

Acceleration of Plastic Waste Biodegradation by The Enzymatic Activity of Microorganisms

Agnessia Eda Vincent Baginda^a, Wan Nor Raihan Wan Jaafar

Structured Abstract

Background: The prolonged manufacturing of plastic and its poor degradation have caused significant global concern over the years. Plastic is a manmade, synthetic polymers derived from fossil fuel sources which have been extensively commercialized due to its convenient features of high durability, readily producible and inexpensive production cost. The accumulation of plastics in various environments, typically in the landfills and water bodies has become a major environmental issue. There have been countless occurrences with plastic as the primary anthropogenic pollution in the oceans, endangering marine wildlife and disrupting ecological balance. To resolve this issue, the method of biodegradation could facilitate the reduction of plastic pollutant in the environment. Biodegradation utilized microorganisms and their enzymes to degrade plastic into its smaller derivatives by an intricate arrangement of biological and enzymatic processes. Biodegradation research has been done extensively in recent years, focusing on the identification of plastic-degrading microbial species and effective enzymes.

Methods: Therefore, this paper provides the evaluation of the optimal requirements that would facilitate and enhance the secretion of plastic-degrading enzymes by microorganisms, crucial for the biodegradation of plastic waste. A comparison of the rate of degradation between traditional plastics and biodegradable plastics is also included to signify the biodegradative differences of the polymeric materials. Furthermore, this study investigated the synergistic collaborative potential of microorganisms in maximizing plastic waste biodegradation outcomes.

Results: Hence, the highest efficiency of most microbial degraders can be obtained in an aerobic soil setting with a neutral pH and temperatures ranging from 20 to 40 °C. The biodegradation rate of biodegradable plastics was remarkably higher than the biodegradation rate of conventional plastics. Though not explored in any research relating to plastic biodegradation yet, fungi-bacteria synergism may significantly accelerate plastic biodegradation.

Conclusion: Conclusively, the acceleration of plastic waste biodegradation can be achieved through the determination of the optimal conditions needed for biodegradation and the application of fungi-bacteria synergism in the biodegradation of plastic waste.

Keywords: plastics, biodegradation, plastic degradation, microbial enzymes, synergism

*Correspondence: raihanjaafar@uitm.edu.my

^a School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia