

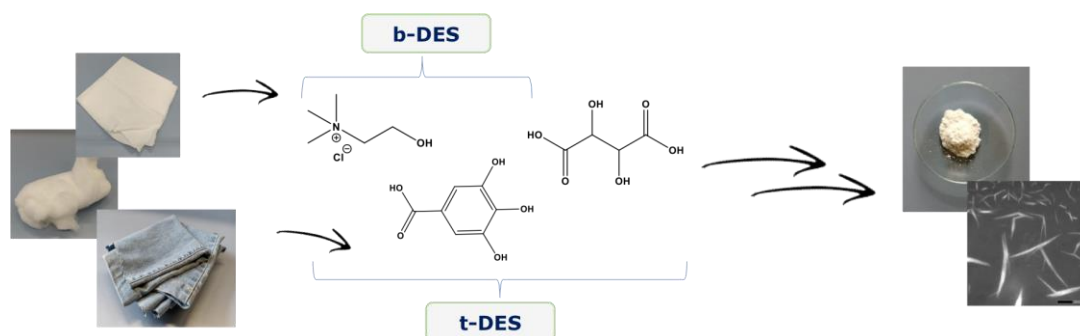
# Sustainable Extraction of Nanocellulose from Textile Waste via Deep Eutectic Solvents for Eco-Friendly Leather Processing

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Textile waste, particularly from cotton-rich materials, is generated in large volumes annually. Valorizing this waste into high-value products like nanocellulose (NC) offers a sustainable solution.<sup>1</sup> Deep eutectic solvents (DESs), known for their tunable properties based on hydrogen bond donor (HBD) and acceptor (HBA) combinations, have shown promise for cellulose nanocrystals extraction.<sup>2</sup> In this study, natural DESs (NADESs) composed of choline chloride (ChCl) and gallic acid (GA) were explored, supported by density functional theory (DFT) modeling of their hydrogen bond networks. A ternary DES (t-DES) variant, partially replacing GA with tartaric acid (TA), showed reduced viscosity (0.58 vs. 0.80 Pa·s) and easier processing. Both solvents were applied to 1% pre- and post-consumer cotton textiles at 90 °C with sonication, yielding nano-sized cellulose fragments: 85% for binary DES (b-DES) and 73% for t-DES. The nanocellulose was successfully characterized, and both solvents were efficiently recycled up to four times, with t-DES demonstrating superior recoverability.<sup>3</sup>



**Scheme 1.** Scheme for the production of NC from textile waste using b-DES and t-DES.

To enable system scalability and application to mixed textiles, different DES formulations were tested, including metal chlorides in their formulation, demonstrating success across different types of polyester blends. The extracted nanocellulose was then functionalized and applied in leather treatment - both in finishing and tanning - highlighting its potential to enhance the sustainability of these processes.<sup>4</sup>

## References

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