Characterization of bioplastics developed from Kappaphycus alvarezii crosslinked with commercial sodium alginate

ABSTRACT

Plastic pollution has become one of the most concerning problems globally due to excessive use of one-time use plastics. However, bioplastics could be the answer to help combat this problem as they are readily biodegradable. Development of bioplastics was done by mixing seaweed biomass into distilled water at specific ratio, using glycerol as plasticizer. Bioplastics were developed at the ratio of 100:0, 75:25, 50:50, 25:75, and 0:100 K. alvarezii to commercial sodium alginate ratio. Characterization was done based on their appearance, mechanical, thermal and permeability properties, and biodegradability. Resulted data for their appearance showed that when more K. alvarezii was in the mixture there were more colour differences in comparison to white background and the same trend for the opacity due to the natural colour of whole K. alvarezii. As for their mechanical properties, tensile strength of the bioplastics decreased from 100:0 ratio to 0:100 ratio at 7.91 ± 0.45 MPa (100:0), 6.78 ± 0.31 MPa (75:25), 5.20 ± 0.37 MPa (50:50), 4.13 ± 0.17 MPa (25:75) and 3.76 ± 0.14 MPa (0:100), respectively. Same goes for their elastic modulus at 20.93 ± 0.61 MPa (100:0), 16.47 ± 0.99 MPa (75:25), 11.42 ± 0.53 MPa (50:50), 8.78±0.45 MPa (25:75) and 6.65±0.32 MPa (0:100), respectively. This shows that the addition of alginate enhances the elasticity but decreases tensile strength. As a conclusion, developed seaweed-based bioplastics resulted different properties at different mixture ratio show potential to be incorporated into the market as they are a greener option to fight single-use plastic wrappings such as saran wrap, beverages and food additive packets.