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Surface-active potential of biosurfactants produced in curd whey by *Pseudomonas aeruginosa* strain-PP2 and *Kocuria turfanesis* strain-J at extreme environmental conditions

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HIGHLIGHTS

- Novel strains *Pseudomonas aeruginosa* PP2 and *Kocuria turfanesis* J for biosurfactant production.
- Excellent surface active potential of biosurfactants.
- Curd whey as a raw material for biosurfactants.
- Emulsification of water insoluble substrates under extremes of environmental by biosurfactants.
- Biosurfactants can be useful in remediation of pesticides contaminated soils.

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ABSTRACT

Surface-active potential of biosurfactants produced cost-effectively in curd whey by *Pseudomonas aeruginosa* strain-PP2 and *Kocuria turfanesis* strain-J were tested using parameters viz. surface tension (ST) reduction, F_{CMC} (highest dilution factor to reach critical micelle concentration) and emulsification index (EI-24) of pesticides; monocrotophos and imidacloprid at extreme environmental conditions. Results have shown that ST reduction of biosurfactants was stable at pH 2–11. High F_{CMC} of the biosurfactant in the fermented whey at low pH improved emulsification of pesticides. ST marginally increased at 5% and 15% NaCl, resulting in high EI-24 and F_{CMC}. Over a range of temperatures 30–121 °C, ST remained low with a higher F_{CMC} and EI-24 at 60 °C than at 121 and 30 °C. The biosurfactants have shown differences in their surface-active property and have marked specificity to emulsify pesticides in extreme environmental conditions.

1. Introduction

Biosurfactants are defined as a class of surface-active molecules synthesized by microorganisms. In the past few decades, biosurfactants have gained attention because of their biodegradability, low toxicity, ecological acceptance and ability to be produced from renewable wastes as substrates and can be applied in bioremediation and wastewater treatment (Makkar et al., 2011; Cerqueira et al., 2011). Some potential applications of biosurfactants are crude oil recovery, hydrocarbon degradation in soils, and hexa-chloro cyclohexane degradation, heavy metal removal from contaminated soils and hydrocarbon biodegradation in aquatic environment (Khire, 2010; Juwarkar et al., 2007; Nitschke et al., 2011). They are active at extreme temperatures, pH and salinity as well, and can be produced from industrial wastes and from by-products (Pacwa-Płociniczak et al., 2011). This last feature makes cheap production of biosurfactants possible as it allows utilization of waste substrates so that application of biosurfactants in environmental remediation can be realized and environmental use is currently considered to be one of the larger markets for biosurfactants (Das and Mukherjee, 2007; Nitschke et al., 2011; Reis et al., 2011).

An alternative and eco-friendly method of remediating the contaminated environment is the use of biosurfactants and biosurfactant-producing microorganisms. Application of biosurfactants for

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