Processing and characterization of poly(vinyl alcohol) compatibilized cellulose nanocrystals/ethylene vinyl alcohol copolymer nanocomposites

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ABSTRACT

Ethylene vinyl alcohol (EVOH) copolymer films are commonly used in food packaging due to their excellent oxygen barrier properties and melt processability. A drawback to EVOH is the lower water barrier properties, which could degrade food quality, so EVOH is often combined with other layers of polymers. The addition of cellulose nanocrystals (CNC) has been reported to improve the gas barrier and mechanical properties for other polymers. This study will focus on using CNC to improve the water barrier properties of EVOH. Since CNC is water dispersible, but EVOH is not soluble in water, poly(vinyl alcohol) (PVA) was used as a compatibilizer to improve the mixing of CNC within EVOH. Solution casting was used to mix CNC and PVA together by dissolving both in water, then making a solid film by evaporating the water. Melt processing was used to melt the CNC/PVA film with EVOH and forming the nanocomposite into a thin film. Gas barrier and mechanical properties, such as tensile strength, were examined as a function of weight percent of PVA used in each nanocomposite film. Compatibility between PVA and EVOH was determined by examining the thermal properties using differential scanning calorimetry (DSC) analysis, and degradation behavior was determined using thermogravimetric analysis (TGA). It is expected that the addition of compatibilizer, PVA, will improve these properties by making a more even mixture of CNC within the EVOH polymer matrix.

KEYWORDS

Cellulose nanocrystals, EVOH, compatibility, nanocomposites