Analysis of the fungal plastisphere and its biodegradation potential

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Abstract

Environmental contamination by plastic is a worldwide problem. In the environment, plastic degradation is the result of physical, chemical and biological reactions. The latter pathway is thought to be primarily carried out by microorganisms, in particular bacteria. However, recent research studies have highlighted the plastic degradation potential of marine fungi (i.e. *Zalerion maritimum* and *Alternaria alternata* on polyethylene -PE-). This raises questions about the diversity, distribution and activity of fungal communities associated with marine plastic waste, as well as their potential to degrade polymers and the involved metabolic mechanisms. In the framework of the ANR project MycoPLAST, different types of plastics voluntarily immersed in seawater in coastal marine habitats were collected and analyzed using molecular and/or culturing approaches. We performed metabarcoding analyses of the mycobiome, targeting both the V4-V5 18S rRNA gene and the ITS2 region, to elucidate the fungal structure and composition. This also allows to incorporate the fungal kingdom to the concept of the "plastisphere" ecological niche, which is currently mainly dedicated to bacteria and protists. In parallel, using a culture-based approach, over 800 fungal isolates were obtained from marine plastic waste. An original laser nephelometry approach, dedicated to mid/high-throughput screening of fungal isolates was applied to assess their ability to use different kind of plastics (PE/PHBV/PS/PCL/PET/PVC) as unique carbon source. Overall, 11 fungal isolates (out of the 192 tested to this date) were of interest as they exhibited either broad (use of multiple polymers, 1 isolate) or limited (use of a single polymer, 10 isolates) spectra of utilization. Further studies will be performed to evaluate the actual biodegradation capacities of these isolates via ATR-IRTF and to decipher the metabolic pathways activated in these processes using stable isotope tagged polymers.

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