Highly transparent films from carboxymethylated microfibrillated cellulose: The effect of multiple homogenization steps on key properties

We produced microfibrillated cellulose by passing carboxymethylated sulfite-softwood-dissolving pulp with a relatively low hemicellulose content (4.5%) through a high-shear homogenizer. The resulting gel was subjected to as many as three additional homogenization steps and then used to prepare solvent-cast films. The optical, mechanical, and oxygen-barrier properties of these films were determined. A reduction in the quantity and appearance of large fiber fragments and fiber aggregates in the films as a function of increasing homogenization was illustrated with optical microscopy, atomic force microscopy, and scanning electron microscopy. Film opacity decreased with increasing homogenization, and the use of three additional homogenization steps after initial gel production resulted in highly transparent films. The oxygen permeability of the films was not significantly influenced by the degree of homogenization, whereas the mean tensile strength, modulus of elasticity, and strain at break were increased by two or three extra homogenization steps. © 2010 Wiley Periodicals, Inc. J Appl Polym Sci, 2011