Lignin from Grape stalks: Nanoparticle Production through Sonication

Ana C. Cassoni[1], Ana I. Bourbon[2], Marta Vasconcelos[1], Manuela Pintado[1]

[1] Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

[2] IBB – Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal

Dare 2 Change

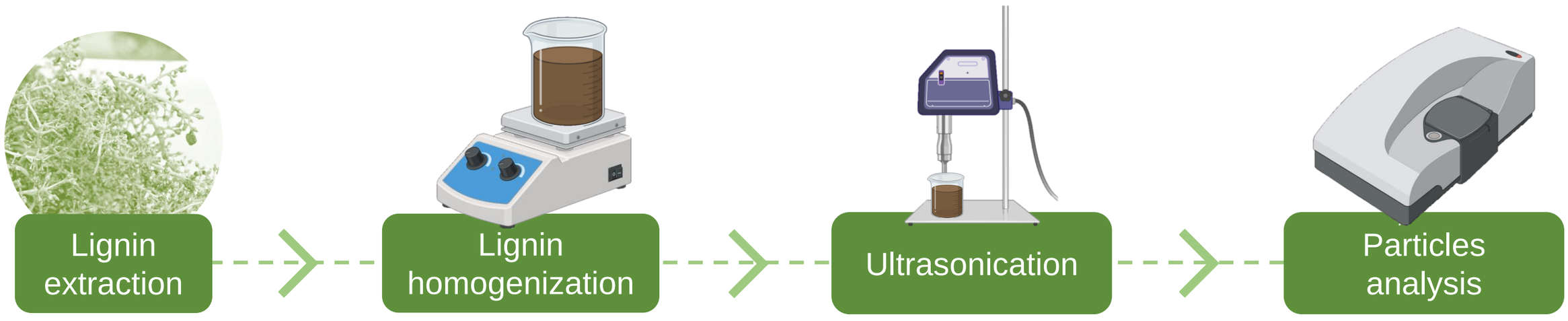
Sustainability & Circular Economy

CATÓLICA FACULTY OF BIOTECHNOLOGY PORTO

Introduction

Lignin nanoparticles represent an emerging class of sustainable nanomaterials that can improve the valorisation of this abundant biopolymer through new applications [1]. This study focused on optimizing the production of lignin nanoparticles through sonication, using minimal amount of chemicals possible, while achieving small particle size and maintaining colloidal stability.

Methodology



Lignin solutions were prepared by dispersing extracted lignin in deionized water and Tween 20 and Tween 80 surfactants (0,05%), followed by overnight agitation. The solutions were then ultrasonicated at 80% amplitude for 15 minutes with a 10-second pulse cycle, while being maintained in an ice bath to prevent overheating. The synthesized nanoparticles were characterized using Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM) to evaluate their size and morphology.

Results

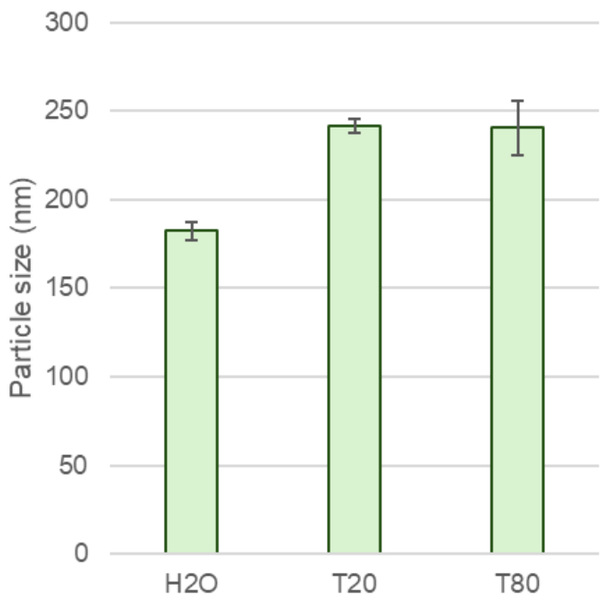


Figure 1 – Lignin nanoparticles size (nm) obtained through ultrasonication from lignin dispersion in water, Tween 20 and Tween 80.

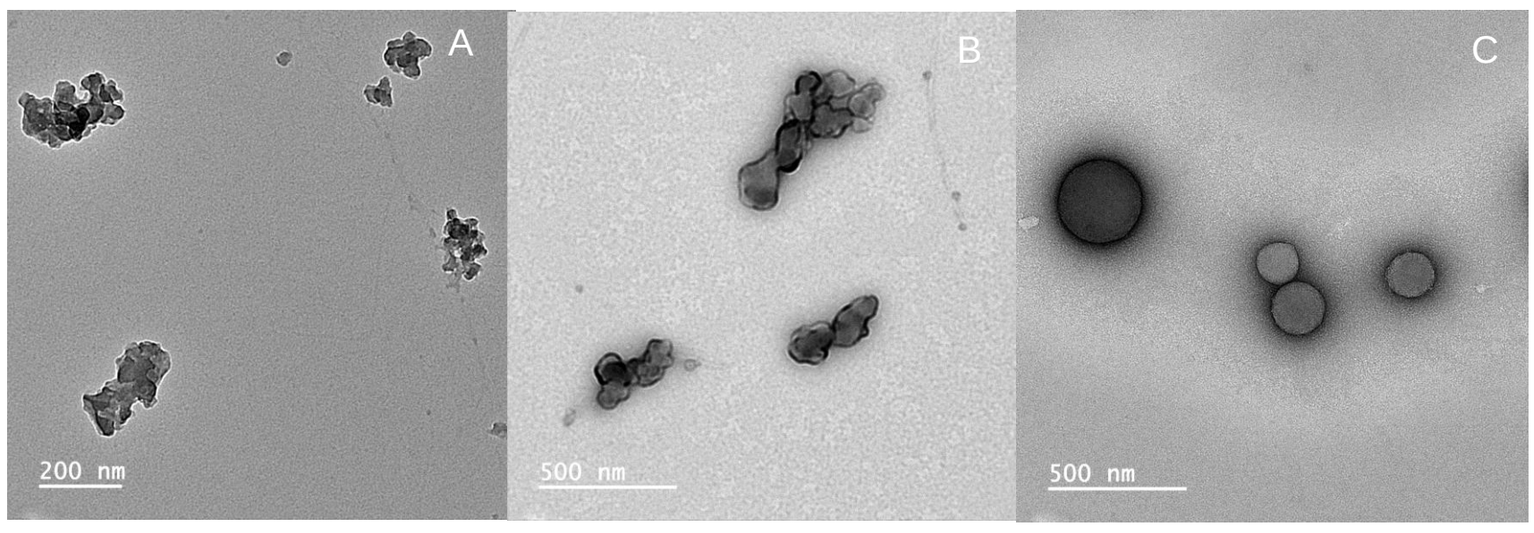


Figure 2 – TEM images of the lignin nanoparticles obtained through ultrasonication. A – Lignin nanoparticles in water; B- Lignin nanoparticles in Tween 20; C- Lignin nanoparticles in T80.

Conclusions

This study shows that it is possible to obtain spherical lignin nanoparticles with sizes ranging from 200 to 300 nm using ultrasonication with minimal use of chemicals. The addition of surfactant (Tween 80) was essential to avoid aggregation of nanoparticles. The developed methodology demonstrates a simple and efficient approach for producing spherical lignin nanoparticles.

Acknowledgments

This work was supported by National Funds from FCT - Fundação para a Ciência e a Tecnologia through project UIDB/50016/2020. Funding for author Ana C. Cassoni was provided by Fundação para a Ciência e a Tecnologia – Portugal (via the PhD fellowship ref. SFRH/BD/143198/2019).

References

[1] S. Beisl, A. Friedl. & A. Miltner, International Journal of Molecular Science, 18 (2017) 2367.

Organized by:

COLAB 4FOOD · Instituto Nacional de Investigação Agrária e Veterinária, I.P. · PORTUGAL FOODS Atlantic meets Mediterranean

FCT Fundação para a Ciência e a Tecnologia · PORTUGAL 2020 · NORTE2020 · UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional