

## Microbial-induced CaCO<sub>3</sub> 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 (CaCO<sub>3</sub>) as a filler to enhance the properties of the red seaweed material for plasticulture purpose. CaCO<sub>3</sub> which was produced by microbially induced precipitation (MB-CaCO<sub>3</sub>) using *Bacillus sphaericus*, was characterized and compared with the commercial CaCO<sub>3</sub> (CCaCO<sub>3</sub>). FESEM image revealed that the size of MB-CaCO<sub>3</sub> was smaller and more uniform compared to CCaCO<sub>3</sub>. FTIR and XRD analyses confirmed the existence of crystalline polymorph of calcite in MB-CaCO<sub>3</sub>, which contained a higher percentage of calcite than CCaCO<sub>3</sub>. However, the crystallinity and thermal stability of MB-CaCO<sub>3</sub> was lower than CCaCO<sub>3</sub>. From the results of physical, mechanical and thermal properties of composite films filled with CCaCO<sub>3</sub> and MB-CaCO<sub>3</sub> fillers, the optimum loading of CCaCO<sub>3</sub> and MB-CaCO<sub>3</sub> was found at 0.1% and 0.15%, respectively. Composite films filled with MB-CaCO<sub>3</sub> promote brighter film, better water barrier, hydrophobicity and biodegradability compared to CCaCO<sub>3</sub>. Since the effect of MB-CaCO<sub>3</sub> on film functional properties was comparable to CCaCO<sub>3</sub>, it can be used as an alternative to CCaCO<sub>3</sub> as inorganic filler for composite films in agriculture applications.

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