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RESEARCH

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Molecular detection of bacteria isolated from polluted environment and screening their ability to produce extracellular biopolymer flocculants

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Abstract

Background Microorganism bioflocculants are the large molecules released by microbes during growth and lysis. Bioflocculants are used in remediation wastewater and are thought to be more environmentally friendly. In the present study, 16 bacteria were isolated from hydrocarbons contaminated soil, sludge, and wastewater from different locations (Washing and lubrication stations of Zubair, Qurna, and Jazira, Beach of Shatt Al -Arab, and Al-Shuaiba Refinery) in Basrah city, south of Iraq. The isolates were identified by *16S rDNA* gene sequencing analysis. All isolated bacteria were subjected to a flocculants production test using a mineral salt medium. Bioflocculant activity was determined using kaolin clay and enhanced by addition cation ($CaCl_2$).

Result The results showed that bacterial isolates were under 10 genera (*Alishewanella, Stutzerimonas, Pseudomonas, Bacillus, Pantoe, Acinetobacter, Escherichia, Exiguobacterium, Franconibacter, Lysinibacillus*), and nine isolates were recorded as new strains. Besides, the Phylogenetic tree was constructed to evaluate their close relationship and evolution between them. *Alishewanella* sp. was the most diverse and dominant genus among sixteen isolated bacteria. The isolates *Shewanella chilikensis, Exiguobacterium profundum,* and *Alishewanella jeotgali* were the most effective producing bioflocculant, where the flocculation activity recorded at 92.40%, 92.25%, and 91.65%, respectively. The ion Ca^{2+} removes most large molecules and reduces solution absorption from 1.918 (kaolin clay) to 1.258.

Conclusion The contaminated environments harbor a diverse bioflocculant producing bacteria. The capacity of bacterial genera to produce bioflocculants varies, requiring the selection of optimal bacteria for bioflocculant production and their application in water treatment as effective alternatives to synthetic flocculants. The considerable flocculation activity seen suggests a potential for industrial applications. Moreover, more research on the process parameters is required to determine the possibility of large-scale production and to identify a compound responsible for flocculation activity.

Keywords Bacteria isolation, Bioflocculants, Ca^{2+} ion, Flocculation activity, Turbidity removal

1 Background

Freshwater resources are widely regarded as the most significant reservoirs worldwide. All living organisms need access to clean drinking water to survive [34]. Long-term droughts, growing industries, and population growth reduce the amount of water. The accelerating growth of population, rapid urbanization, agricultural activity, and industrialization have raised the need for clean

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