

PLA/MMT and PLA/Halloysite Bio-Nanocomposite Films: mechanical, barrier, and transparency

ABSTRACT

The usage of biopolymers in developing biodegradable food packaging films that are sustainable and safe towards environment has been restricted because of the poor mechanical and barrier properties of the biopolymers. This study aims to enhance the limited properties of biopolymers particularly polylactic acid (PLA) for food packaging applications by investigating the effects of incorporating different types (montmorillonite (MMT) and halloysite) and concentrations (0–9 wt.%) of nanoclays on the mechanical, oxygen barrier, and transparency properties of the films. PLA with 3 wt.% concentration of nanoclays resulted in the optimum mechanical and oxygen barrier properties due to the strong interaction between nanoclays and torturous path length created by nanoclays respectively. Nevertheless, these properties reduced as more nanoclays (≥ 5 wt.%) was added into the films due to agglomeration of nanoclays. PLA incorporated with MMT nanoclay exhibited better properties compared to halloysite nanoclay due to the nanoclay structure in nature. Addition of 3 wt.% nanoclays into virtually transparent PLA film have only small effects on the transparency of the film whereby the reduction in light transmittance was only around 10%. This study is crucial to improve the feasibility of biopolymers usage for food packaging applications.

Keyword: Barrier properties; Bio-nanocomposite; Biopolymer; Halloysite; Mechanical properties; Montmorillonite; Nanoclay; PLA; Transparency