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Aspergillus Flavous Link. as a High Potential Fungal Member for High Density Polyethylene Degradation

KEYWORDS: Rabi sorghum, root characters, water stress, Physiological characters.

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ABSTRACT *The present study deals with the isolation of fungi from soil with great potential ability of polymer degradation. PVC, LDPE, HDPE, waxes and polyethylene wax were used in this study. The fungal members with the ability to degrade these polymers were isolated in synthetic medium. Several methods were employed to monitor the biodegradation of the polyethylene. The comparative study of ten fungal forms isolated from soil for polymer degradation. A.flavous reveals high plastic degradation ability during experimental period (for short and long duration) on HDPE.*

Introduction-
polyethylene-terephthalate, polyethylene, polypropylene, polystyrene, polytetraflouro- ethylene, polyurethane, polyvinyl chloride are being continuously used in our day-today life (Smith, 1964). Among the synthetic plastics waste produced, polythene shares about 64% (Lee & Pometto, 1991). As per the reports the most commonly used non-degradable solid waste is polythene which is a linear hydrocarbon polymers consisting of long chains of the ethylene monomers (C_{2H4}). The general formula of polyethylene is CnH2n,

Material and Methods
Intialy HDPE use for experiment in form of grannules and sheets.The term polyethylene describes a huge family of resins obtained by polymerizing ethylene gas, $H_2C=CH_2$ and it is by far the largest volume commercial polymer. Polyethylene can be formed by a wide variety of thermoplastic processing methods. HDPE is defined by a density of greater or equal to 0.941 g/cm^3. HDPE has a low degree of branching and thus low intermolecular forces and tensile strength.

Numerous fungal forms with plastic degrading ability were isolated from soil. In laboratory experiment 10 species were use for further experiment by considering its growth on synthetics medium

To check plastic degradation ability of fungi various analytical, gravimetric and biological methods were employed. TGA, DTA, FTIR Spectra and same image were carried out by IIT pawai, Mumbai.Fungal identification was by manual of fungi- Gilman and conform by ARI Pune. Modified Sturm test was employed in laboratory for CO_2 evolution in terms of grams per liter during the experiment. CO_2 production in flask was measured indirectly in terms of decrease in normality of KOH.

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Observations and result –
During sturm test The decrease in normality of KOH is directly proportional to the absorption of CO_2 by KOH.

FTIR Analysis
In HDP-B and HDP-O changes in intensity of peak observed between 2915cm^{-1} whereas changes in appearance as well as position observed in region between 1700 cm^{-1} to 550cm^{-1} some peaks are observed in this region of HDP-O are absent in spectra of HDP-B which indicates change in composition.

Comparative analysis of SEM image of treated and original HDPE granuales and sheet reviles numerous changes in treated sample such as pit,cracks and erosion of surface. Thermal analysis gives the exact idea of changes in treated sample the difference in weight loss of sample of different temperature interval suggest changes in treated sample

DISSCUSSION
In this study we have isolated fungal strains from soil capable of adhering to the surface of plastic and utilizing it as a source of carbon and energy. Shafei, et. al.,(1998) investigated the ability of fungi to attack on degradable polyethylene and isolated two fungi viz. Mucor rouxii Calmette and Aspergillus flavus Link from sewage sludge. Aspergillus flavus Link also found to be able to degrade PE (Mendez et al., 2007). Yamada-Onodera et. al., (2001) has identified a fungus, Penicillium simplicissimum (Oudemans) Thom, which could degrade the untreated high-density polyethylene. When polyethylene plastic pieces were examined microscopically after enrichment experiment in basal medium, fungal attachment was found on the surface of the plastic, indicating possible utilization of plastic as a source of nutrient. The microscopic examination revealed the growth of fungal mycelium over the surface of HDPE.

tn thermal analysis and IR spectra of treated sample observed conspicoues changes which reflects change in polymer structure or may brekage in polymer to monomer.

Sr. No.	Name of fungus	gm of CO_2/litre		
		2 weeks	4 weeks	12 weeks
01	Mucor hiemalis Wehmer	0	0.0088	0.022
02	Aspergillus versicolor gr.	0.0088	0.0176	0.0352
03	Aspergillus niger gr.	0.0176	0.0264	0.0528

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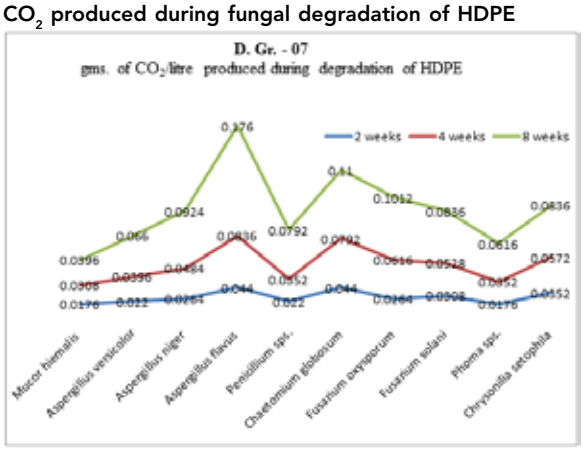
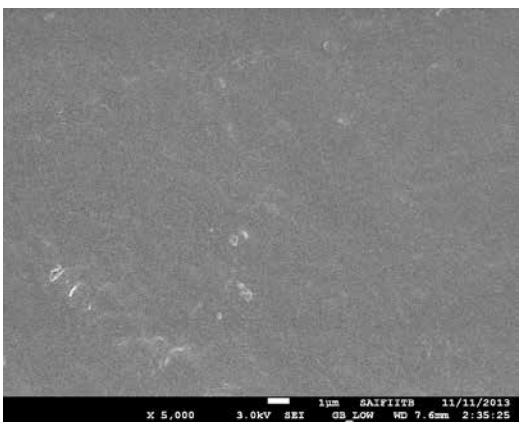
Sr. No.	Name of fungus	gm of CO_2/litre		
		2 weeks	4 weeks	12 weeks
04	Aspergillus flavus Link.	0.0352	0.0484	0.1232
05	Penicillium sps.	0.0176	0.0396	0.0616
06	Chaetomium globosum Kunze and Schmidt	0.0264	0.0528	0.0748
07	Fusarium oxysporum (Martius) Appel and wollenweber	0.022	0.0352	0.066
08	Fusarium solani (Martius) Saccardo	0.0264	0.044	0.0572
09	Phoma sps.	0.0132	0.0264	0.044
10	Chrysonilia setophila (Mont) Arx.	0.022	0.0352	0.044

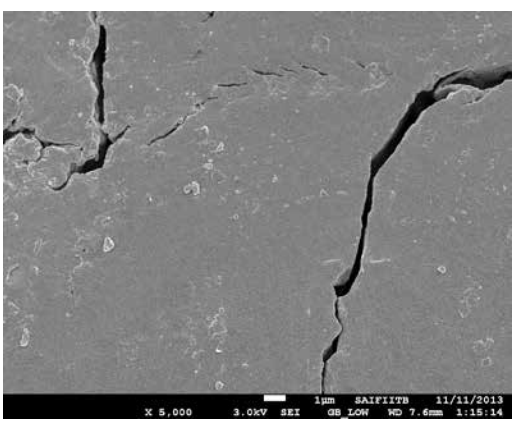
Table no. D07
CO_2 produced during fungal degradation of HDPE



OR-IMG-02
SEM images of HDPE sheet before and after treatment
Original Fig-01



Treated Fig-02



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