IONCELL-P: A SELECTIVE EXTRACTION AND FRACTIONATION METHOD WITH IONIC LIQUIDS

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High purity cellulose from wood is an important raw material for many applications such as cellulosic fibers, films or the manufacture of various cellulose acetate products. Hitherto, multi-step refining processes are needed for an efficient hemicellulose removal and most of them suffer from severe cellulose losses. In the IONCELL-P(ulp) process, hemicelluloses are selectively extracted from bleached paper grade pulp by an ionic liquid (IL) and water mixture, where both fractions can be recovered without yield losses or polymer degradation. Thus, the process is capable of refining paper grade pulp to high purity dissolving pulp and polymeric xylan. [1]

Some ILs capable of dissolving cellulose can also dissolve hemicelluloses, but there are significant differences in the efficiency. This difference in solvation capacity towards cellulose and hemicelluloses can be influenced by the addition of water to the system. Thus, the selectivity is achieved by tuning the IL's solvent properties by the addition of an optimal amount of water. Our recent studies show that not only the amount of water, but the type of IL and the pulp source also influence the extraction. [1,2,3,4] In the IONCELL-P process the pulp is suspended in a mixture of IL and water at 60°C for 3h. The hemicelluloses are dissolved and then removed via filtration. Then the cellulose fraction is first washed with the mixture of the IL-water solvent system and then two additional times with hot deionized water in order to remove all the dissolved hemicelluloses and the residual IL. The dissolved hemicellulose fraction is then precipitated from the filtrate by combining it with the washing water, which acts as anti-solvent when it is added in excess. Then the hemicelluloses are collected via centrifugation and washed two times with hot water. [1] The optimal water content varied strongly between the tested ILs, but the pulp source had no influence on the optimal water content of each ionic liquid-water system. [2] However, hardwood and softwood pulps were extracted most efficiently with different IL systems. The amount of the hemicelluloses had no influence on the extraction efficiency, but the molecular length and type did. This caused short chained hemicelluloses to be extracted more easily than the longer ones and thus glucomannan was more difficult to remove than xylan. [4] This theory was supported by the fractionation of pure cellulose with the IONCELL-P, where the molecular weight of the fractionated celluloses could be altered by the amount of added water.

Overall, the used IL, water content and the treated pulp need to be considered carefully when up-scaling this extraction/fractionation process.

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