ABSTRACT

This study examines the consumption of pyrolyzed polyethylene terephthalate, polypropylene and polystyrene as a potential carbon source utilized by bacteria to synthesize polyhydroxyalkanoates (PHAs); a worth added material, able to substitute some synthetic plastics while being completely biodegradable, non-toxic and renewable. The polystyrene waste was pyrolyzed at 400°C and 450°C to produce maximum yield of pyrolysis oil. This pyrolysis oil (PS) was used as a carbon source for different bacterial isolates as the best PHA producers in MSM broth. Out of total bacterial isolates, only 8 isolates were able to grow on MSM agar with sodium benzoate used as a carbon source. Of these, 4 isolates were competent to grow on PS pyrolysis oil and also produced PHAs. The morphology of PS oil degrading bacterial isolates was observed by gram staining. The qualitatively screening of PHAs were confirmed in bacterial isolate KK1, KK2, KK3 and KK4 by using two dyes i.e. Sudan Black B and Nile Blue-A. After quantitative screening, maximum PHA synthesis on the basis of cell dry weight was observed in isolate KK4. After optimization, maximum PHA accumulation (67.24% w/w) on the basis of cell dry weight was produced under pH 7 with NH_4Cl (0.25g/L) and PS oil (1.5%) at 30°C after 96h of incubation. Maximum accumulation of PHA was produced using 5% sodium hypochlorite + chloroform method. The produced biopolymer was characterized by different techniques. The bands observed at 1453 and 1375 cm^{-1} analyzed that the existing polymer was PHA. The surface topography of the extracted polymer was observed under scanning electron microscopy. The UTM analysis showed that the elongation to breakage ratio of PHA film was 2.63%, young modulus (0.97 GPa) and tensile strength (25.6 MPa). Thermogravimetric analysis showed that the total weight loss of PHA was measured 39.60% between 26.50°C and 494.03°C and maximum decomposition of PHA polymer was observed at 270°C.