Biosurfactants: promising bioactive molecules for tackling petroleum related environmental contamination challenges

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Abstract

Biosurfactants are naturally occurring surface active biological molecules produced mainly by microorganisms capable of partitioning at interphases reducing surface and interfacial tensions between different phases, gas, liquid and solid. Biosurfactants are also good foaming emulsification and wetting agents that have low critical micelle concentrations and surface-tension properties compared to their chemical counterparts, suggesting that these compounds can potentially replace these more recalcitrant and problematic surfactants in the market. The most promising biosurfactants are the glycolipid in nature including sophorolipids produced by yeasts strains such as *Starmerella* and *Candida*, rhamnolipids produced by *Pseudomonas* bacteria and related bacterial strains and mannosylerythritol lipids produced by *Pseudozyma* yeasts. Global interest in biosurfactants steadily increased during the past three decades and was mainly stimulated not only by their exceptional surfactant characteristics but also their environmentally friendly attributes, biodegradability potential, sustainable production technologies, and lower toxicity. They also have consistently shown suitability for application in numerous processes particularly those related to oil contamination and petroleum related industries. These application include, oil mobilization, microbial enhanced oil recovery, oil storage tank cleaning, oil pollution treatment and enhancing hydrocarbon bioavailability to biodegradation among many others. Further applications include use as components in both domestic and industrial cleaning products, dispersants in pesticides, anti-microbial agents and as emulsifiers in food products. In addition, some medical pharmaceutical applications including cosmeceuticals as anti-aging, oral hygiene products and wound-healing agents in dermatological products have been reported. In this presentation, we will concentrate on biosurfactants, and their applications related to oil pollution and petroleum industries with some examples of case study for use in oil storage tank cleaning processes, oil spill remediation in addition to future potential applications in conjunction with other technologies.