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Title: Microbial-mediated enzymatic degradation of polyethylene: A sustainable approach to address plastic pollution

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Statement of the Problem: Plastic has been an integral part of daily life, with the most desirable characteristics such as flexibility, durability, and resistant properties. These properties make plastic popular starting material for packaging, automotive, construction, electronics applications, and personal protective equipment. Plastic naturally breaks down to form micro- and nano-plastics, easily transported to marine and terrestrial sites, posing a threat to human health. In this context, the biodegradation of plastic has attracted worldwide attention because the process primarily involves hydrolytic enzymes secreted by microbes to convert plastic waste into smaller molecules. However, the reports on the enzymes and their mechanism of action are still in their infancy.

Methodology & Theoretical Orientation: A study was carried out to explore diverse bacterial isolates from less to highly polluted environments to determine their ability to degrade **low-density polyethylene** (LDPE). The LDPE degradation was determined by observing changes in the surface morphology, colonization, biofilm formation, weight loss of the LDPE film, and enzymatic analysis. The findings highlighted the diversity of LDPE-degrading bacterial strains and the catalytic activities of enzymes involved in LDPE degradation. **Findings:** Based on 16S rRNA sequencing, five bacterial isolates were identified to release plastic-degrading enzymes esterase, lipase, laccase, and manganese peroxidase to degrade LDPE. The Fourier-transform infrared spectroscopy showed structural damage on the surface of LDPE, and Field emission scanning electron microscopy revealed the colonization of bacterial isolates on the surface. Weight loss after four weeks of the experiment confirmed the degradation of LDPE.

Conclusion & Significance: The study showed the potential of five bacterial isolates belonging to a diverse genus in the secretion of plastic-degrading enzymes. The study is significant as exploring enzymatic pathways to biodegradation can serve as a greener and more ecological solution to address plastic pollution and a step toward the sustainable development of the circular economy of plastics.

Biography

Pooja Singh is a plant biologist whose research interests focus on plant-microbe interactions. Her work on microbes to use in agricultural applications has gained much attention. She worked with the institution and industry partners to focus on microbial bioinoculants as a sustainable solution to plant stress. Her current work on microplastic degradation and its effect on agricultural productivity secured national and International awards, including Advancing Women's Success Grant 2022 from Australia. She has published and presented her work on various national and international platforms.