

Starch-based composite film reinforcement with modified cellulose from bamboo for sustainable packaging application

ABSTRACT

Biocomposite starch film based on modified bamboo cellulose treated with phosphoric acid were evaluated for their application as food packaging materials in food industry. In this study, the neat starch, starch with a phosphorylated cellulose–chlorine extract (St–Bam_{Cl-PO4}), and starch with a phosphorylated cellulose–nitric acid extract (St–Bam_{HNO3-PO4}) were mixed with glycerol using a casting process. Results showed that tensile strengths for both St–Bam_{Cl-PO4} and St–Bam_{HNO3-PO4} were increased at 1.18 and 7.74-folds as compared to the neat starch. Meanwhile, the crystallinity index of St–Bam_{Cl-PO4} and St–Bam_{HNO3-PO4} films were improved at 4.9 and 5.16-folds, respectively, without lowering the thermal stability. These indicated that the modification of hydroxyl groups from the bamboo cellulose with the phosphoryl group increased cellulose–starch compatibility. Also, St–Bam_{Cl-PO4} and St–Bam_{HNO3-PO4} films showed enhanced UV absorption, demonstrating their potential use for UV protection. This study provides new insights into the functional improvement of starch films reinforced with treated cellulose for sustainable packaging applications.