Assessment of sophorolipids assisted biodegradation of microplastics by *Brevibacillus parabrevis*

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Abstract

The cumulative accumulation of microplastics (MPs) in the environment poses major threats to ecosystems. In the present study, we assessed the effect of sophorolipids (SLs) biosurfactant in biodegradation of microplastics (PE, PS, PP, PET, and PVC present together) incubating *Brevibacillus parabrevis*. Two different concentrations of sophorolipids (SLs) were added to the shake flasks at 80 mg/L and 160 mg/L, after which six different incubation tests were underwent for 30 days as: (i) CTr (MPs without inoculum), (ii) BTr (MPs with inoculum), (iii) SL_{80}CTr (MPs+SLs at 80 mg/L without inoculum), (iv) SL_{80}BTr (MPs+SLs at 80 mg/L with inoculum), (v) SL_{160}CTr (MPs+SLs at 160 mg/L without inoculum), (vi) SL_{160}BTr (MPs+SLs at 160 mg/L with inoculum). The degree of their biodegradation between before and after incubation was determined by weighing their difference, Fourier Transform Infrared (FTIR) spectroscopy, and Thermogravimetric analysis (TGA). There was the highest weight loss of MPs observed for SL_{160}BTr (8.9%). FTIR revealed the reduced peaks of functional groups, such as aromatic C-H stretching peaks (3025 cm^{-1}), C=O stretching (1740 cm^{-1}), and C-O stretching (1100-1200 cm^{-1}), which signifies oxidation degradation and chain scission taken place in BTr, SL_{80}BTr and SL_{160}BTr. TGA profile demonstrated that initial decomposition temperature for SLs could decompose microplastics by shifting the temperature 5-20 °C lower than the initial temperature, indicating that their thermal stability and polymer chain integrity have been slightly deteriorated. It was clearly emphasized that the addition of sophorolipids could significantly play a role in accelerating the degradation of microplastics in the presence of such bacteria in the environment.

Keywords: Microplastics, *Brevibacillus parabrevis*, Sophorolipids, Biodegradation, Biosurfactant, Polyethylene