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Isolation of biosurfactant producing strains for enhanced bioavailability of hydrocarbon contaminants

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Abstract

Biosurfactants are surface active agents produced by microorganisms. Due to their amphiphilic structure, biosurfactants show a wide range of properties, including the lowering of surface and interfacial tension of liquids, the ability to form micelles and microemulsions between two different phases, the ability to increase the surface area of hydrophobic water-insoluble substances, and thus increase the water bioavailability of such substances. The present study focused on the isolation of novel biosurfactant producing strains from hard surfaces (tar surfaces) which exclusively utilize agrowaste as their primary carbon source for the expression of the biosurfactants – quantified using various standardized methods. Agrowastes used were; Pear (P, *Pyrus*), Pineapple (PP, *Ananas comosus*), Apple (A, *Malus domestica*), Beetroot (B, *Beta vulgaris*), Brewers spent yeast (SPY), PP plus SPY, B plus SPY, P plus SPY, PP plus SPY and A plus SPY. The drop-collapse method showed that the highest biosurfactant production was achieved using *B. vulgaris*. Surface tension reduction and emulsification index were used to screen the biosurfactant produced for its potential application in enhancing bioavailability of hydrocarbon contaminants. Emulsification was carried out using diesel, engine oil, cyclohexane, phenanthrene and benz(a)anthracene as hydrocarbons. The biosurfactant produced using *B. vulgaris* waste as a sole carbon source (without supplementation with refined carbohydrates, inducers, etc.) was able to lower the surface tension of the medium to 33 mN/m within 4 days of incubation without optimization – for which the crude extract formed stable emulsions. The results obtained in this study demonstrated the feasibility of producing biosurfactants using renewable and easily available resources as sole and primary carbon sources. The emulsification achieved showed the biosurfactants' propensity for use in enhancing bioavailability and hence, bioremediation of an environment contaminated with various hydrocarbons.