Galoá

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PRODUCTION OF NON-TOXIC CELLULOSE NANOCRYSTALS FROM GRAPE POMACE RESIDUE USING A CHEMICAL-ULTRASONIC PROCESS

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The use of agricultural residues for the production of high-value materials is a key issue for sustainable agriculture that can provide an economic benefit for the agroindustry. In this work cellulose extracted from Pinot noir grape pomace residues was used to obtain cellulose crystals. The non-cellulosic components were removed from grounded untreated grape pomace (UGP) resulting in pretreated grape pomace (PGP). The compositional analyses was determined by High-performance liquid chromatography (HPLC). The PGP was then acid hydrolyzed (AH) under 30 and 90 min and then ultrasonic treatment was applied to obtain cellulose nanocrystals. Crystallinity index and thermal stability were analyzed by X-ray diffraction (XRD) and thermogravimetric analysis (TGA), respectively. The morphology of the cellulose before and after the sonication treatment was evaluated by transmission electron microscopy (TEM). The non-toxicity of the cellulose nanocrystals (CNCs) was assessed by human intestinal Caco-2 cell line and PrestoBlue assay. The pretreatment was effective in removing non-cellulosic components, recovering 77.4% of cellulose on PGP (compared with 18.83 % of UGP). Defined peaks around 15.0º and 22.5º in the PGP XRD diffractogram as well as the intensities were significantly higher than UGP, confirming the great amount of cellulose. The CrI were 23.50, 62.13, 65.45, 70.62, 71.13 and 76.19, for UGP, PGP, AH30, AH30S, AH90 and AH90S, respectively. The increase in CrI of the cellulose was due to the removal of amorphous regions from the cellulose by AH. Tmax of degradation of cellulose crystals was 364.23 ºC (AH30), 365.32 °C (AH30S), 283.01 °C (AH90), and 288.72 °C (AH90S). Using AH alone is possible to produced cellulose crystal from the purified cellulose, being sonication a required step for the CNCs production. The obtained CNCs showed a needle-shaped morphology, stability in solution, and good thermal stability. Furthermore, the CNCs obtained are non-toxic, making them attractive for food applications.