Complexation between burdock holocellulose nanocrystals and corn starch: gelatinization properties, microstructure, and digestibility *in vitro*

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Table S1 Textural properties of CS gels in the absence or presence of 0.2 %, 0.5 %, 1.0 %, or 2.0 % (*w/w*, relative to the weight of pure CS) of burdock *h*CNCs.

Samples	Cohesiveness	Adhesiveness/g	Chewiness/g
Pure CS	0.19 ± 0.02^{a}	249.23 ± 10.23^{a}	157.32 ± 10.23^{a}
CS + 0.2 % *h*CNC-600	0.22 ± 0.02^{a}	277.65 ± 10.21^{b}	319.52 ± 6.90^{c}
CS + 0.5 % *h*CNC-600	0.21 ± 0.01^{a}	272.87 ± 4.22^{b}	280.19 ± 9.52^{b}
CS + 1.0 % *h*CNC-600	0.22 ± 0.03^{a}	280.12 ± 8.32^{b}	285.43 ± 18.43^{b}
CS + 2.0 % *h*CNC-600	0.22 ± 0.01^{a}	278.20 ± 9.16^{b}	267.89 ± 7.34^{b}
CS + 0.2 % *h*CNC-400	0.43 ± 0.03^{c}	477.09 ± 12.23^{e}	514.32 ± 19.31^{f}
CS + 0.5 % *h*CNC-400	0.37 ± 0.02^{b}	449.33 ± 8.87^{d}	463.40 ± 8.76^{d}
CS + 1.0 % *h*CNC-400	0.40 ± 0.02^{bc}	512.29 ± 19.92^{f}	507.52 ± 11.45^{f}
CS + 2.0 % *h*CNC-400	0.47 ± 0.01^{d}	537.61 ± 6.34^{g}	483.90 ± 6.78^{e}
CS + 0.2 % *h*CNC-200	0.38 ± 0.01^{b}	424.07 ± 8.43^{c}	583.10 ± 15.26^{g}
CS + 0.5 % *h*CNC-200	0.43 ± 0.02^{c}	614.51 ± 25.55^{h}	749.03 ± 31.23^{h}
CS + 1.0 % *h*CNC-200	0.40 ± 0.02^{bc}	474.13 ± 3.98^{e}	523.98 ± 17.77^{f}
CS + 2.0 % *h*CNC-200	0.42 ± 0.01^{bc}	454.27 ± 11.09^{d}	486.01 ± 3.56^{e}

Different lowercase letters in the same column represent significant differences ($p < 0.05$).

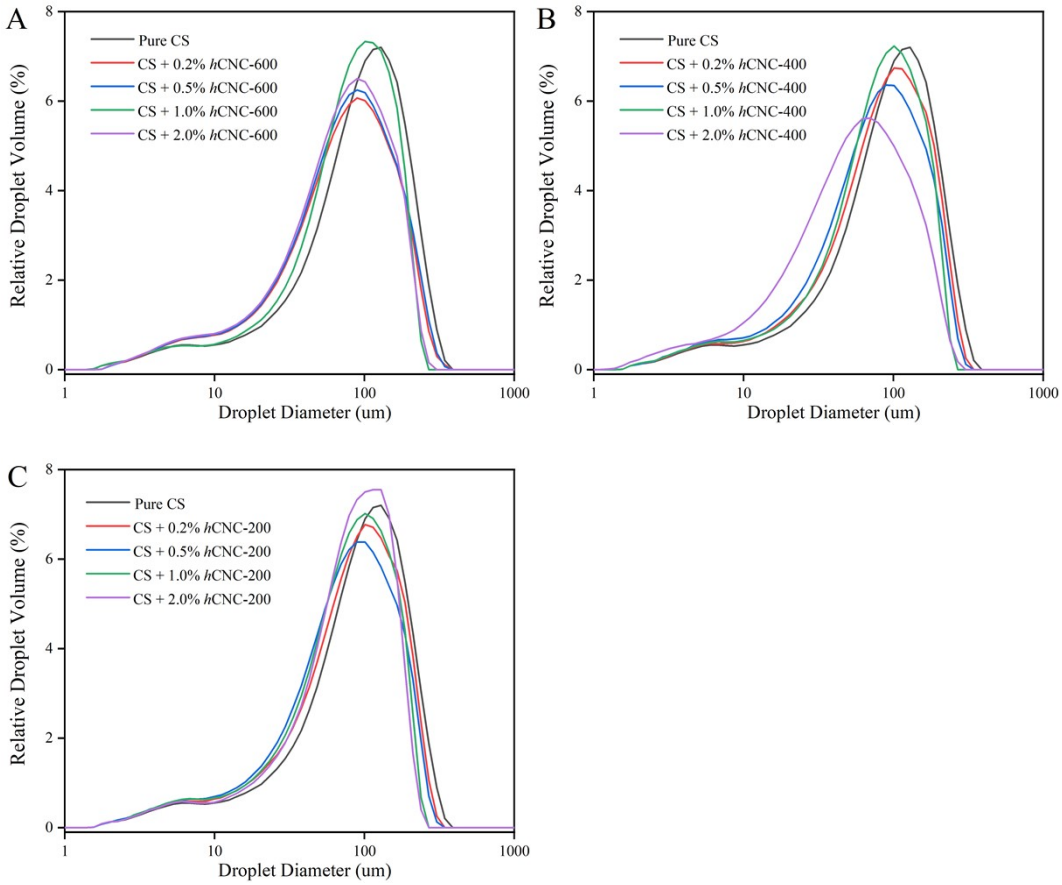

Fig. S1. The size distribution of pure CS gel and those containing different amounts of burdock *h*CNC-600 (a), *h*CNC-400 (b) or *h*CNC-200 (c).

Table S2 Particle size of CS gel after the RVA experiments in the absence or presence of 0.2 %, 0.5 %, 1.0 %, or 2.0 % (*w/w*, relative to the weight of pure CS) of burdock *h*CNCs.

Samples	D_{10} (μm)	D_{90} (μm)	$D_{4,3}$ (μm)	$D_{3,2}$ (μm)	$D_{4,3}$ - $D_{3,2}$ (μm)
Pure CS	20.11 ± 0.17^{k}	188.33 ± 0.49^{j}	99.65 ± 0.28^{h}	37.78 ± 0.15^{i}	61.87 ± 0.13^{k}
CS + 0.2 % *h*CNC-600	15.32 ± 0.17^{e}	179.72 ± 0.35^{i}	92.81 ± 0.52^{g}	31.92 ± 0.18^{d}	60.89 ± 0.34^{j}
CS + 0.5 % *h*CNC-600	14.84 ± 0.05^{d}	168.12 ± 0.23^{g}	81.98 ± 0.67^{d}	31.06 ± 0.37^{c}	50.92 ± 0.24^{e}
CS + 1.0 % *h*CNC-600	14.61 ± 0.13^{c}	156.09 ± 0.59^{e}	82.22 ± 0.15^{d}	32.71 ± 0.28^{e}	49.51 ± 0.06^{d}
CS + 2.0 % *h*CNC-600	14.50 ± 0.08^{c}	152.81 ± 1.45^{c}	76.69 ± 0.19^{b}	30.33 ± 0.06^{b}	46.36 ± 0.04^{b}
CS + 0.2 % *h*CNC-400	19.15 ± 0.48^{j}	175.30 ± 1.16^{h}	93.10 ± 1.05^{g}	36.29 ± 0.25^{h}	56.81 ± 0.83^{i}
CS + 0.5 % *h*CNC-400	16.59 ± 0.06^{h}	165.66 ± 1.84^{f}	89.32 ± 0.08^{f}	33.35 ± 0.48^{f}	55.97 ± 0.03^{h}
CS + 1.0 % *h*CNC-400	16.11 ± 0.12^{fg}	156.51 ± 0.29^{e}	81.93 ± 0.21^{d}	32.21 ± 0.69^{de}	49.72 ± 0.12^{d}
CS + 2.0 % *h*CNC-400	11.52 ± 0.07^{a}	136.58 ± 0.43^{a}	64.04 ± 0.27^{a}	23.55 ± 1.14^{a}	40.49 ± 0.13^{a}
CS + 0.2 % *h*CNC-200	17.46 ± 0.02^{i}	174.73 ± 0.25^{h}	87.31 ± 0.08^{e}	35.23 ± 0.05^{g}	52.08 ± 0.03^{g}
CS + 0.5 % *h*CNC-200	16.22 ± 0.02^{g}	166.61 ± 0.12^{f}	82.85 ± 1.05^{d}	31.51 ± 0.22^{c}	51.34 ± 1.03^{f}
CS + 1.0 % *h*CNC-200	16.03 ± 0.03^{f}	155.70 ± 0.15^{d}	82.19 ± 0.12^{d}	32.73 ± 0.05^{e}	49.46 ± 0.87^{d}
CS + 2.0 % *h*CNC-200	12.41 ± 0.07^{b}	149.38 ± 0.06^{b}	81.06 ± 0.09^{c}	33.15 ± 0.04^{f}	47.91 ± 0.05^{c}

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Table S3 Thermodynamic parameters of pure corn starch gel and those containing 0.2 %, 0.5 %, 1.0 %, or 2.0 % (*w/w*, relative to the weight of pure CS) of burdock *h*CNCs.

Samples	T_o (℃)	T_p (℃)	T_c (℃)	ΔT (℃)
Pure CS	66.46 ± 0.34^{a}	70.51 ± 0.21^{a}	80.66 ± 0.12^{a}	14.20 ± 0.23^{a}
CS + 0.2 % *h*CNC-600	66.48 ± 0.15^{a}	71.23 ± 0.12^{b}	85.05 ± 0.29^{c}	18.57 ± 0.21^{e}
CS + 0.5 % *h*CNC-600	66.88 ± 0.29^{a}	71.56 ± 0.17^{b}	85.19 ± 0.21^{c}	18.31 ± 1.03^{e}
CS + 1.0 % *h*CNC-600	66.27 ± 1.03^{a}	71.18 ± 0.25^{b}	84.97 ± 0.33^{c}	18.70 ± 1.23^{e}
CS + 2.0 % *h*CNC-600	66.52 ± 0.18^{a}	71.21 ± 0.07^{b}	84.70 ± 0.31^{c}	18.18 ± 0.43^{e}
CS + 0.2 % *h*CNC-400	66.76 ± 0.23^{a}	71.03 ± 0.15^{b}	81.86 ± 0.22^{b}	15.10 ± 0.17^{c}
CS + 0.5 % *h*CNC-400	66.83 ± 0.21^{a}	71.05 ± 0.26^{b}	81.88 ± 0.16^{b}	15.05 ± 0.04^{c}
CS + 1.0 % *h*CNC-400	66.49 ± 0.37^{a}	71.16 ± 0.31^{b}	81.65 ± 0.32^{b}	15.16 ± 0.21^{c}
CS + 2.0 % *h*CNC-400	66.80 ± 0.16^{a}	71.41 ± 0.24^{b}	82.71 ± 0.17^{b}	15.91 ± 0.34^{d}
CS + 0.2 % *h*CNC-200	66.45 ± 0.45^{a}	70.53 ± 0.13^{a}	80.74 ± 0.22^{a}	14.29 ± 0.55^{ab}
CS + 0.5 % *h*CNC-200	66.41 ± 0.29^{a}	70.74 ± 0.19^{a}	81.20 ± 0.52^{ab}	14.79 ± 0.04^{b}
CS + 1.0 % *h*CNC-200	66.32 ± 0.68^{a}	70.57 ± 0.10^{a}	81.04 ± 0.23^{ab}	14.72 ± 0.23^{b}
CS + 2.0 % *h*CNC-200	66.47 ± 0.15^{a}	70.61 ± 0.15^{a}	81.52 ± 0.46^{b}	15.05 ± 0.19^{c}

Different lowercase letters in the same column represent significant differences ($p < 0.05$).

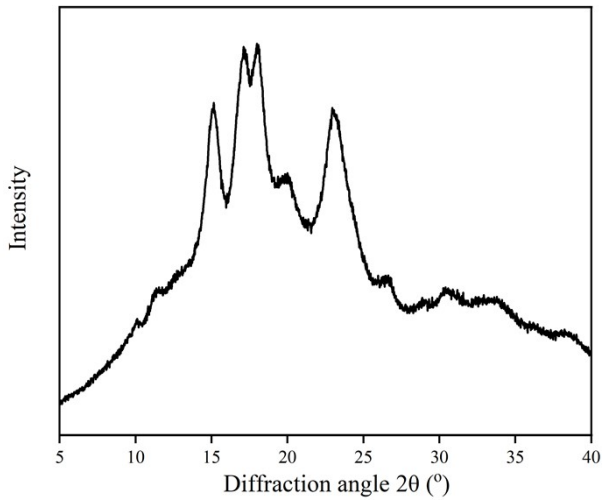

Fig. S2. The XRD pattern of native corn starch.