

Nanocellulose reinforced thermoplastic starch (TPS), poly(lactic) acid (PLA), and poly(butylene Succinate) (PBS) for food packaging applications

ABSTRACT

Synthetic plastics are severely detrimental to the environment because non-biodegradable plastics do not degrade for hundreds of years. Nowadays, these plastics are very commonly used for food packaging. To overcome this problem, food packaging materials should be substituted with “green” or environmentally friendly materials, normally in the form of natural fiber reinforced biopolymer composites. Thermoplastic starch (TPS), polylactic acid (PLA) and polybutylene succinate (PBS) were chosen for the substitution, because of their availability, biodegradability, and good food contact properties. Plasticizer (glycerol) was used to modify the starch, such as TPS under a heating condition, which improved its processability. TPS films are sensitive to moisture and their mechanical properties are generally not suitable for food packaging if used alone, while PLA and PBS have a low oxygen barrier but good mechanical properties and processability. In general, TPS, PLA, and PBS need to be modified for food packaging requirements. Natural fibers are often incorporated as reinforcements into TPS, PLA, and PBS to overcome their weaknesses. Natural fibers are normally used in the form of fibers, fillers, celluloses, and nanocelluloses, but the focus of this paper is on nanocellulose. Nanocellulose reinforced polymer composites demonstrate an improvement in mechanical, barrier, and thermal properties. The addition of compatibilizer as a coupling agent promotes a fine dispersion of nanocelluloses in polymer. Additionally, nanocellulose and TPS are also mixed with PLA and PBS because they are costly, despite having commendable properties. Starch and natural fibers are utilized as fillers because they are abundant, cheap and biodegradable.

Keyword: Food packaging; Nanocellulose; Polybutylene succinate (PBS); Polylactic acid; Thermoplastic starch