

ABSTRACT

Biosurfactants are environmentally friendly natural surfactants produced by microorganisms, including endophytic bacteria. The endophytic bacterium Bacillus sp. GSP-D3, isolated from a fern plant at Gedong Songo, was previously known to produce biosurfactant using palm oil within 7 days, but this was considered insufficiently efficient for industrial scale application. This study aimed to analyze the effect of varying hydrophilic carbon sources (glucose, glycerol, and molasses), combinations of hydrophilic and hydrophobic sources, and hydrophobic carbon sources (palm oil, coconut oil, VCO, and olive oil) on biosurfactant production by Bacillus sp. GSP-D3, as well as to characterize the resulting biosurfactant and test its bioactivity. Screening results showed that coconut oil was the best carbon source, yielding the highest clear zone diameter (6.87 cm) with faster optimum production achieved on day 5.5, and the resulting pure extract was coded Bs-D3-CO. The biosurfactant extract (Bs-D3-CO) showed an emulsification index of 98%, close to that of SDS, was anionic in nature, and was classified as a glycolipid based on FTIR and GC-MS analysis. This biosurfactant exhibited strong antioxidant activity against ABTS radicals ($IC_{50} = 85.40$) as well as antibacterial activity that was more effective against Gram-positive bacteria, with the highest inhibition observed against Propionibacterium acnes (90.86%), indicating its potential as a natural active ingredient for cosmetic and food applications.

Keywords: Biosurfactant, Endophytic Bacteria, Bacillus sp. GSP-D3, Carbon Source, Bioactivity