Title: Effect of continuous water steam explosion on crystalline structure of microcrystalline cellulose

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Original abstract:

Continuous steam explosion was applied to preprocess microcrystalline cellulose(MCC), and the changes in crystalline structure of MCC were studied. All samples preprocessed showed a typical cellulose I crystal structure by XRD (Figure). However, the degrees of crystalline (Xc) of all samples preprocessed decreased, compared with raw MCC. The band of all samples preprocessed around at 3414 cm⁻¹, assigned to -OH stretching vibrations, was sharper and narrower than the band of raw MCC. Moreover, the bands were resolved into three peaks by Gaussian function[1], these were at 3551 cm⁻¹, 3350 cm⁻¹ and 3164 cm⁻¹, assigned to the intramolecular hydrogen bond of 2-OH...O-6, intramolecular hydrogen bond of 3-OH...O-5 and the intermolecular hydrogen bond of 6-O...HO-3', respectively[1]. These three bands of samples preprocessed had red shift, which indicated that the hydrogen-bonding network of MCC changed after the preprocessing.

References:

[1] Oh SY, Yoo DI, Shin Y, et al. Crystalline structure analysis of cellulose treated with sodium hydroxide and carbon dioxide by means of X-ray diffraction and FTIR spectroscopy. Carbohydrate research. 2005;340(15):2376-91.

Preprocessing conditions & Information of samples:

Temperature: 120°C

Pressure: 10 MPa

Sample number	steam explosion frequency	feeding modes	steam explosion times
A(raw MCC)	-	-	-
B	30 Hz	one-time feeding	once
C	40 Hz	continuous and uniform feeding	once
D	40 Hz	two-time feeding	twice
E	40 Hz	one-time feeding	once

Figure 1. XRD patterns of all samples.

Figure 2. FTIR spectrum of all samples.

Figure 3. Resolution of hydrogen-bonded OH stretching for raw MCC.