Abstract:
Water-soluble sulfonated cellulose (SC) samples were synthesized by oxidizing hardwood kraft pulp with sodium periodate followed by the sulfonation reaction with sodium bisulfite. Six levels of oxidation/sulfonation were obtained by using different mmoles (0.93-4.87) of periodate per gram of pulp. The aldehyde and sulfonic acid contents, surface morphology, and water solubility property of these treated fibers were characterized. It was found that carbonyl group content increased with the periodate charge and so did the sulfonic acid content in subsequent sulfonation step. Scanning electron microscopy images showed a significant change in surface morphology of the sulfonated samples. Solubility of sulfonated cellulose in water was determined from 1H NMR spectra and a solubility of 28.57 g/L was found when cellulose was oxidized with 4.87 mmol periodate per gram cellulose followed by the sulfonation reaction.

Experimental:

\[
\text{Cellulose} \quad \xrightarrow{\text{NaOCl oxidation}} \quad \text{DAC} \quad \xrightarrow{\text{Sulfonic acid}} \quad \text{SCX}
\]

\[X = 0.2, 0.3, 0.4, 0.5, 0.7, 1.0\]

= Weight ratio of NaOCl to cellulose

\[\text{DAC = Dialdehyde Cellulose} \quad \text{SC = Sulfonated Cellulose}\]

Results and Discussion:

Conclusions:

- Sulfonated cellulose samples were obtained in good yield by following sodium periodate oxidation and sodium bisulfite sulfonation of bleached hardwood kraft fibers.
- The increase in periodate concentration has led to a corresponding increase in sulfonic acid group.
- The resulting sulfonated cellulose was shown to have water solubility properties that the sulfonic acid content is above 0.16 mmol g\(^{-1}\) of the sample.

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