Abstract

For production, optimization and characterization of polyhydroxyalkanoates (PHA), microalgae are cultivated and screened in the current study. There were three distinct unicellular eukaryotic microalgae species available: *Chlorella emersonii*, *Bracteacoccus cohaerens*, and *Asterarcys* sp. Nile blue A and Sudan black B staining methods were utilized to qualitatively screen these microalgal species for PHA production after they were grown in BG-11 and Zarrouk medium. Following quantitative screening of these species, the extraction of biopolymer was done by using methanol, sodium hypochlorite, and chloroform extraction techniques. To achieve the best results, a variety of physico-chemical parameters were optimized to improve PHA production. After optimization, *Bracteacoccus cohaerens* demonstrated the highest PHA production of 25.46% (w/w) on CDW basis, with *Asterarcys* sp. exhibiting the highest PHA output of 27.25% (w/w) on CDW basis whereas the highest PHA production in *Chlorella emersonii* obtained was 26.58%. FTIR spectroscopy adsorption peaks confirmed that the recovered biopolymer was PHA. Thermogravimetric analysis indicated that the PHA produced by *Asterarcys* sp., *Bracteacoccus cohaerens*, and *Chlorella emersonii* remained stable below 300°C. SEM analysis provided insights into the surface morphology and porosity of the extracted PHA. These findings suggest that these microalgal species could be propitious sources for PHA production. The recovered PHA, being both biocompatible and biodegradable, has the ability to displace synthetic petrochemical-derived plastics effectively.