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Fatty acids and benzene derivatives partitioned from marine-derived bacillus safensis: Novel agents against methicillin-resistant staphylococcus aureus

Abstract

The global rise in antimicrobial resistance poses significant challenges to treating infectious diseases, particularly those caused by methicillin-resistant Staphylococcus aureus (MRSA) in healthcare settings. This research explores the potential of halophilic microorganisms as a source of novel antimicrobial compounds, focusing on Bacillus safensis isolated from saltpan soils in the Tuticorin coastal region, India. Among 158 isolates, B. safensis strain TC67 demonstrated potent anti-MRSA activity and was optimized under specific growth conditions for maximal metabolite production. The active compound was purified through silica gel column chromatography and analyzed using TLC, GC–MS, and ^{1}H NMR spectroscopy. These analyses identified benzene derivatives and saturated fatty acids as key components, including eicosanoic and decanoic acids. The purified metabolites exhibited a minimum inhibitory concentration (MIC) of 31.25 µg/mL against MRSA. Mechanistic studies using flow cytometry and scanning electron microscopy (SEM) confirmed that the compound disrupts MRSA cell membranes, leading to decreased cell viability. This study highlights the potential of marine-derived Bacillus species as a source for antimicrobial agents, providing viable choices to combat MRSA infections.

Keywords

Bacillus safensis; benzene derivatives; fatty acids; flow cytometry; marine soils