High-strength cellulose nanofibers produced via swelling pretreatment based on a choline chloride–imidazole deep eutectic solvent

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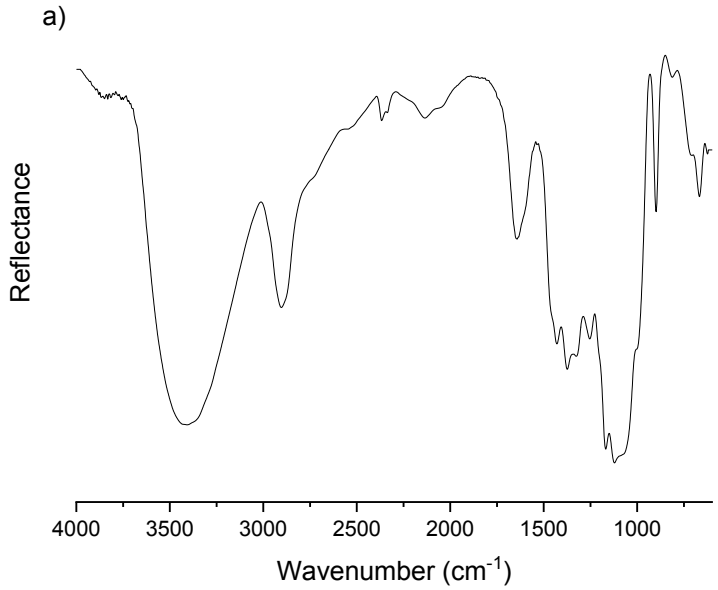
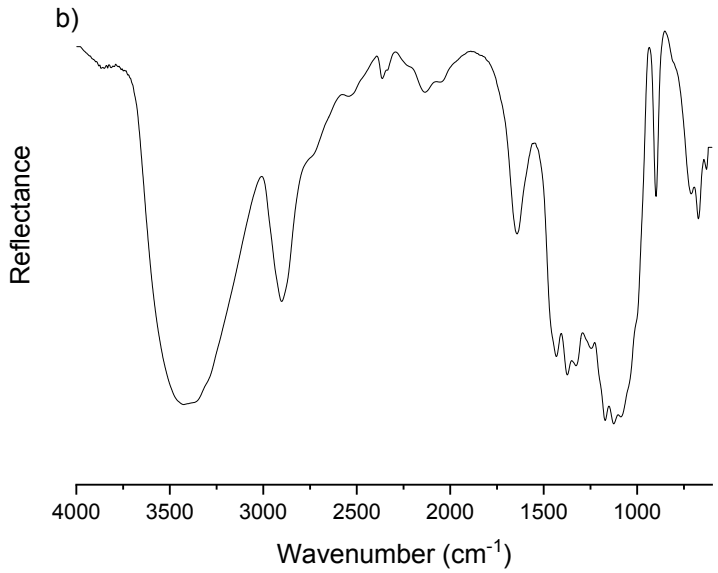
Table S1. Fiber width and CWT of cellulose fibers after treatment with CCIMI DESs at various cellulose/solvent mass ratios for 1 h.

Entry	Cellulose/DES mass ratio	Temperature (°C)	Fiber properties	
			Width (µm)	CWT (µm)
1	1:50	60	19.3	6.4
2	1:50	80	19.5	6.3
3	1:50	100	19.5	6.2
4	1:33	60	19.3	6.3
5	1:33	80	19.6	6.5
6	1:33	100	19.7	6.3
7	1:25	60	19.2	6.2
8	1:25	80	19.2	6.3
9	1:25	100	19.6	6.5

Table S2. The number average molar mass (M_n), weight average molar mass (M_w), and polydispersity (PD) of cellulose before and after treatment with CCIMI at 100°C for 180 min and CCUrea 100°C for 120 min

Sample	M_n (g/mol)	M_w (g/mol)	PD
Original pulp	47 000 ± 3000	476 000 ± 29 000	10.2 ± 0.3
CCIMI 100C 180 min	51 000 ± 2000	543 000 ± 85 000	10.6 ± 1.7
CCUrea 100C 120 min	52 000 ± 13 000	728 000 ± 79 000	14.4 ± 2.2


a)
Reflectance
4000
3500
3000
2500
2000
1500
1000
Wavenumber (cm-1)


b)
Reflectance
4000
3500
3000
2500
2000
1500
1000
Wavenumber (cm-1)

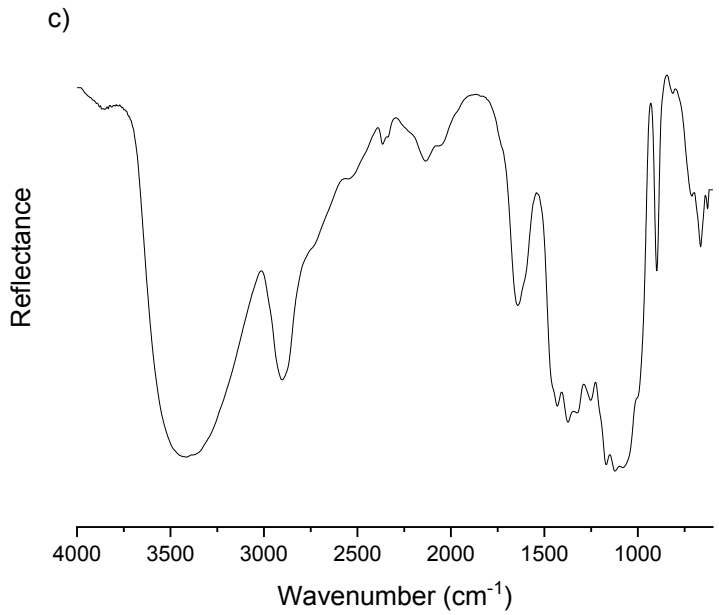
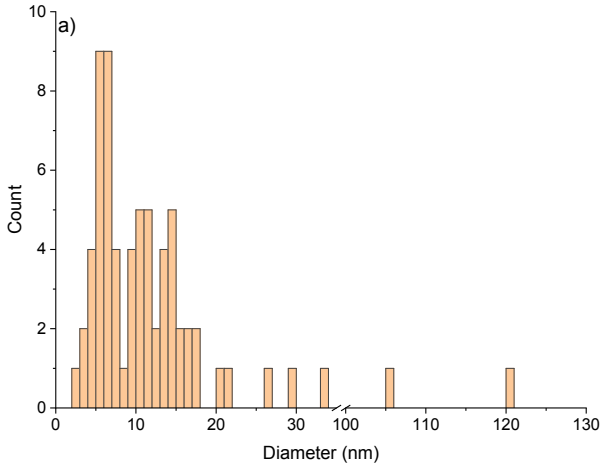
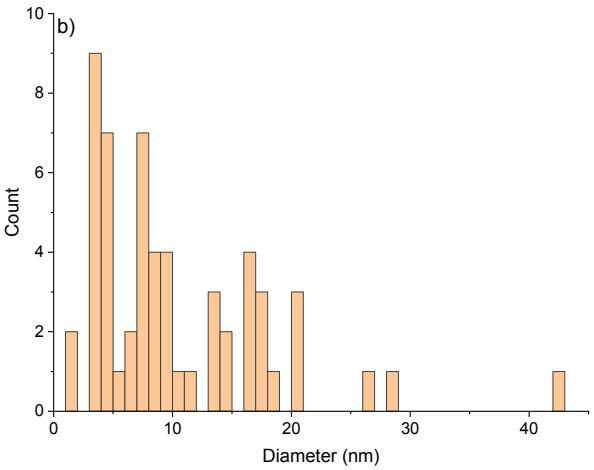
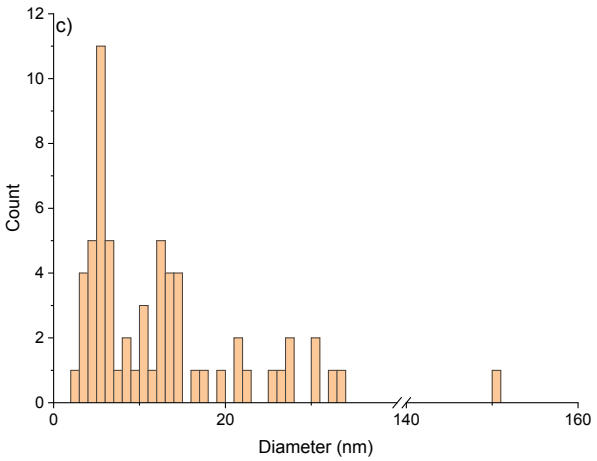


Figure S1. DRIFT spectra of DES treated fibers: a) CCIMI 15 min 60 °C, b) CCIMI 180 min 60 °C,

Figure S2. Aerogels produced by freeze-drying from CNFs obtained from DES treated cellulose fibers, from left to right: CCIMI 15 min 60 °C; CCIMI 180 min 60 °C; CCIMI 15 min 100 °C; CCIMI 180 min 100 °C; CCUrea 120 min 100 °C


a)
Count
Diameter (nm)
0
2
4
6
8
10
0
10
20
30
100
110
120
130


b)
Count
Diameter (nm)
0
2
4
6
8
10
0
10
20
30
40


c)
Count
Diameter (nm)
0
2
4
6
8
10
12
0
20
140
160

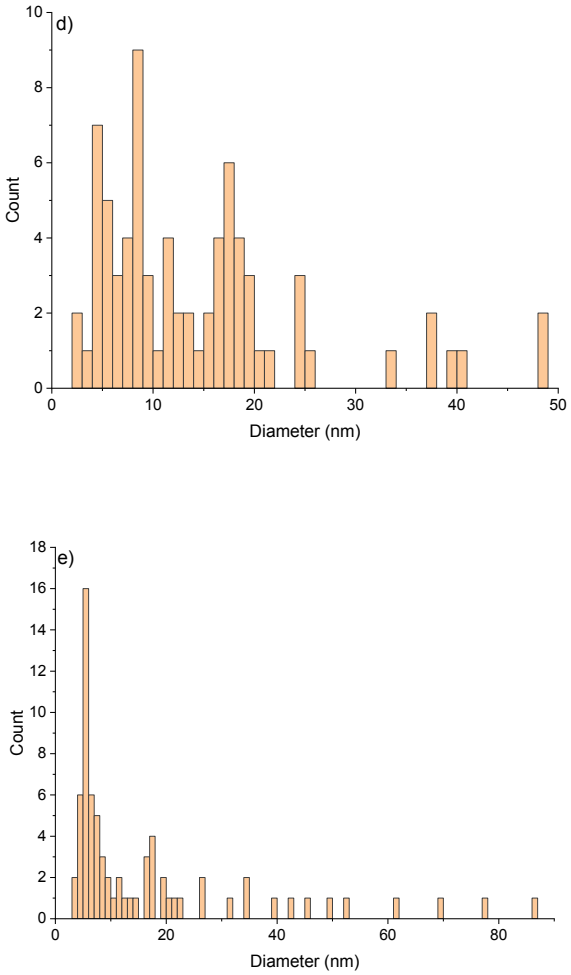


Figure S3. The histograms of the diameters of cellulose nanofibers produced from DES pre-treated fibers. a) CCUrea 60 °C 15 min b) CCUrea 60 °C 180 min c) CCUrea 100 °C 15 min d) CCUrea 100 °C 180 min e) CCUrea 100 °C 120 min

5

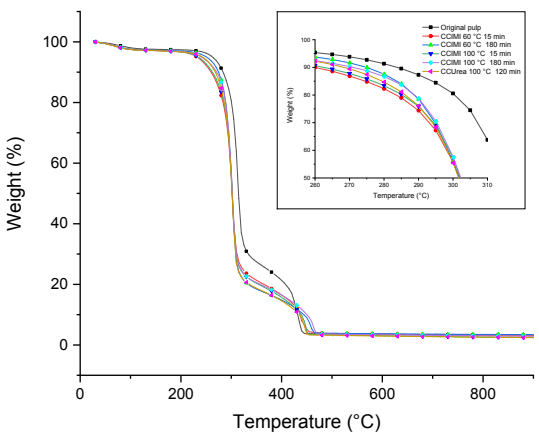


Figure S4. TGA curves of original pulp and CNFs produced from CCIMI and CCUrea treated fiber measured in air.

Table S3. Yield and the water content of the CCIMI after recycling

Recycling times	Mass after evaporation (g)	Water content (%)[a]
1	263	4.9
2	264	5.3
3	260	3.8
4	260	3.8

[a] Calculated from the original mass of the DES

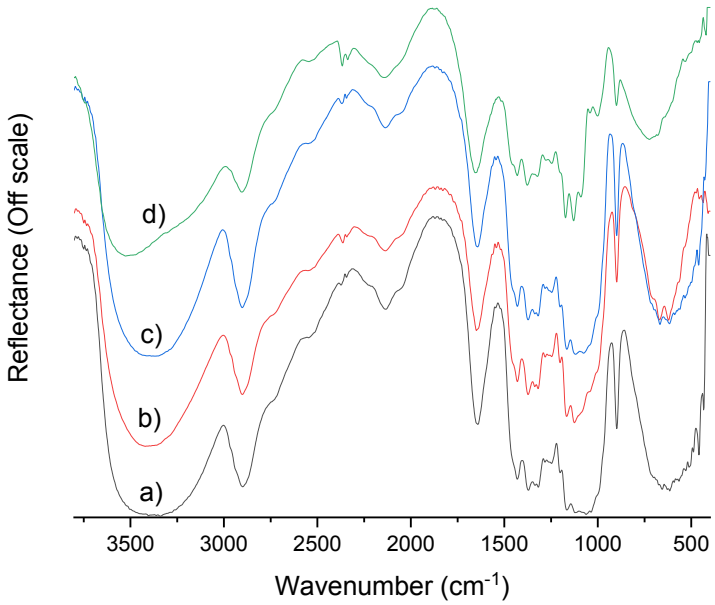


Figure S5. DRIFT spectra of CNFs produced using pristine CCIMI (a) and after 1 (b), 2 (c), and 3 (d) recycling.