REVIEW ARTICLE

Microbial biofilms application in environmental monitoring, bioremediation and waste water treatment

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ABSTRACT

Increased contamination of the environment with toxic pollutants has paved the way for efficient strategies, which can be implemented for environment restoration. The major problem with conventional methods used for cleaning of pollutants is inefficiency and poor economics. Bioremediation is a growing technology having an advanced potential for cleaning pollutants. Biofilms formed by various microorganisms potentially provide a suitable microenvironment for efficient bioremediation processes. A biofilm is a microbially derived sessile community characterized by cells that are attached to an abiotic or living surface and embedded in a matrix of extracellular polymeric substances that they have produced. Biofilm communities provide a beneficial structure, possibility for nutrient, and genetic exchange to participating microorganisms as well as protection from the surrounding environment concerning for instance predation and chemical and shear stresses. Biofilms can also be utilized in other ways as biomarkers for monitoring of stream water quality from mine drainage. Biofilm systems are especially suitable for the treatment of recalcitrant compounds because of their high microbial biomass and ability to immobilize compounds. Bioremediation is also facilitated by enhanced gene transfer among biofilm organisms and by the increased bioavailability of pollutants for degradation as a result of bacterial chemotaxis. Many plant extracts contain phenol derivatives, terpenes, flavonoids, etc. which have ability to suppress the microbial cell attachment and biofilm growth. Strategies for improving bioremediation efficiency include genetic engineering to improve strains and chemotactic ability, the use of mixed population biofilms and optimization of physico–chemical conditions are discussed in this review.