Proteomic and metabolomic assessment of polypropylene biodegradation by bacteria isolated from a landfill

Theo Obrador-Viel*†[1], Maria De Mar Aguilo-Ferretjans[1], Jean Armengaud[2], Balbina Nogales[1], Rafael Bosch[1,3], and Joseph A. Christie-Oleza‡[1]

[1]Laboratory of Microbiology, Department of Biology – University of the Balearic Islands, Spain
[2]CEA-INRAE – CEA-INRAE – Bagnols-sur-Cèze, France
[3]IMEDEA-CSIC – Esporles, Spain

Abstract

Plastic is a globally used material due to its unrivalled properties. Even though its benefits to society, plastic is a hazard to aquatic and terrestrial ecosystems due to waste mismanagement. Over the variety of polymers used to produce different plastic types, polyethylene (PE) and polypropylene (PP) represent 50 % of global plastic production. In the past, microbial isolates have been shown to degrade plastics, however, most of these studies lack a molecular understanding of such a process. While the metabolic pathways involved in PE biodegradation have been previously reported, the mechanisms behind PP biodegradation remain unexplored. In this work, two bacteria were isolated from a 30 years-old plastic landfill in Mallorca, Spain. Plastic-degrading bacteria were obtained through an enrichment and isolation method specifically designed. Isolates were screened for their ability to grow with PE and PP as the sole carbon and energy source in minimal medium. The most promising strains *Rhodococcus* sp. and *Stenotrophomonas* sp. were genome-sequenced and analysed by shotgun proteomics to decipher the metabolic pathways involved in PP degradation. Mass spectrometry was also used to identify compounds consumed or generated by bacteria. Results show clear differences between PE and PP degradation.

Keywords: biodegradation, bacteria, proteomics, polypropylene

*Speaker
†Corresponding author: theo.obrador1@estudiant.uib.cat
‡Corresponding author: joseph.christie@uib.eu