ON CELLULOSE DISSOLUTION AND GELATION

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Cellulose is the World's most abundant biopolymer and an important renewable raw material for many materials. For applications like textile fibers it is necessary to first dissolve the cellulose pulp. However, dissolving cellulose turns out to be a challenge. This crystalline polymer is insoluble in most classical polar and non-polar solvents, but soluble in certain ionic liquids and also (partly) in concentrated NaOH. Replacing sodium with the larger and more hydrophobic/amphiphilic tetrabutyl ammonium cation, increases the solubility. Cellulose solutions can turn into gels. The reason for this appears to involve the issue of crystal polymorphism. While natural (wood) cellulose, so called Cellulose I dissolves, solutions may become supersaturated with respect to the more stable Cellulose II. Recrystallizing polymers from semi-dilute solutions may lead to gelation as chains can participate in more than one nucleus.

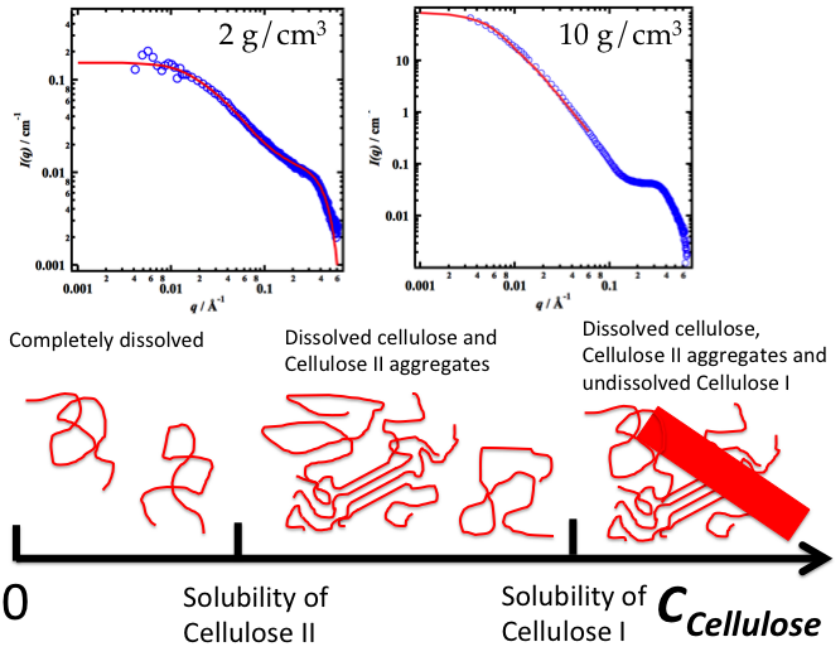

FIGURE 1 – (TOP) SMALL ANGLE X-RAY SCATTERING PATTERS OBTAINED FROM CELLULOSE DISSOLVED IN 40 WT.% TBAH(AQ) AT 2 AND 10 G/CM³, RESPECTIVELY. (BOTTOM) ILLUSTRATING THE DIFFERENT SOLUBILITY OF CELLULOSE I AND CELLULOSE II AND ITS CONSEQUENCE.

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