include highly valuable bioactive compounds. The extract of strains belonging to the genera *Aspergillus, Penicillium, Cladosporium* and *Sesquicillium* showed osteogenic potential in both *in vitro* and *in vivo* tests or antiviral activity against important human viruses. The identification of the responsible molecules is still ongoing.