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Effect of cellulose microcrystals in starch and chitosan-based films properties

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Comunicación:

Cellulose microcrystals (CMC) can be used as reinforcing material in the preparation of composite films. This study aimed to evaluate the effect of CMC in starch and chitosan-based films properties. Starch/CMC and Chitosan/CMC composite films were formulated with 1% (w/v) of biopolymer, 0.25% (w/wbiopolymer) glycerol and 0.1% or 0.2% of CMC. The solutions were prepared at 70°C during 30 min under stirring and submitted to 45 min of ultrasonication. Afterwards were dried in an air-circulating oven at 30°C for 24 h. The effect of CMC incorporation was evaluated in respect to the surface morphology on a scanning electron microscope (SEM). Solubility was expressed as percentage of the film dry matter solubilized after 24 h immersion in distilled water, and mechanical properties were measured using a texture analyzer following the guidelines of ASTM D 882-10. X-ray diffraction analyses (XRD) were used to evaluate the crystallinity of the samples. SEM micrographs of films with the incorporation of CMC revealed an irregular structure with high heterogeneity and that the roughness of the surface of the films increased for higher concentrations of CMC. Nevertheless, the surface of starch and chitosan films in the absence of CMC are smooth. Regarding to XRD patterns, it was observed that the addition of CMC leads to the presence of reflection peaks at $2\theta=22.5^\circ$ which are related to the cellulose crystalline structure. The values of solubility in water for films with 0.1% and 0.2% of MCM are statistically lower ($p<0.05$) than for chitosan and starch control films, thus indicating that the presence of CMC reduces the solubility of the film in water. The incorporation of CMC in films decreased the tensile strength values of starch-based films and the elongation at break ($p<0.05$). Regarding chitosan-based films the incorporation of CMC showed to be effective in increasing the tensile strength values, however leads to a decrease of elongation at break values. Overall, results showed that the incorporation of CMC in chitosan and starch-based films can be used to change the properties of the films and that according to the biopolymer used distinct behaviors can be obtained.