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Interactions between rod-like cellulose nanocrystals and xylan derivatives: A light scattering study JAE HYUN SIM, Virginia Tech, KATRIN SCHWIKAL, THOMAS HEINZE, University of Jena, SHUPING DONG, MAREN ROMAN, ALAN ESKER, Virginia Tech — Interactions between rod-like cellulose nanocrystals and 2-hydroxypropyl-trimethylammonium (HPMA) xylan were investigated by polarized (DLS) and depolarized dynamic light scattering (DDLS). Cellulose nanocrystals were prepared by the controlled hydrolysis of black spruce pulp. Binary rod-like cellulose nanocrystal/water and ternary HPMA xylan/rod-like cellulose nanocrystal/water systems with different concentrations of cellulose nanocrystals were probed. Translational and rotational diffusion coefficients of cellulose nanocrystals in water are (4.8 $\pm$ 0.4) $\times$ 10^{-8} cm^2s^{-1} and (526 $\pm$ 20) s^{-1}, respectively, and calculated lengths and diameters for nanocrystals are comparable to those of cellulose whiskers from cotton. At high cellulose nanocrystal concentrations, DDLS studies in ternary systems provide translational and rotational diffusion coefficients. However, at low cellulose nanocrystal concentrations, DDLS studies of ternary systems do not yield rotational diffusion coefficients. This behavior is attributed to bridging between polymer chains that causes non-linear deviation on standard decay rate (Γ) versus scattering vector magnitude (q^2) plots.

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