Área: FIS

Influence of drying on the rehydration capacity of bacterial cellulose and polyaniline hydrogels.

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Highlights

Title: Influence of drying on the rehydration capacity of bacterial cellulose and polyaniline hydrogels.
CB and CB/Pani hydrogels present were dried in oven or by freeze-drying and their rehydration capacity (RC) were evaluated. Freeze-drying shows to be the best alternative for membranes rehydration, with RC values near 100%.

Abstract

Bacterial cellulose (BC) is a natural biopolymer composed of β-D-glucopyranose units linked by β-1,4 bonds. It is characterized by an abundance of hydroxyl groups and high hydrophilicity, allowing it to be used as a hydrogel. The incorporation of polyaniline (PANI), an easily synthesized conductive polymer, gives CB/PANI hydrogels additional conductive properties while maintaining the biocompatibility of CB. These characteristics allow the incorporation of Pani in BC to be used as 3D electrodes in biodevices. For this application, water retention (WR) and rehydration capacity (RC) are important factors. In this work, water retention (%) and rehydration capacity of BC and BC/Pani hydrogels were evaluated using samples obtained by different drying methodologies: oven or freeze-drying. BC and BC/Pani membranes were weighed after removing the excess of water to obtain their wet weight (w_{wet}). Then, they were oven-dried or lyophilized and their dry weights were (w_{dry}) measured in order to obtain water retention (WR), according Eq. (1). These materials were soaked into deionized water and specimens were removed at certain intervals and weighed again as rehydration weight (w_{rehyd}). When w_{rehyd} remains constant, these values were used to calculate rehydration capacity (RC) by Eq. 2.[1] All measurements were made in triplicate.

$$WR = \left(\frac{w_{wet} - w_{dry}}{w_{dry}}\right).100 \quad (1) \qquad RC = \left(\frac{w_{rehyd} - w_{dry}}{w_{wet} - w_{dry}}\right).100 \quad (2)$$

WR were greater than 90% for both samples, showing high water retention of BC and BC/Pani, but WR for BC/Pani is smaller, showing Pani presence reduces water absorption. Indeed, RC for BC hydrogels are higher than BC/Pani. However, the drying methodology showed more influence on the RC values. Both BC and BC/Pani hydrogels presented RC values near 100% for freeze-dried membranes. When membranes were dried in oven, RC values were lower than 50%. Dry-freezing allows dehydration without the collapse of cellulose chains in the BC membrane, with is crucial for applications as 3D electrodes and the incorporation of electroactive species.

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