Organic Chem Curr Res 2017, 6:2 (Suppl)
DOI: 10.4172/2161-0401-C1-020

Chemical/Enzymatic treatments of soybean straw for cellulose nanofiber production and their potential application as reinforcing filler in soy protein films

Milena Martelli Tosi
University of São Paulo, Brazil

Statement of the Problem: Current environmental issues have prompted the search for reinforcement additives in polymeric matrixes, aiming at the improvement of their functional and mechanical properties. Soybean straw (SS) is a lignocellulosic agro-industrial residue available in large amounts throughout the world and considered a rich source for obtaining cellulose nanofibers. The purpose of this study was (i) to investigated changes in the chemical composition and structure of soybean straw (SS) after pre-treatments with alkali (NaOH 17.5%) and hydrogen peroxide (H_2O_2); (ii) to produce cellulose nanofibers from pre-treated SS and (iii) to evaluate SS fiber/nanofibers as reinforcement filler in soy protein films (SPF) at 5% w/w.

Methodology & Theoretical Orientation: Cellulose nanofibrils (CNF) were obtained using commercial available enzymes (xylanase/cellulases, 42 h at 50°C in pH 4.0) and cellulose nanowhiskers – CNW) by acid hydrolysis (H_2SO_4 64%, 40 min at 70°C). Film processing is presented in Figure 1.

Findings: Pre-treatments were able to remove the amorphous constituents increasing the degree of crystallinity and the content of cellulose fibers. Moreover, the treatment with NaOH 17.5% contributed to the allomorph transition from cellulose I to II. The incorporation of nanofibers into soy protein films (thickness: 55 to 81 m) promoted higher tensile strength (TS) and Young's modulus (YM), but lower elongation at break (EB). This effect was more evident when CNF were added to the film: TS increased from 5.6 to 9.7 MPa, YM rose from 298 to 575 MPa, and EB decreased by 50% (from 30 to 17%). CNW had practically the same effect on the TS, with higher values of YM, but lower values of EB. The residual sugars presented in CNF suspension, as a product of enzymatic action, might have contributed as plasticizer.

Conclusion & Significance: The applied enzymatic processes are environmentally friendly and suitable for nanofiber extractions proper for application as reinforcement material.

mmartelli@usp.br