From Wheat Straw to MMCF: Circular Economy in the Rheinisch Mining Area

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Abstract

The transformation of the Rhenish Mining Area requires new value chains that combine regional resources, circular economy approaches and sustainable industrial applications. The project Alternative cellulose feedstocks for man-made cellulosic fibres (AltCell2) contributes to this transition by investigating the use of wheat straw as alternative raw material for man-made cellulosic fibres (MMCF).
Instead of relying exclusively on conventional wood-based dissolving pulp, the project explores how agricultural residues can be converted into cellulose-rich pulps suitable for further processing into fibres. Different fractionation and pretreatment routes, including SODA and OrganoCat processes, are investigated to separate cellulose from lignin and hemicellulose and to assess the resulting pulp quality. Furthermore, a clean-up and bleaching step is added to achieve the necessary requirements to create a spinning solution. As a continuation of AltCell1, the set benchmark has been improved significantly. Wheatpulp has been successfully spun via a variation of the Cupro process developed by the ITA. The original Cupro process is behind the famous "Kunstseide" (Aritifical Silk) which is also considered a staple for luxury textiles. In addition the fibres find application in non wovens for hygiene and filtration for medical and technical applications.
A particular focus is placed on the link between raw material, pretreatment and subsequent fibre production. The obtained cellulose is therefore evaluated with regard to its properties and processability for MMCF production. By connecting agricultural side streams with high-value textile applications, AltCell2 demonstrates a potential pathway from regional biomass to new cellulose-based products. The project thereby supports the development of circular bio-based value chains and new industrial perspectives for the Rhenish Mining Area.

Keywords: MMCF, Cupro, alternative feedstocks, wheat straw, wheat pulp, cellulose, ITA, Lee, Khan

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