

Plasticizer polyols/mfc films production for single-use primary food packaging

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This study evaluated the changes in physical, mechanical, optical, and barrier properties of microfibrillated cellulose (MFC) films with food-grade polyols addition. MFC was obtained from pine sawdust pulp using a simple disk refiner. The films were acquired by solvent casting mixing 75%w/w MFC and 25% w/w of three polyols (sorbitol, mannitol, and glycerol) and dried at 50°C. The characterization included: physical-mechanical properties, optical behavior, and water vapor permeability (WVP). Finally, the aerobic biodegradation in soil of films was evaluated (15 days period).

The visual appearance of films varied according to the applied polyol (Figure 1. a). The combinations between MFC and sorbitol had a similar appearance to the control. In the case of the sample containing glycerol, the films mostly stuck to the Petri dishes, making it difficult to remove them. The films were sticky and ripped without effort. The mannitol films were very brittle, with typical white spots of the polyol crystallization in the framework. Significant differences were observed in the film's transmittance values at 600 nm ($p < 0.005$), being higher for the samples with the addition of sorbitol ($T_{600} = 9.23\%$) and mannitol ($T_{600} = 13.4\%$). However, the values for the films with the addition of glycerol ($T_{600} = 5.97\%$) were lower than the control ($T_{600} = 3.87\%$).

The thickness range was 26.0-48.0 μm . The addition of sorbitol and glycerol increased the elongation at the break of the films (8.25% and 23.7%, respectively). The tensile index values decreased when adding the plasticizers obtained (up to 80% lower). The E modulus values decreased 25.2% with the addition of sorbitol and 52.9% with glycerol (an increase of elasticity in both cases). The addition of mannitol increased 5.13% E modulus concerning 100% MFC film (Figure 1. b).

The incorporation of polyols in MFC decreases the WVP in all cases ($p < 0.005$): 180 $\text{g/m}^2 \text{ day kPa}$ (100% MFC), 118 $\text{g/m}^2 \text{ day kPa}$ (sorbitol), 92.0 $\text{g/m}^2 \text{ day kPa}$ (glycerol), and 159 $\text{g/m}^2 \text{ day kPa}$ (mannitol).

All samples showed evidence of biodegradation. The MFC films combined with sorbitol and glycerol reached 100% biodegradation after 15 days. The MFC/mannitol films attained a weight loss of 72.3%.

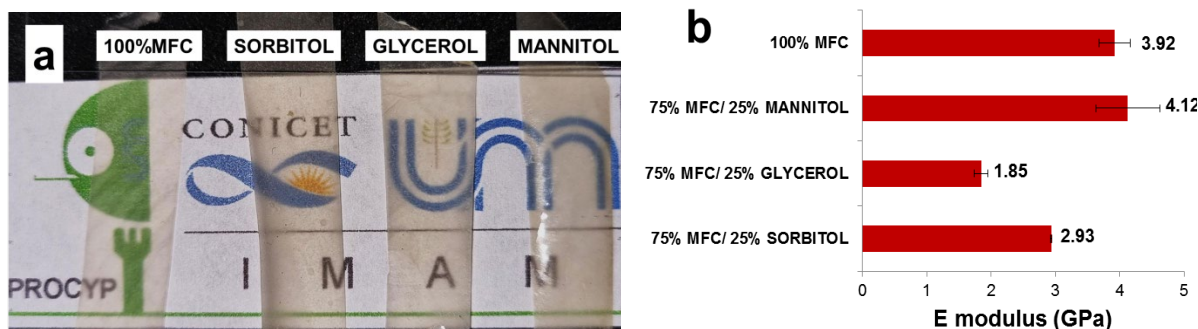


Figure 1. a) Optical aspect for films, and b) E modulus values