Optimization of microwave-assisted cellulose isolation from soybean hulls

Monica Rigoletto[1*], Giorgio Grillo[2], Elisa Natali[1], Maria Laura Tummino[3], Enzo Laurenti[1], Silvia Tabasso[2]

[1] Dipartimento di Chimica, Università degli Studi di Torino, Via P. Giuria 7, Torino (Italia)
[2] Dipartimento di Scienza e Tecnologia del Farmaco, Università degli Studi di Torino, Via P. Giuria 9, Torino (Italia)
[3] Istituto di Sistemi e Tecnologie Industriali Intelligenti per il Manifatturiero Avanzato (STIIMA), Consiglio Nazionale delle Ricerche (Cnr), Corso G. Pella 16, Biella (Italia)
*Corresponding author: monica.rigoletto@unito.it

In recent years, biopolymer extraction from biomasses has been considered an interesting waste valorization approach. Indeed, agro-industrial residues are rich in components exploitable as new raw materials for a wide range of fields, such as food packaging, bio-plastics, drug carriers and water treatment [1,2].

Classic extraction processes often employ strong acidic or alkaline hydrolysis to isolate bio-polymers from lignocellulosic matrixes [3], which are far from the green chemistry concepts that suggest avoiding strong reagents and promoting environmentally friendly solvents.

Cellulose, in particular, is one of the most abundant carbohydrates in nature and an interesting compound, since it can be easily modified and functionalized. In this research work, we focused our attention on the development and optimization of its green isolation from soybean hulls through Microwave-assisted Sub-critical Water Extraction (MASWE), coupled with a weak alkaline delignification (Figure 1).

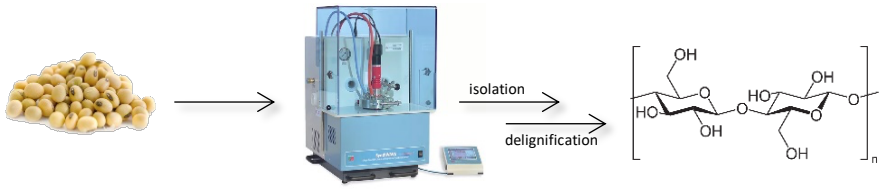

Figure 1. cellulose isolation scheme

Both the obtained cellulosic samples and the liquid extracts have been deeply characterized (SEM, TGA, DSC, FT-IR, NREL, phenolic content) in order to select the best extraction conditions to be applied with a view to scaling-up. In addition, preliminary tests on waste-derived cellulose in hydrogel production and in the agri-food sector are under study.

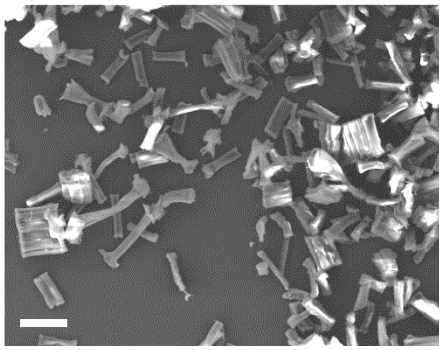

Figure 2. SEM image of delignified cellulose (treatment in microwave at 150°C). Scale bar: 50 µm

Acknowledgments
MR, EN and EL acknowledge support from the Project CH4.0 under the MUR program "Dipartimenti di Eccellenza 2023-2027" (CUP: D13C22003520001)

References:
[1] M. Rigoletto et al, 2023, DOI: 10.1039/d3re00009e
[2] J. Baranway et al, 2022, DOI: 10.3390/polym14050983
[3] M.L. Tummino et al, 2023, DOI: 10.1007/s10570-023-05339-w