Isolation and identification of Klebsiella pneumoniae P6 strain from palm oil mill effluent as a potential producer of medium and long chain length polyhydroxyalkanoates

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Abstract

Polyhydroxyalkanoates (PHA) are biodegradable polyesters gaining attention as sustainable alternatives to plastic. However, medium and long-chain PHA-producing bacteria from industrial waste sources remain largely underexplored. Discovering new PHA-producing bacterial strains remains important to improve yield, reduce production costs, and develop diverse, sustainable bioplastics for various applications. This study investigates the isolation and screening of bacterial strains from palm oil mill effluent (POME) for polyhydroxyalkanoates (PHA) production, using oleic acid (C18:1) as a defined carbon substrate. Fourteen bacterial colonies were successfully isolated and screened for intracellular PHA accumulation via Nile Red fluorescence staining, using mineral salts medium (MSM) supplemented with C/N ratio of 20:1. Five isolates (P5, P6, P12, P13, and P14) exhibited significant fluorescence intensity, with isolate P6 showing the highest (16,698.4 A.U.), indicating strong PHA biosynthesis. Gas chromatography–mass spectrometry (GC-MS) analysis revealed the presence of both saturated and unsaturated PHA monomers, confirming the conversion of oleic acid into medium-and long-chain-length PHA. FTIR analysis further validated the polymer structure through characteristic absorption bands of PHA functional groups. Molecular identification via 16S rRNA gene sequencing revealed that isolate P6 shares 94.06% homology with Klebsiella pneumoniae. The ability of K. pneumoniae P6 to produce a diverse range of PHA monomers highlights its potential as an industrially relevant biopolymer for sustainable bioplastic production.

Author keywords

identification; Klebsiella pneumoniae; polyhydroxyalkanoates; POME; wastewater

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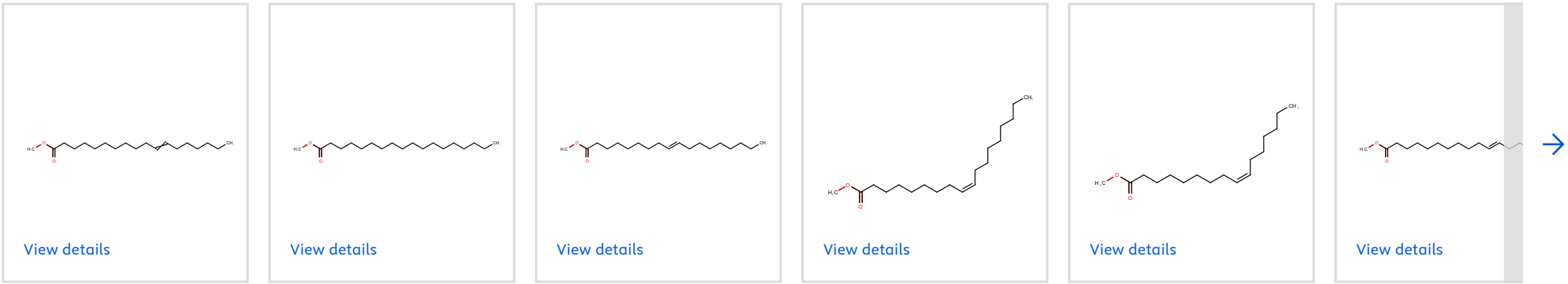

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