Supplementary Information

Efficient preparation of fluorescent nanomaterials derived from chitin via modification first strategy assisted by click chemistry

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Experimental Section

(1) Deacetylation of Chitin

α-Chitin (1 g) was suspended in 33% (w/w) NaOH (25 ml) and the slurry was heated at 90°C for 4 h with stirred. The partially deacetylated chitin was collected, and thoroughly washed with de-ionized water by repeated centrifugation at 8000 r/min for 5 min to neutrality. A portion of the wet NaOH-treated product was freeze-dried for further analyses, and the rest was kept in the wet state at 4°C.

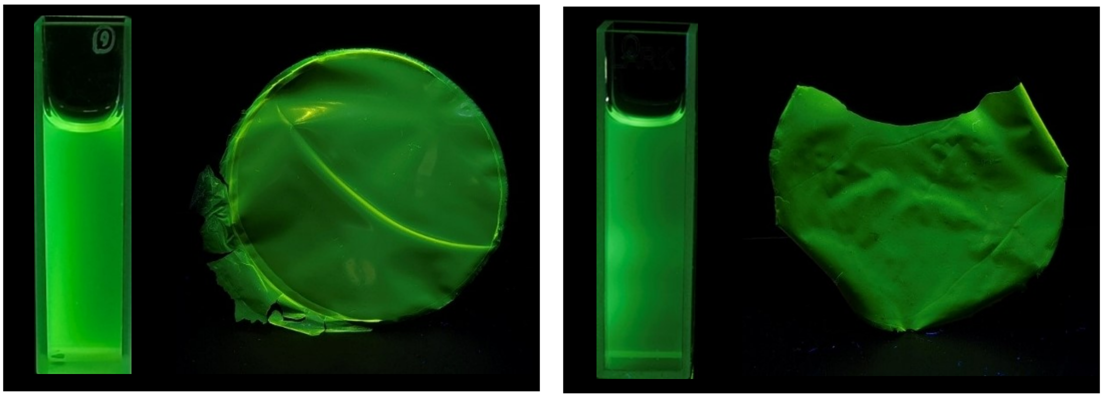
(2) Preparation of TOChN-PPK and ChitinPPK

The preparation method of TOChN is as follows, the ratio of chitin to water was 1:100 (g/v) consisting of TEMPO (0.016 g/g chitin) and NaBr (0.10 g/g chitin), and then NaClO solution (8 mmol/g chitin) was mixed in the suspension in order to oxidize all the hydroxyl group at the C6 position. Moreover, the pH of the mixture was kept at 10 for 4 h at room temperature. Next, the sediments were cleaned to neutral with distilled water and homogenized under high pressure. The TOChN aqueous dispersion (the concentration was 1.01%, and the carboxyl content of TOChN was 0.93 mmol/g) was centrifuged (5 min, 8000 rpm) and stored at 4°C until use.

TOChN dispersion (0.10 g dry weight) was taken to adjust pH to 13, 0.081 g PPK (0.62 mmol) (dissolved in DMF) and DMAP (0.0075 g, 0.062 mmol) were added and stirred for 4 h. Finally, TOChN-PPK were obtained by multi centrifugal washing with ethanol.

Chitin powder (0.10 g dry weight) was dispersed in water and the pH was adjusted pH to 13, 0.081 g PPK (0.62 mmol) (dissolved in DMF) and DMAP (0.0075 g, 0.062 mmol) were added and stirred for 4 h. Finally, ChitinPPK were obtained by multi centrifugal washing with ethanol.

Supplementary Figures



Strategy a: via modification first **Strategy b: via nanosizing first**

Figure.S1 The left figure shows the dispersion and film of fluorescent chitin nanofibers prepared by modification first of strategy a. The right figure shows the dispersion and film of fluorescent chitin nanofibers prepared by nanosizing first of strategy b.

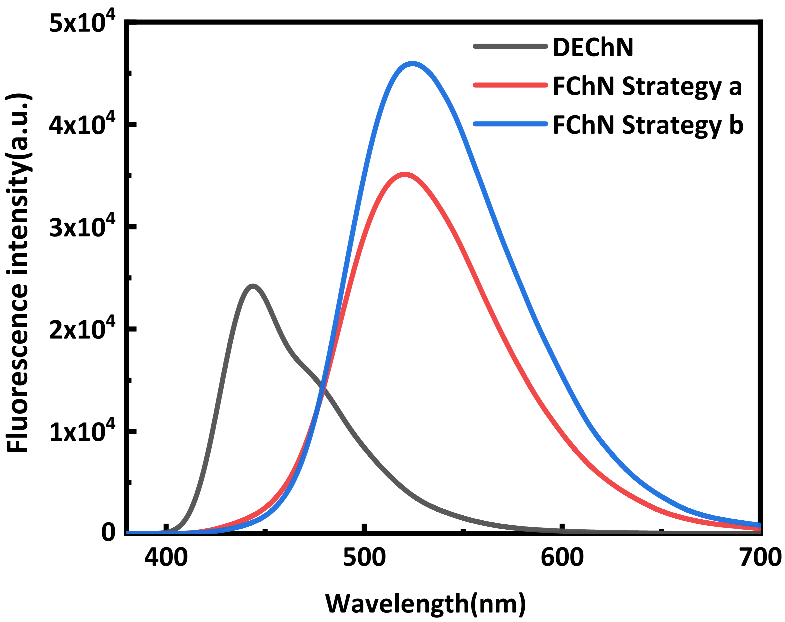


Figure.S2 Emission spectra of fluorescent chitin nanofibers prepared by two strategies.

Table S1 The amount of chemical reagents used and wasted in additional steps in traditional methods strategy b

Procedure	Chemical reagent			Waste salt
	NaOH/g	Acetic acid/mL	Distilled water/mL	Sodium acetate/g
b1	2.58	-	640	-
b2	-	5.00	500	-
b3	4.30	-	200	7.20

NOTE: The amount of the chemical reagents is calculated based on 1.00 g chitin and the resulted FChN dispersion with a concentration of 0.20 wt%.

Table S2 Comparison of preparation processes of different fluorescent nanofibers.

Entry	Sample name	Modification		Separation		Ref.
		temperature	time	steps	reagent	
1	dChNC-FITC	RT	36 h	centrifugation	ethanol, water	1
2	FChN	120℃	4-48 h	centrifugation, filtration	ethanol	2
3	DTAF-CNF	RT	24 h	vacuum filtration, centrifugation and ultrafiltration	NaOH	3
4	TOCNC-AANI	RT	16 h	centrifugation, dialysis	water	4
5	CNC-RBITC	60℃	4 h+24 h	dialysis	water	5
6	FCNC	RT	16 h	centrifugation, dialysis	water	6
7	FCNF	60℃	4 h+24 h	centrifugation, filtration	water	7
8	DTAP-CNF	RT	24 h	centrifugation, dialysis	water, PBS	8
9	FChN	RT	4 h	centrifugation	ethanol	This work

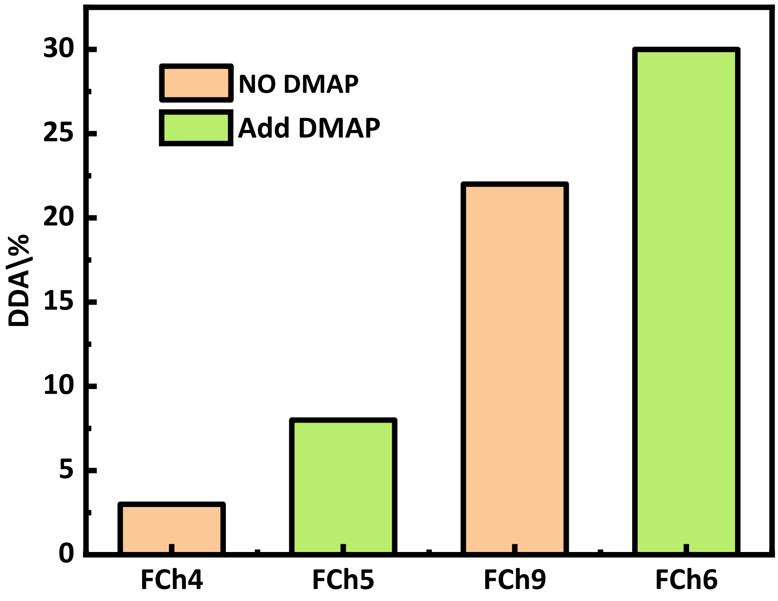


Figure S3 DDA of different FCh samples.

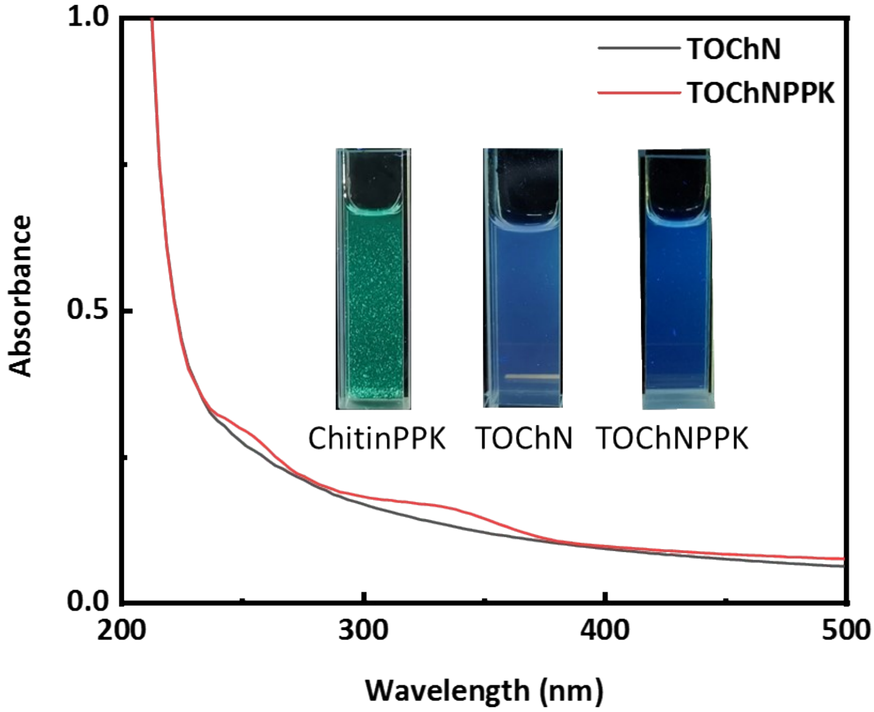


Figure S4 The absorbance of TOChN and TOChN-PPK and digital photographs of ChitinPPK, TOChN and TOChNPPK under UV (365 nm).

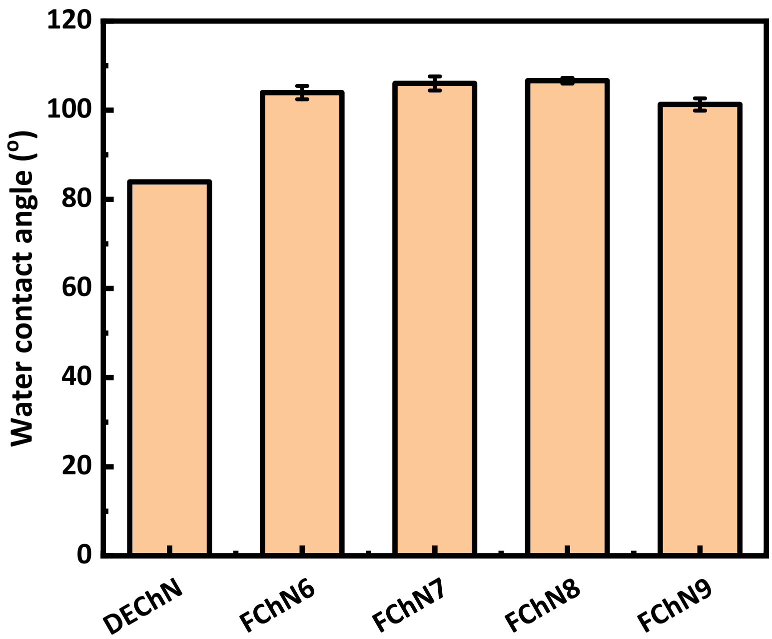


Figure.S5 Hydrophobicity of DEChN and FChN6-9.

Table S3 Summary of mechanical properties and UV shielding properties of different sustainable materials.

Entry	Sample name	Stress/ MPa	UV shielding/%	UV shielding to/nm	Ref.
1	ChNF/PVA	225.00	100.00	360	[9]
2	PVA-ChNF-LNPs	33.24	100.00	350	[10]
3	GL	70.00	100.00	400	[11]
4	CMC/Pal-D1	40.02	97.00	300	[12]
5	CNF-VE	127.78	100.00	400	[13]
6	C/PVA/CIP	54.00	100.00	355	[14]
7	BACNC	11.55	97.00	300	[15]
8	CS:hBNNSs	35.90	96.40	400	[16]
9	HEC/ANFs	55.60	100.00	375	[17]
10	ACN	73.50	87.00	400	[18]
11	PI/PDA-120	94.10	100.00	400	[19]
12	FChN	200.12	100.00	400	This work

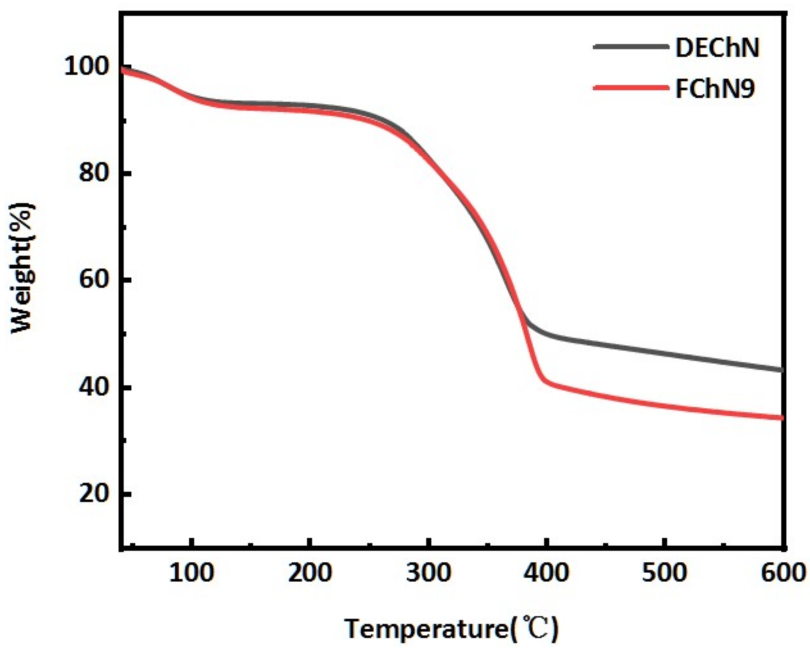


Figure S6 Thermal stability analysis of FChN9 and DEChN

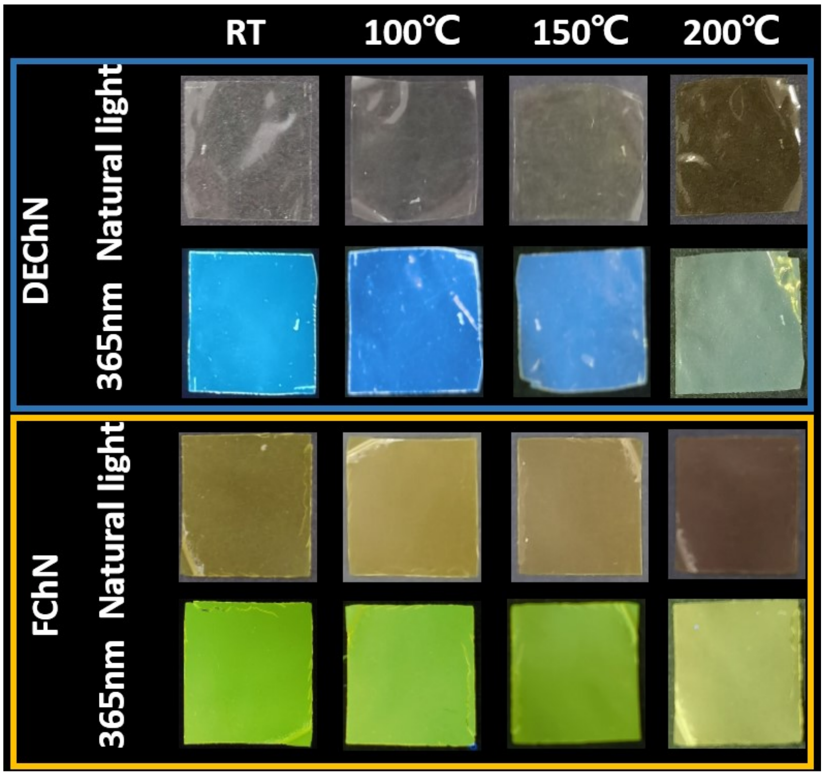


Figure S7 Stability of DEChN and FChN9 at different temperatures

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