A sustainable approach to green algal bioplastics production from brown seaweeds of Sabah, Malaysia

ABSTRACT

A significant concern in generating ecologically friendly plastics has paved a way for use of algae-based green bioplastics as a substitute for conventional plastics. This study signifies the production and characterization of biodegradable algae-based bioplastics using alginate extracted from brown seaweeds of Sargassum sp. found abundantly in coastal waters of Sabah, Malaysia. During the extraction of alginate from Sargassum sp., process variables such as the alkali (Na_2CO_3) concentration, temperature (□ C), and time (hours) were optimized by employing ethanol method of extraction. The maximum yield of alginate (20.85 %) was obtained with the following conditions of 3 % of Na_2CO_3, at 95 □ C and 3 h. Then, the extracted alginate was used to synthesize seven bioplastics with different formulations, one in the absence of invert sugar (green plasticizer) as control while the others were blended with 5 %, 10 % and 15 % of invert sugar (IS) respectively. The synthesized bioplastics were further characterized via mechanical test through tensile-strength (TS) and elongation at break (E) while its degradability was evaluated using soil burial test. The results reveal that bioplastics incorporated with IS enhanced the features of the bioplastics as they were more flexible, unlike the control bioplastics which were brittle. Among the formulations used, the bioplastics that comprised of alginate (Alg) 6 % with 5 % IS exhibited the highest TS and were able to degrade completely within 4 days. Thus, this study brings in an insight into the importance of Sargassum sp. as a potential feedstock for the development of green algae-based bioplastics to counter the plastic pollution problems as it can surpass the sustainability matter and environmental challenges caused by disposal of conventional plastics.