Evaluation of Hydrocarbon Emulsification and Heavy Metal Detoxification Potentials of Sophorolipid Biosurfactants Produced from Waste Substrates using Yeast and Mushroom.

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Abstract

Insolubility challenges have reduced the efficiency and rate of environmental bioremediation of hydrophobic pollutants occurring in hydrocarbons, soil and water environments. As biosurfactants, sophorolipids possess the unique capacity of activity at the interface of immiscible liquids or solid-liquid phases, thus reducing surface and interfacial tensions through emulsification, dispersion, foaming and wetting, with advantages of stability, ecological acceptability and ability to be produced from renewable and cheaper substrates. In light of the above, this study was aimed at assessing the hydrocarbons emulsification and heavy metals detoxification efficiencies of sophorolipid biosurfactants produced from harvested mushrooms and yeasts isolated from a hydrocarbon contaminated site in Obohia, Abia State, Nigeria. Isolates were cultured on an optimized media fortified with agro-industrial waste substrates of rice bran and food industry waste oil as hydrophilic and hydrophobic sources of carbon, respectively. However sophorolipids production from the yeast, Candida bombicola, was confirmed by the emulsification index after 24 h, surface tension (ST), FT-IR spectroscopy and GC-MS analyses. Solubilization of selected hydrocarbons (used engine oil, kerosene, unused engine oil, diesel and crude oil) was observed with percentage emulsification activities at 60.7, 56.7, 46.9, 44.8 and 40.0 %, respectively. Furthermore, various concentrations of chromium, lead, zinc, copper and cadmium salt solutions incubated with culture supernatants of sophorolipids for 24 h were observed to remove 43.41% chromium from a 10mg/l salt solution and 23.11(Cr), 9.93 (Pb), 7.29 (Zn), 4.96 (Cu) and 15.71 (Cd) from the highly toxic 70 mg/L salt solutions upon analysis via atomic absorption spectrometry. Our results indicate that sophorolipid biosurfactants could enhance the rate of bioremediation efficiency by emulsifying, solubilizing and detoxifying environmental contaminations of hydrocarbons and heavy metals respectively. Sophorolipids of agro-industrial waste origin possess good surface-active properties that can facilitate the solubilization, dispersion and desorption of hydrophobic environmental contaminants for microbial uptake and bioremediation.

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