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Influence of the matrix and synthesis conditions onto the final properties of bacterial cellulose polyaniline nanocomposites

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Bacterial cellulose/polyaniline (BC/PANi) nanocomposites have greatly attracted the scientific community due to the increasing demand of the development of novel electronic devices and sensors that can be applied in several areas such as medicine and electronics. The current study evaluates the impact of using different BC matrixes (drained, freeze-dried and regenerated) and different synthesis conditions (in situ and ex situ) to improve the inherent properties of BC, which were monitored through FTIR-ATR, EDX, XRD, SEM, AFM, swelling, contact angle measurement and IGC. The employment of in situ polymerization onto drained BC presented as the most effective method to obtain the most conductive membrane. Moreover, through the incorporation of PANi onto the different BC matrixes, the overall properties were significantly changed. The increased up to 150%, indicating a more reactive surface. Also, a loss of porosity (up to 85%) on the nanocomposites is observed due to the pore obstruction resulted from the introduction of PANi. Regarding the different BC matrixes used, the freeze-dried BC/PANi nanocomposites presented the highest crystallinity (up to 53.7%) and swelling capacity (up to 413.6%). Hence, this work evidenced that the final properties of the BC/PANi blends are greatly influenced by both the BC matrixes and synthesis methods employed, highlighting IGC as the most versatile technique to evaluate the physico-chemical changes upon different BC modifications.

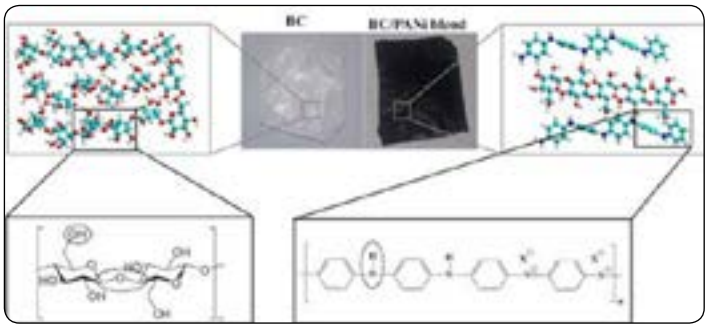

Figure 1: Design of the SLS machine (described in the text): a-general view, b-longitudinal section (axonometry), c-cross-section (axonometry)

Recent Publications:

1. Conductive bacterial cellulose-polyaniline blends: Influence of the matrix and synthesis conditions, Emanuel Alonso, Marisa Faria, Faranak Mohammadkazemi, MaticResnik, Artur Ferreira, Nereida Cordeiro, 2018, 183, 254-262.
2. Improvement of bagasse fiber–cement composites by addition of bacterial nanocellulose: an inverse gas chromatography study, Faranak Mohammadkazemi, Roberto Aguiar, Nereida Cordeiro, Cellulose, 2017, 24 (4), 1803-1814.
3. In situ biosynthesis of bacterial nanocellulose-CaCO3 hybrid
4. bionanocomposite: One-step process, Faranak Mohammadkazemi, Marisa Faria, Nereida Cordeiro, Materials Science and Engineering C, 2016, 339-39.
5. Biodegradable Nanocomposite Films Based on Sodium Alginate and Cellulose Nanofibrils, B. Deepa, Eldho Abraham, Laly A. Pothan, Nereida Cordeiro, Marisa Faria, Sabu Thomas, Materials, 2016, 1-11.

6. In-situ glyoxalization during biosynthesis of bacterial cellulose, Cristina Castro, Nereida Cordeiro, Marisa Faria, Robin Zuluagaa, Jean-Luc Putauxc, Ilari Filpponend, Lina Velez, Orlando J. Rojas, Piedad Ganán, Carbohydrate Polymers, 2015, 32-39.

Biography

Nereida Cordeiro is an Associated Professor of Chemistry in the Faculty of Sciences and Engineering of the University of Madeira. She holds a degree in Analytical Chemistry (University of Aveiro) and PhD in Chemistry (University of Aveiro). Her main research interests are in Analytical and Environmental Chemistry, with focus on biomaterials and biotechnology. She authored more than 70 scientific publications in international journals.

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