748a: Cellulose Pretreatment and Dissolution: Selection of Solvent and Processing Conditions

Thursday, November 02, 2017
03:15 PM - 03:36 PM
Minneapolis Convention Center - 101A

Efficient utilization of biomass is hindered by the recalcitrance to dissolution of semicrystalline cellulose. Pretreatment is often used to alter the structure of cellulosic biomass in order to make cellulose more accessible to solvents and enzymes. The pretreatment involves physical and/or chemical processing which affects the degree of crystallinity and size of biomass particles. We examine here the effects of (i) solvent properties, pretreatment steps and temperature, and (ii) fiber diameter and degree of crystallinity, on the kinetics of cellulose swelling and dissolution. To this end we have combined (a) experimental results on cotton fiber swelling, change in crystallinity and dissolved amount when treated under different solvent conditions, with (b) a phenomenological model that accounts for the phenomena governing the dissolution of solid cellulose, e.g., solvent penetration, transformation from crystalline to amorphous domains, specimen swelling, and polymer chain untangling. [Ghasemi, M.; Singapati, A. Y.; Tsianou, M.; Alexandridis, P., Dissolution of nanostructured polymer fibers: Numerical modeling and parametric analysis. AIChE Journal 2017, 63 (4), 1368-1383. DOI: 10.1002/aic.15615] The insights obtained from this analysis would facilitate the rational selection of solvents and the design of pretreatment processes to reduce the size and degree of crystallinity of cellulosic biomass particles, leading to enhanced biomass utilization. [Ghasemi, M.; Tsianou, M.; Alexandridis, P., Assessment of solvents for cellulose dissolution. Bioresource Technol. 2017, 228, 330-338. DOI: 10.1016/j.biortech.2016.12.049]

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