Microbial-induced $CaCO_3$ filled seaweed-based film for green plasticulture application

ABSTRACT

This work aimed to develop green biodegradable film using red seaweed (Kappaphycus alvarezii) as a base matrix and calcium carbonate (CaCO3) as a filler to enhance the properties of the red seaweed material for plasticulture purpose. CaCO3 which was produced by microbially induced precipitation (MB-CaCO3) using Bacillus sphaericus, was characterized and compared with the commercial CaCO3 (CCaCO3). FESEM image revealed that the size of MB-CaCO3 was smaller and more uniform compared to CCaCO3. FTIR and XRD analyses confirmed the existence of crystalline polymorph of calcite in MB-CaCO3, which contained a higher percentage of calcite than CCaCO3. However, the crystallinity and thermal stability of MB-CaCO3 was lower than CCaCO3. From the results of physical, mechanical and thermal properties of composite films filled with CCaCO3 and MB-CaCO3 fillers, the optimum loading of CCaCO3 and MB-CaCO3 was found at 0.1% and 0.15%, respectively. Composite films filled with MB-CaCO3 promote brighter film, better water barrier, hydrophobicity and biodegradability compared to CCaCO3. Since the effect of MB-CaCO3 on film functional properties was comparable to CCaCO3, it can be used as an alternative to CCaCO3 as inorganic filler for composite films in agriculture applications.

Keyword: Bacillus sphaericus; Biodegradable polymers; Biopolymers; Calcium carbonate; Red seaweed