

# Spun dyed Lyocell-type fibers from colored textile waste

Hummel M.<sup>\*a</sup>, Nygren N.<sup>a</sup>, Langhans M.<sup>a</sup>, Schlapp-Hackl I.<sup>a</sup>

<sup>a</sup> *Department of Bioproducts and Biosystems, Aalto University, Finland*

\* michael.hummel@aalto.fi

The overconsumption of textiles during the past three decades has led to continuously growing amounts of textile waste which pose environmental threats on multiple levels. However, discarded textiles have meanwhile also been recognized as important and plentiful material resource. Cellulosic fibers, foremost cotton but also manufactured cellulose fibers (MCFs) can be turned into a dissolving-pulp like feedstock for the production of new MCFs. [1,2] This is an opportunity to introduce circularity into a currently mostly linear textile economy. However, textile waste is a multi-material mix of different fibers and additives such as dyes and finishes. Pretreatment procedures are thus needed to separate the fibers and remove undesired components.[3] Currently, this includes bleaching protocols to arrive at a white substrate. Evidently, thereafter spun fibers need to undergo a dyeing process again.

Herein we present strategies to recycle dyed cellulose waste to produce *in situ* dyed fibers. The recyclability of VAT, reactive and disperse dyes is evaluated and compared. Further, we disclose strategies to produce spin-dyed fibers can be recycled without any loss in the dye intensity.

[1] Asaadi S., Hummel M., Hellstén S., Ma Y., Michud A. & Sixta H. *ChemSusChem* 9, 3250–3258, 2016

[2] Haslinger S., Hummel M., Anghelescu-Hakala A., Määttänen M. & Sixta, H. *Waste Manage.* 97, 88-96, 2019

[3] Haslinger S., Hietala S., Hummel M., Maunu S.L. & Sixta, H. *Carbohydr. Polym.* 207, 11-16, 2019