MWP – Young Researcher Abstract 2026

Project title: Shining light on textile recycling – Fast, non-invasive assessment of cellulosic fiber quality using NIR imaging and chemometrics		
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Abstract (approx. 200 words)**:**
Transitioning towards a circular textile ecosystem requires new methods to assess textile material properties during recycling. A key property in the chemical recycling of cellulose-based materials is the degree of polymerization, typically determined by measuring intrinsic viscosity. The traditional intrinsic viscosity measurements are based on wet-chemical methods that are invasive, time-consuming and unsuitable for high-throughput industrial applications. We have developed a non-invasive method to estimate intrinsic viscosity in cellulose-based fabrics using near-infrared imaging combined with chemometrics. Our method uses the spectral fingerprint of the fabric to predict intrinsic viscosity, resulting in errors that are only two times larger than those from the standardized reference method. The determined spectral fingerprints suggest that fiber degradation causes a decrease in intrinsic viscosity which could be linked to changes in cellulose crystallinity and water adsorption. These structural changes are relevant because they influence cellulose dissolution and processability during recycling, eventually affecting the quality of the regenerated fibers. Our method therefore provides a rapid and scalable approach for assessing textile fiber properties and selecting suitable recycling routes. This approach is not only limited to textiles but could potentially be transferred to the broader field of cellulose modification contributing to transition toward more sustainable and circular bioeconomy.

Key words:
Near-infrared imaging, Degree of polymerization, Cellulosic textiles, Chemical recycling, Circular bioeconomy