Microorganisms are involved in the degradation of polymers under aerobic condition. Polymeric materials are diverse in their biodegradability and the methods for testing such property need to address the degradation rate and material characteristics. Traditional gravimetric and respirometry methods are suitable for general degradable polymers that can be degraded at an appreciable rate.

Four fungi and one bacterium have been tested for their ability to degrade recalcitrant synthetic polymers nylon 6 and nylon 6, 6. One of the species of fungi was isolated from soil sample which was contaminated with the plastic. From soil sample final enrichment culture was prepared which consist of the polymer degrading microflora. One of the fungus isolated which is having ability to degrade nylon plastic. The fungal strength was identified from NCIM, Pune as one of the species from Cladosporium fungus. Microbial (Trametes versicolor NCIM 1086, Phanerochaete chrysosporium NCIM 1073, Phanerochaete chrysosporium NCIM 1106, Pseudomonas aeruginosa NCIM 2242, Cladosporium sp.) mediated biodegradation of nylon 6 and 6, 6 polymer under submerged condition was studied. Degradation of the polymer was confirmed since there was weight loss, decrease in thickness of polymer sheet, formation of new functional groups and physical damage to the fibers visible under inverted microscope.

In case of both the nylon materials tried highest degradation was observed with Trametes versicolor NCIM 1086 and also degradation was higher with nylon 6, 6 than with nylon 6. Both oxidation and hydrolysis were found to operate leading to the formation of corresponding groups. Trametes versicolor NCIM 1086 was found to be more effective than other fungi and the soil organisms. So the data indicates the potential for degrading recalcitrant polymer such as nylon. Two species of lignolytic fungi, Phanerochaete chrysosporium NCIM 1073, Phanerochaete chrysosporium NCIM 1106 were shown the biodegradation results for nylon 6 and nylon 6, 6. The isolated fungus Cladosporium sp. shows less ability of biodegradation than Trametes versicolor NCIM.
1086 and *Phanerochaete chrysosporium* NCIM 1073, *Phanerochaete chrysosporium* NCIM 1106, *Pseudomonas aeruginosa* NCIM 2242. One of the tested bacterial strength *Pseudomonas aeruginosa* NCIM 2242 shows slow biodegradation as compared to other fungal strains. This may be due to the reason that the fungus produces large quantity of enzymes as compared to bacteria.

In submerged condition biodegradation study shows good results as compared to composting condition. This may be due to the number of microbes which are able to degrade polymer in minor quantity in soil sample. The composting condition shows less percentage weight loss and less percentage thickness reduction. Also from FTIR study it is showed that there is decrease in the strength of amide bonds. But it was not clearly understood the biodegradation product at the composting condition. From morphological changes such as change of color of the sheet and the rough surface formation of the sheet confirms the degradation.

Polyamide plastics are considered to be susceptible for degradation. From the present study it has been concluded that, nylon 6, 6 is more favored than nylon 6, which may be possibly be due to hydrolysis and oxidation. Nylon 6, 6 is formed by the condensation of hexamethylene diamine and adipic acid while nylon 6 is formed by the ring opening of caprolactum. So the repeat units of the former polymer has twice the number of C=N bond when compared to the repeat units of the later polymer. Since C-N bonds are easily cleaved than the C-C bonds more degradation is observed with the former. Cleavage of the bond would lead to the formation of CONH$_2$, CHO and COOH.

Nylon 6, 6 is more hydrophilic than nylon 6 as it is having nitrogen in the repeats units which make favorable condition for the interaction between polymer and organism. It was demonstrated that nylon 6, 6 gets degraded faster and FTIR spectra for both the polymers indicate formation of new groups such as NHCO, CH$_3$, CONH$_2$, CHO and COOH. Their groups may be formed due to the processes of hydrolysis and oxidation. These two processes are also responsible to reduce weight of the polymer. The result open up new prospect for the use of fungi and bacteria for biodegradation of nylon
6 and nylon 6,6 and possibly other environmental pollutant in the form of recalcitrant synthetic polymer.

Therefore, the study emphasized several parameters that can represent the biodegradation of polyamide. These results are advantageous for use in monitoring environmental problems. Following are some of the conclusions of the study.

1. Polyamide based thermosetting kind of plastics are considered to be susceptible for degradation. As it contains heteroatom linking (N-C, O-C) in the bases backbone that provides degradability to plastics.

2. In both the nylons samples highest degradation was observed with fungus Trametes versicolor NCIM 1086.

3. A well known lignolytic fungus, Phanerochaete chrysosporium is found to be effective for biodegrading the nylon 6 and nylon 6, 6.

4. FTIR spectra for both the polymers indicate formation of new groups such as NHCO, CH₃, CONH₂, CHO and COOH after the 6 month exposure to the selected microorganisms.

5. The reason behind the formation of new groups may be hydrolysis and oxidation process.

6. The formation of NHCHO and CH₃ may be caused due to the cleavage of C-C bond in CH₂-CH₂ adjacent nitrogen atom and the formation of CCNH₂, CHO and COOH may cause due to the cleavage of C-N bond in NH-CH₂.

7. In the present study for the biodegradation, the fungi culture showed best results as compared to bacterial culture of Pseudomonas aeruginosa NCIM 2242.

8. One of the fungus from the isolate shows results for the biodegradation and that species was identified as one of the species of Cladosporium.

9. Nylon 6, 6 shows more degradation than nylon 6. This could possibly be due to two reasons. Nylon 6, 6 is having the repeat units of the former polymer, twice the number of C = N bond than nylon 6.
10. In comparison to biodegradation with submerged condition, it is concluded that composting process show less biodegradation of nylon 6 and nylon 6, 6.

11. The study of thermal stability of the nylon 6 and nylon 6, 6 samples conclude that the control sample was degraded between 413 °C and 487 °C. Sample treated with fungus, *Trametes versicolor* NCIM 1086 which show degradation between 407 °C to 469 °C. It indicates that thermal stability get decreased which confirms biodegradation of the nylon.

12. Morphological study concludes that the nylon 6 and nylon 6, 6 sheet starts to degrade from the edge of the sheet as it was observed to become totally blackish color and with rough margin but with smooth surface.