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ABSTRACT

The use of plastics for several decades has caused its accumulation in the environment. In a city such as Bengaluru, India persistence of plastic materials in soil is polluting the city drastically. Hence, the current study aims to devise an eco-friendly, cost effective approach for degradation of plastics by using plastic degrading microbial consortia screened from polluted soil samples. This study also aims for the evaluation of biodegradation of end products and molecular characterization of best plastic degrading isolates. The highly contaminated soil samples were collected from various regions of Bengaluru city. The plastic degrading bacteria were isolated and enriched by standard microbiological methods. The degradation capacity of the isolated bacteria was determined by zone of clearance method. The percentage of degradation was monitored by weight loss method. The isolates were characterized by standard microbiology methods. To enhance the rate of degradation, the growth conditions such as temperature and pH for the isolated bacteria were optimized. The best isolates were used to form a microbial consortia and the degradation efficiency of the consortia was compared with known strains obtained from MTCC and Gene Bank, India. Structural changes of the degradation end products were analysed using FTIR studies. Confirmatory analysis of plastic degradation was analysed by GC-FID studies. Elongation studies and surface analysis of degraded plastic strips was scrutinised using tensile strength studies and SEM analysis. Molecular characterization of best isolates was carried out. The study of probable mechanism of plastic degradation was studied using computational approach. This study, showed a clear zone around the bacterial colonies inoculated in suitable conditions at 37 °C for a period of 10 days. The current study identified, 15-30% degradation in pellets and 50-70% degradation in strips at optimised conditions of 37 ºC and pH 9.0 for a span of 120 days. The isolated samples were characterized to be *Enterobacter spp*. This study also revealed that, our isolates were capable of having rapid and higher degradation potential than known strains obtained from MTCC and GenBank, India. FTIR studies showed that, the presence of absorption bands between 3,100 and 4,000 cm^{-1} of the spectra were probably due to amine and alcohol groups, caused by biodegradation. Tensile strength analysis demonstrated a reduction in percentage elongation. SEM analysis showed, the presence of pits, cavities, cracks and attachment of bacterial film to the surface of the plastic strip suggesting that the microorganisms have a good interaction with the plastic. Molecular characterization of best isolate showed 98-99 % of

identity with *Enterobacter spp*. Computational studies showed best interaction of cutinase and esterase with polystyrene A-COOH. Thus it can be concluded from the study that, use of microbial consortia for the degradation of plastic is much more efficient than using individual isolates.

Keywords: Microbial consortia, plastic degrading isolates, zone of clearance method, weight loss method, MTCC, FTIR studies, GC-FID studies, SEM analysis and *Enterobacter spp*.