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Dr. Inge Schlapp-Hackl

## Lyocell-type fibers from banknotes by means of Ioncell® technique.

Inge Schlapp-Hackl\*, Matthias Selinger, Marja Rissanen, Herbert Sixta, Michael Hummel

Ioncell®,<sup>[1]</sup> a technology developed for the sustainable production of MMCFs, offers the possibility to recover resources from different waste materials to minimize landfill and CO<sub>2</sub> emissions through incineration. Moreover, the resulting fibres are often stronger than the original textile fibres providing textiles of higher quality. This represents an important milestone towards a circular-flow economy, which reduces the demand for virgin raw materials and mitigates problems associated with the currently generated amounts of waste.

So far, our investigations have focused on the “production of novel cellulosic Ioncell textile fibres” by the use of waste textile materials like cotton roll towels, hemp, viscose or modal fibers. The quality and durability of Ioncell® fibres was determined and a new technique for fibre production was introduced. Now, we extend the variety of materials and started to investigate the recycling of banknotes.

Enormous amounts of banknotes are taken out of rotation every year (e.g. 113.2 billion euros in EU in 2019). This has intrigued us to look into the recycling of this material. In general, two kinds of banknotes, polymer and cotton (CO) -based notes, are available. The estimated lifetime of each sheet is around 3 years and after that time, the polymer-based ones are recycled and the cotton-based ones are incinerated. The cotton-based banknotes consist of cotton, a protective coating, a magnet for reading and a nylon bar for visual inspection. Consequently, besides the cellulose a large amount of additives, like inks and dyes, binders, wax, can be found. To recover the cotton, first all of these additives have to be removed. The natural polymer is recovered and new fibers are produced by means of the Ioncell® process.<sup>[2,3]</sup> The properties of the starting material and 2<sup>nd</sup> generation fibres were evaluated in detail and compared with already recycled materials.

This study guides future recycling strategies for demanding multi-component waste materials.



Figure1: Illustration of the initial banknotes (left) and the produced textile (right).

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