A green alternative for oily wastewater treatment: lipase from *Acinetobacter haemolyticus* NS02-30

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**ABSTRACT**

Biological treatment of wastewater is negatively affected by high concentrations of oil and grease, which decrease the oxygen transfer rate in the aerobic process by forming a layer on the water surface, making removal of oil and grease from manufacturing wastewater essential. However, the most common currently used techniques are inadequate as well as costly, and chemical methods create environmental pollution. By contrast, fermentation can be used to produce extracellular microbial lipases relatively cheaply and in large quantities for industrial use. Biological methods that use lipase enzymes also represent an appropriate, “green” choice for removing oil and grease from wastewater. This study identified and characterized a novel lipase produced from bacteria isolated by screening soil and olive pomace samples for lipolytic activity. The bacteria was subsequently identified as *Acinetobacter haemolyticus*, and the lipase produced from this bacteria (LipAH02–30) was then purified and characterized. Findings are presented as means ± SD. Enzyme $K_m$ and $V_{max}$ were 0.8 mM and 3.833 mmol/ml/min, respectively. Optimal temperature and pH for enzyme activity were identified as 40°C and 9.0, with good stability exhibited at temperatures ranging between 10 and 30°C and a pH range of 5.0–11.0. The effects of organic solvents, metal ions, surfactants, commercial detergents, enzyme inhibitors, oxidizing agents, protease and boric acid on LipAH02–30 activity were also examined. The enzyme was found to be highly stable at +4°C, displaying 90% activity even after 60 d, and to be effective in hydrolyzing oils found in kitchen wastewater. The high stability demonstrated by LipAH02–30 over a wide range of temperatures and pHs, along with its ability to maintain its activity in the presence of various surfactants, oxidizing agents, proteases and commercial detergents, indicates it to be an effective solution for the treatment of lipid-rich wastewater.

**Keywords:** *Acinetobacter haemolyticus*; Lipase; Characterization; Stability; Wastewater treatment