Biofilm formation and partial biodegradation of polystyrene by the actinomycete Rhodococcus ruber

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ABSTRACT

Polystyrene, which is one of the most utilized thermoplastics, is highly durable and is considered to be non-biodegradable. Hence, polystyrene waste accumulates in the environment posing an increasing ecological threat. In a previous study we have isolated a biofilm-producing strain (C208) of the actinomycete Rhodococcus ruber that degraded polyethylene films. Formation of biofilm, by C208, improved the biodegradation of polyethylene. Consequently, the present study aimed at monitoring the kinetics of biofilm formation by C208 on polystyrene, determining the physiological activity of the biofilm and analyzing its capacity to degrade polystyrene. Quantification of the biofilm biomass was performed using a modified crystal violet (CV) staining or by monitoring the protein content in the biofilm. When cultured on polystyrene flakes, most of the bacterial cells adhered to the polystyrene surface within few hours, forming a biofilm. The growth of the on polystyrene showed a pattern similar to that of a planktonic culture. Furthermore, the respiration rate, of the biofilm, exhibited a pattern similar to that of the biofilm growth. In contrast, the respiration activity of the planktonic population showed a constant decline with time. Addition of mineral oil (0.005% w/v), but not non-ionic surfactants, increased the biofilm biomass. Extended incubation of the biofilm for up to 8 weeks resulted in a small reduction in the polystyrene weight (0.8% of gravimetric weight loss). This study demonstrates the high affinity of C208 to polystyrene which lead to biofilm formation and, presumably, induced partial biodegradation. [PUBLICATION ABSTRACT]

DETAILS

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