Biocarriers for biofilm immobilization in wastewater treatments: a review

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Abstract

Biocarriers (biofilm carriers) play an essential role in attached growth systems for wastewater treatments. They act as redox mediators to speed up biotransformation of contaminants in industrial effluents. However, over 90 years of introducing the idea of using microorganisms to perform bioremediation, to date, it is still challenging to choose a biocarrier material to achieve a strong biofilm adhesion and high rates of microbial activities. Hence, this review is the first reporting most of the past reports of insoluble polymeric biocarriers and discuss them critically. It systematically addresses the following subjects: (1) selecting a biocarrier, (2) applications and drawbacks of polymeric biocarriers, and (3) surface modification and composites. In so doing, it investigates the biofilm growth on different polymeric biocarrier surfaces, and in-depth how various circumstances influence the metabolic pathways of the biofilm system. Based on the reported removals of chemical oxygen demand, it had been concluded that utilization of conventional and modified/composites polymers as biocarriers could be rated as following: polyvinyl alcohol > polyurethane > polyethylene > polypropylene, and polyvinyl alcohol > waste tire > polyurethane > polyethylene, respectively. However, if the ranking was based on drawbacks, polyurethane will be at the top because of being prone to biological and physical fouling. Finally, it was concluded that selecting a biocarrier based on its commercial/material name is impractical.

Keywords: Wastewater Treatment; Polymeric Biofilm Carrier; Packing Material; Attached Growth Biofilm System; Biofilter Fouling.

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