Producing Biosurfactants from Waste Materials

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Abstract

Potential of using used oils as substrates to produce biosurfactants under non-sterile condition are being investigated. The produced biosurfactant was biodegradable and had a CMC of 1 g/L and lowered the surface tension of water to 27 dynes/cm. Using biosurfactant increased the solubility of naphthalene from 32 to over 500 mg/L.

1. Introduction

Million tons of hazardous and nonhazardous wastes are generated each year in the U.S. The treatment and disposal costs for these wastes are causing a vast amount of financial burden to various industries and may soon outstrip the available resources. Thus, there is a great need to better manage these wastes via reduce, reuse, and recycle.

Biosurfactant are biologically synthesized surface-active agents. They are extracellular macromolecules produced as metabolic byproducts of microbial transformation of organic substrate. Biosurfactant, have the advantages of being readily biodegradable and posses properties comparable to chemical produced surfactants, can be used for various applications. Thus, producing biosurfactants from used vegetable oil and use motor oil is a sound strategy of waste management for food and auto industries to reduce the generation of wastes.

2. Objective

The overall objectives of this study is to produce biosurfactants from used oils and apply them in remediating of non-aqueous phase liquids (NAPLs) contaminated sites. Specific objectives are (1) to produce biosurfactants from used oils under non-sterile conditions; (2) to characterize biosurfactants through surface tension, critical micelle concentration (CMC), and critical micelle dilution (CMD); and (3) to investigate the role of biosurfactants in remedying selected NAPLs contaminated soils compared to chemically produced surfactants (Triton X-100 and sodium lauryl sulfate).

3. Testing Program

Biosurfactant production. Used oils obtained locally were adopted as substrates for acclimated *Flavobacterium sp.*, isolated from field samples, to produce biosurfactant under nonaseptic conditions. The broth was monitored for parameters such as surface tension, pH, ORP and the emulsification capacity during the biosurfactant production process. Recovering the biosurfactant using solvent mixture such as chloroform/methanol and NaOH are being investigated.

Characterization of Biosurfactant. The produced biosurfactant was characterized by measuring surface tension, CMC, CMD and toxicity. Effect of pH on surface activity of biosurfactant is also being investigated.

4. Results

Biosurfactant production. The biosurfactant produced under nonaseptic and aseptic fermentations had similar characteristics. The surface tension of broth was reduced to below 29 dynes/cm after 24 hours of operation. The surface activity of the biosurfactant was mainly due to a proteinaceous component, and partly due to a sugar.

Biosurfactant extraction. Solvent extraction of the cell-free supernatant was tried to extract the biosurfactant from solution. Among the many solvents, chloroform-methanol, in the ratio 1:1, yielded the best results.

5. Conclusions

(1) Biosurfactant produced from water insoluble substrates such as used oils reduced the surface tension of water to below 29 dynes/cm. The biosurfactant was produced during the growth phase.

(2) The produced biosurfactant increased the apparent solubility of naphthalene from 32 to over 500 mg/L.

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7. Reference

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