Presentation 6
Activation of dissolving celluloses pulp for viscose and cellulose ether production

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Mercerisation of cellulose by alkali treatment is the most common procedure used to activate natural cellulose fibres into many commercial cellulosic materials. During mercerisation, the NaOH solution enters the cellulose fibres, transforming them into a swollen and a highly reactive material called alkali cellulose (Na-Cell). In case NaOH is completely washed out of the cellulose structure, Na-Cell turns into Cellulose II upon drying.

Traditionally the cellulose is mercerised by suspending it in a 15-20 % NaOH solution. The result is a high (15-25 mol/mol) NaOH: Anhydroglucose molar ratio (r) and mercerisation in these conditions have been extensively studied. However, in modern production of cellulose ethers, the mercerisation conditions are often very different. The main reason is that any excess of water and OH^--ions used during the mercerisation can later react with different chemicals in the process, thus forming unwanted by-products *e.g.* methanol. One way to avoid this kind of side reaction is by using low-water-content mercerisation conditions, i.e. low (r) = 0.8-1.8 mol/mol and high NaOH concentration (45-55% w/w). The traditional mercerisation is a suspension process while the cellulose during the latter process, *i.e* low-water-content mercerisation conditions, remains quite "dry". Thus, although the chemical reaction principles of activation of cellulose for both viscose and cellulose ethers processes are the same, the activation conditions used are often very different. Therefore, the different dependencies of process parameters as well as any similarities between the processes are interesting.

The presentation summarises the findings presented in two papers which described the influence of the different parameters on the mercerisation/activation of softwood Sulphite dissolving pulp in viscose production conditions (Albán Reyes et al. 2016) and cellulose derivatives production conditions (Albán Reyes et al.) respectively. In the individual studies this has been done by analysing the degree of transformation (DoT) of dissolving pulp to Na-cellulose (or more correctly cellulose II after washing and upon drying) as a function of simultaneous variation of [NaOH], temperature, and reaction time varied using design of experiment. Also the (r) was varied for samples mercerised at dry conditions. A combination of Raman imaging and multivariate data analysis have been used to study the DoT to Cellulose II.

It was found that the mercerisation under the different conditions was dependent on different parameters. For traditional mercerisation, on the one hand, the temperature was shown to be important for the DoT and showed negative correlation with the data, while [NaOH] showed a positive correlation. On the other hand, at low-water-content mercerisation conditions the (r) was overall most important while the temperature showed no statistical importance in a Partial least squares analysis. Traditional mercerisation gave much higher DoT than the low-water-content mercerisation. Thus, the data for low-water-content mercerisation was further examined at the different (r). The same chemistry is always expected and the different influences of the parameters seen is understood and discussed in terms of the different physical reaction mechanisms.

Littetature

Albán Reyes DC, Skoglund N, Svedberg A, Eliasson B, Sundman O (2016) The influence of different parameters on the mercerisation of cellulose for viscose production. Cellulose 23 (2):1061-1072. doi:10.1007/s10570-016-0879-0

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