Evaluation of heavy metal tolerance level of the Antarctic bacterial community in biodegradation of waste canola oil

ABSTRACT

Heavy metal contamination is accidentally becoming prevalent in Antarctica, one of the world's most pristine regions. Anthropogenic as well as natural causes can result in heavy metal contamination. Each heavy metal has a different toxic effect on various microorganisms and species, which can interfere with other pollutant bioremediation processes. This study focused on the effect of co-contaminant heavy metals on waste canola oil (WCO) biodegradation by the BS14 bacterial community collected from Antarctic soil. The toxicity of different heavy metals in 1 ppm of concentration to the WCO-degrading bacteria was evaluated and further analyzed using half maximal inhibition concentration (IC50) and effective concentration (EC50) tests. The results obtained indicated that Ag and Hg significantly impeded bacterial growth and degradation of WCO, while interestingly, Cr, As, and Pb had the opposite effect. Meanwhile, Cd, Al, Zn, Ni, Co, and Cu only slightly inhibited the bacterial community in WCO biodegradation. The IC50 values of Ag and Hg for WCO degradation were found to be 0.47 and 0.54 ppm, respectively. Meanwhile, Cr, As, and Pb were well-tolerated and induced bacterial growth and WCO degradation, resulting in the EC50 values of 3.00, 23.80, and 28.98 ppm, respectively. The ability of the BS14 community to tolerate heavy metals while biodegrading WCO in low-temperature conditions was successfully confirmed, which is a crucial aspect in biodegrading oil due to the co-contamination of oil and heavy metals that can occur simultaneously, and at the same time it can be applied in heavy metal-contaminated areas.

Keyword: Heavy metals; Biodegradation; Canola oil; Antarctic; Bacteria; Dose response