10th International Conference

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This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No 101079173

ABSTRACT BOOK

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Exploring the enzymatic ability of strains isolated from plastic-polluted environments for enhancing synthetic and natural biopolymers' biodegradation

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Background: Renowned oil-based polymers represent an environmental nuisance, due to their well-known permanency in nature, known to disrupt ecosystems. In response, bio-based polymers have emerged as an alternative, providing a sustainable blueprint for plastic circularity1. However, despite being classified as biodegradable, these polymers can still show resistance to biodegradation when not presented with optimal environmental conditions such as specific temperature and pH, amongst other key factors in their breakdown. Due to this, microbial degradation results in an interesting path to promote biodegradation of such polymers.2

Objective: This study aims to evaluate the ability of selected strains isolated from polluted environments to improve the rate of biopolymers' biodegradation such as Polyhydroxy butyrate (PHB), Polylactic acid (PLA), and Bacterial cellulose (BC) when exposed to strains with specific enzymatic tools to aid in its degradation.

Methods: Selected strains were previously isolated from plastic-polluted soil samples. Strains were transferred to Mineral Salt media (MSM) biopolymer-supplemented plates (7d, 30℃) (MSM (15 g/l Agar, 9 g/l Na2HPO4 x 12H2O, 1.5 g/l KH2PO4, 1 g/l NH4Cl, 0.2 g/l MgSO4 x 7H2O, 0.2 g/l CaCl2 x 2H2O, Fe(III)NH4-citrate 0.0012 g/l), (1-3%) biopolymers (PHB, BC, and PLA) growth and clear-zone method were used to determine strains' possible enzymatic activity. Selected strains were transferred to flasks containing PHB, PLA, and BC films, respectively, in MSM and incubated for 20 days at 30℃, 120 rpm. Samples were washed and dried and their level of degradation was assessed by FTIR, weight loss, and scanning electron microscopy (SEM). The ability of the best performer strain to degrade PHB was additionally assessed using Respirometer (Echo Instruments) to determine the biodegradability of said films under a controlled temperature (25°C) with a flow rate of 500ml/min.

Results: Significant weight loss was observed in samples exposed to strains, meaning biodegradability was achieved in an important percentage, proving their capability to degrade the proposed biopolymers, compared to samples lacking microbial presence.

Dhanraj, N. D et al (2022) Biodegradation of petroleum based and bio-based plastics: Approaches to increase the biodegradation rate. Archives of Microbiology, 204(5),258.

Siracusa, V. (2019) Microbial Degradation of Synthetic Biopolymers Waste, Polymers 11, 1066; doi:10.3390/polym11061066