Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 30(3): 271 – 289 (2026)
www.ejabf.journals.ekb.eg



Biodegradation of Polypropylene and Low-Density Polyethylene Microplastics by *Ectopseudomonas alcaliphilas* Strain B1 Isolated from Aquatic Environments in Basrah, Iraq

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ARTICLE INFO

Article History:
Received: March 1, 2026
Accepted: April 21, 2026
Online: May 7, 2026

Keywords:
Microplastics,
Polyethylene,
Polypropylene,
Ectopseudomonas alcaliphilas,
FTIR

ABSTRACT

Microplastic pollution is an urgent issue that requires immediate attention. Microplastics are very tiny plastic particles that range in size from about one micrometer to five millimetres and can have a wide variety of types, shapes, and forms, including primary and secondary. In recent years, their presence has garnered increasing global attention. In this study, *Ectopseudomonas alcaliphila* strain B1 was used, a newly identified strain isolated from water, which plays a prominent role in the biodegradation of polypropylene and low-density polyethylene microplastics under laboratory conditions. Microplastic particles were prepared, treated with bacteria, and the biodegradation process was monitored through physical, chemical, and biological changes. The results revealed that the weight loss of polypropylene (PP) microplastics was 17.8%, while that of low-density polyethylene (LDPE) microplastics was 13.2%, after a 45-day incubation period. Additionally, a decrease in pH and an increase in the electrical conductivity of the medium were observed, indicating the formation of secondary degradation products, along with a significant increase in bacterial biomass, suggesting their ability to utilize microplastics as a source of carbon and energy. FTIR analysis revealed the emergence of new functional groups, such as carbonyl, ketone, hydroxyl, and alkene, indicating oxidation and breakdown within the polymer chains. The GC-MS results confirmed the formation of organic compounds from the decomposition of these polymers. Scanning electron microscopy (SEM) images revealed cracks and erosion on the surface of the microplastics. EDX analysis further highlighted an increase in oxygen levels and a decrease in carbon content following the bacterial treatment. Thus, biodegradation is an effective, environmentally safe, and economically viable method for treating and removing toxic and hazardous pollutants, including microplastics, from the environment.

INTRODUCTION

Plastic materials are extensively used in our daily lives since they play an important role in the packaging industry due to their exceptional mechanical strength, durability, and lightweight. This sector includes food, cosmetics, pharmaceuticals, and other

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