ENHANCED BIODEGRADATION OF PHOTODEGRADABLE POLYETHYLENE FROM DEVELOPED MICROBIAL BIOFILMS

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Microorganisms play a significant role in biological decomposition of materials including synthetic polymers in natural environments. This is called biodegradation. Multicellular microbial communities known as biofilms attached to surfaces of synthetic wastes have been found to be very powerful degrading agents in nature showing increased resistance to antimicrobial agents. Therefore, there is a great scope for developing a biofilm technology by producing biofilmed communities for biodegradation. High-density and low-density polyethylenes are the most heavily consumed synthetic plastics in the world. They are very slow in degradability in natural environments hence causing serious environmental problems concerning landfill and municipal waste creating hazards to fresh water and marine animals.

In this study the aim is to isolate and identify a certain combination of microorganisms associated with degrading high-density polyethylene i.e. "shopping bags", which can be used for effective biological decomposition of polyethylene wastes.

The bacteria and fungi were isolated on to separate plates and identified using morphological and physiological characters, using microscopic observations and biochemical tests. The isolated and identified groups of microorganisms were cultured in a synthetic medium in the laboratory with pieces of both degradable and non-degradable polyethylene as the sole carbon source. Degradability or the microbial activity on the polyethylene was tested following microscopic observations, weight loss and emission of carbon dioxide.

In degradable polyethylene, a combination of *Penicillium sp.* + *Bacillus* strain 2 showed a high reduction in weight (ca. 7%) and a high emission of carbon dioxide compared to their monocultures and the controls. This microbial combination showed the highest weight loss in non-degradable polyethylene too, but it was only 1.6%. Inoçulation of polyethylene wastes with this particular microbial combination or community could improve degradation process in landfills and composting areas. Further investigations on this community are needed to understand the metabolic processes involved in effective degradation of this polymeric material.