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Biodegradation of plastic compounds by fungi isolated from plastic waste

Elham Taghinia
Islamic Azad University, Iran

Introduction: Plastic is one of the most widely used synthetic materials and man-made, and the raw material for their production is an oil-based material called resin, While most of them are not biodegradable, increasing their accumulation in the environment is very dangerous. Biodegradation of plastics by microorganisms is very important.

Objective: Separation of decomposing isolates of plastic compounds

Materials and Methods: In this experiment, 30 plastic samples in different types of environment around Tehran were collected. Separation and purification of plastic degrading fungi in specific culture media Potato Dextrose Agar (PDA) And Sabouraud dextrose agar (SDA) was performed .Identification of microbes was performed based on morphological and microscopic characteristics and biochemical tests. The isolates that had the highest growth rate in the minimum environment and M9 saline base based on the growth curve were selected and sequenced and identified using PCR technique. Production of urease, manganese peroxidase, lipase, laccase, protease enzymes qualitatively and the production of enzymes manganese peroxidase, laccase (for all isolates) by mnp, lccC primers, respectively were investigated. Then, the decomposition of various plastic compounds was investigated by SEM and FTIR techniques.

Results: The identified isolates of plastic decomposers were:Aspergillus niger, Aspergillus flavus,Penicillium commune,Bipolaris sorokiniana ,Curvularia eragrostidis Enzymatic degradation ability of isolates showed that genes producing manganese peroxidase and laccase and urease, protease and lipase are active for some isolates. Production of manganese peroxidase, laccase, urease, protease and lipase enzymes by the strains was demonstrated qualitatively in the laboratory. Aspergillus niger,Aspergillus flavus,Curvularia eragrostidis, protease (+), Aspergillus niger ,Aspergillus fungus,Penicillium commune,Curvularia eragrostidis,Bipolaris sorokiniana, manganese peroxidase (+), Aspergillus niger, Aspergilluss flavus,Penicillium commune,Curvularia eragrostidis lipase (+), Aspergillus niger, laccase (+) , Aspergillus niger, Bipolaris sorokiniana urease (+) and the other strains urease negative (-) . The genes producing manganese peroxidase, laccase (for all isolates) were examined by , lccC and mnp primers, respectively. The results showed that the fungus Aspergillus niger laccase positive (+) and its genomic region in 2609 bp and Aspergillus flavus manganese peroxidase (+) and its genomic region in 650 bp is an observation. Surface degradation and porosity and fragility on the surface of polyethylene (morphological changes) by SEM technique (electron microscopy)Changes in the chemical structure of the polyethylene composition were determined based on the analysis of FTIR(infrared spectroscopy) curves. After 45 days, Aspergillus niger, Curvularia eragrostidis, Penicillium commune, Bipolaris sorokiniana had the most weight loss in polyethylene and Aspergilluss flavus had the most weight loss in Nylon (polyamide).

Discussion: Decomposition of plastics by microbes solves the problem of waste accumulation but also leads to the production of useful compounds It becomes a food supplement for livestock and poultry.

Keywords: Polyethylene biodegradation, Aspergillus niger, Enzymatic activity, Electron microscope,Fourier Transform Iinfrared Spectroscopy

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