Supplementary Information (SI) for RSC Advances.
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Electronic supplementary information

Seaweed residue as a low-cost source for producing cellulose nanofibrils with ultraviolet shielding properties

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Table S1 Component analysis of SR

component	content (%), dry basis
ash	24.43±4.48
lipid	3.98±0.60
cellulose	63.64±5.44
water-soluble	6.45±0.36
protein	Nd

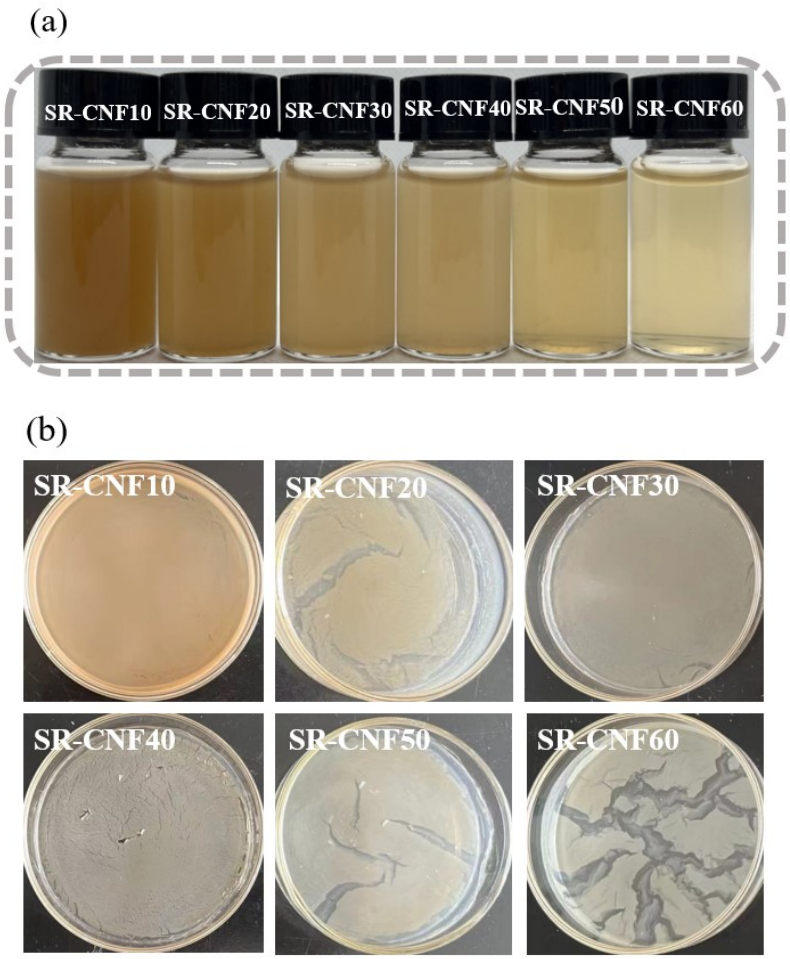

Fig. S1 The visual characteristics of the SR-CNF suspensions (a) and the dried samples (b).

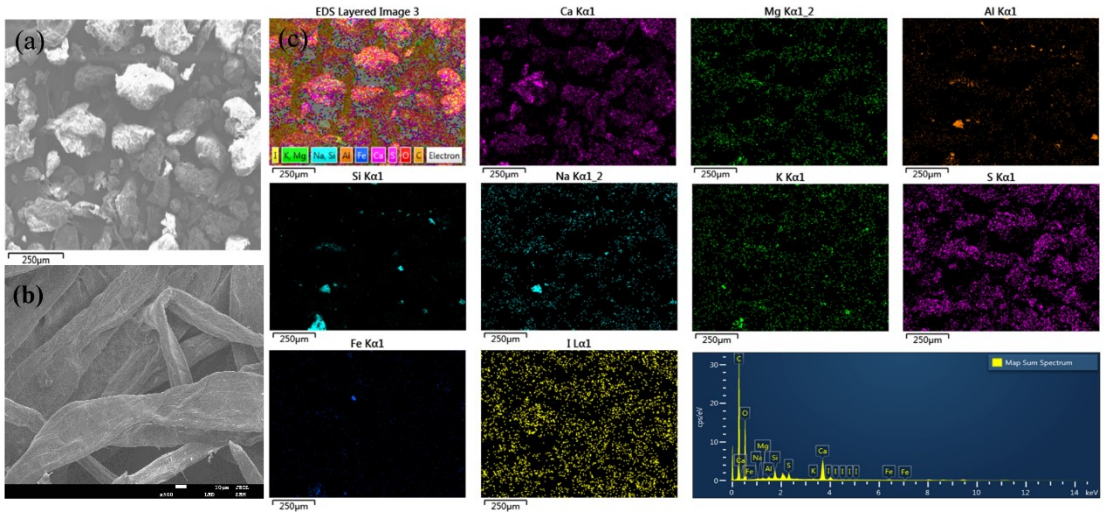

Fig. S2 SR microscopic analysis: (a) SR microscopic appearance, (b) bleached SR microscopic appearance, (c) EDS analysis.

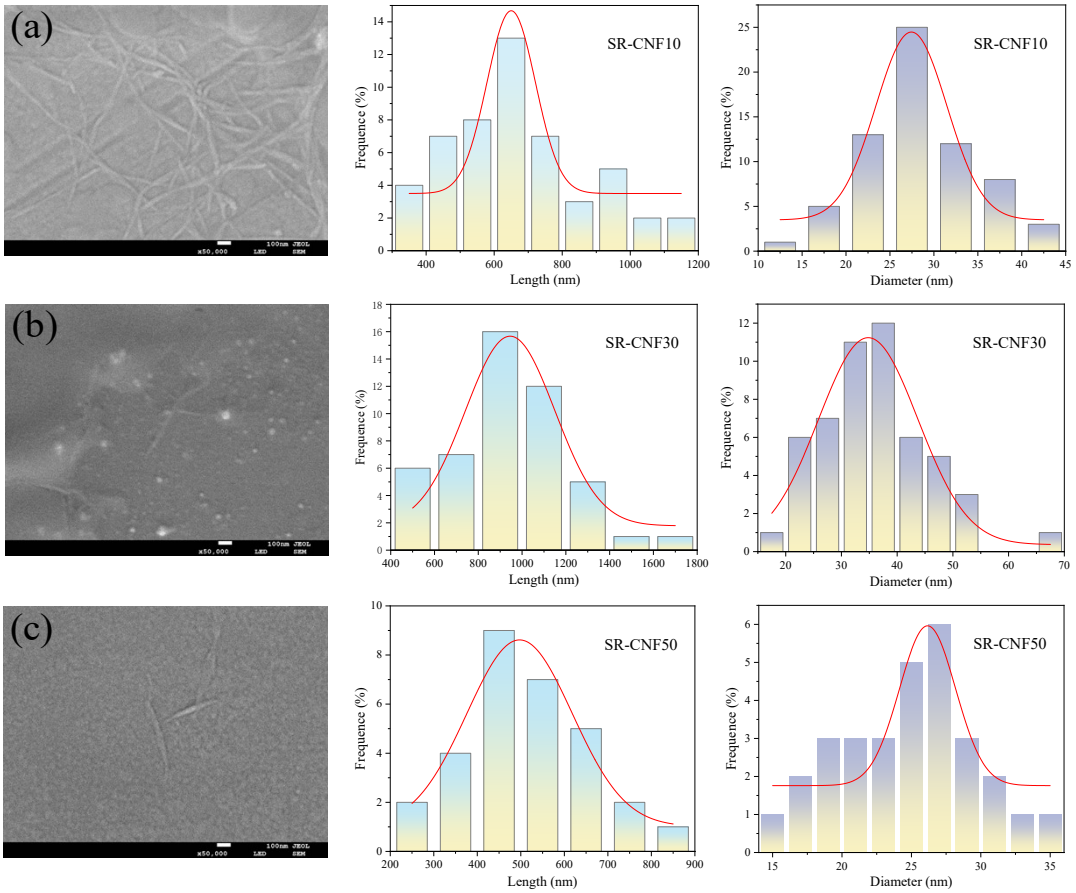

Fig. S3 Effects of OA concentrations in pretreatment systems on the size distribution of prepared SR-CNFs.

Table S2 Average length and diameter of SR-CNF samples prepared using OA-water pretreatment.

Samples	SR-CNF	
	Length (nm)	Diameter (nm)
SR-CNF10	957.6±210.6	36.0±3.8
SR-CNF20	670.9±208.4	28.4±4.1
SR-CNF30	640.6±198.7	27.5±3.8
SR-CNF40	503.9±188.1	26.8±3.3
SR-CNF50	498.1±206.3	24.6±3.3
SR-CNF60	419.7±152.7	21.4±3.5

Table S3 The d-spacing, CrI, D_{hkl} and Z-value of SR and prepared SR-CNFs.

Samples	D-spacing (nm)			Z	D_{hkl} (nm)			CrI (%)
	d_1	d_2	d_3		$1\bar{1}0$	110	200	
SR	0.60	0.53	0.39	11.26	3.98	8.70	3.33	76.73
SR-CNF10	0.60	0.55	0.40	37.21	5.47	8.29	4.21	65.21
SR-CNF20	0.61	0.54	0.40	28.19	3.80	8.31	3.40	66.72
SR-CNF30	0.59	0.54	0.40	44.14	13.78	8.78	4.74	71.47
SR-CNF40	0.58	0.54	0.40	31.10	6.57	9.11	3.64	68.03
SR-CNF50	0.60	0.54	0.40	15.53	5.31	11.46	4.47	66.72
SR-CNF60	0.60	0.54	0.40	20.28	4.48	12.84	3.59	62.50

Table S4 T_0, T_{max} and char residue (500 °C) for SR-CNFs

Samples	T_0 (℃)	T_{max} (℃)	residue at 500℃ (%)
SR	279.6	358.5	29.4
SR-CNF10	269.	344.0	21.0
SR-CNF20	287.1	348.9	17.3
SR-CNF30	290.2	353.7	15.0
SR-CNF40	293.1	346.9	12.8
SR-CNF50	297.8	343.2	9.3
SR-CNF60	311.3	342.4	8.5

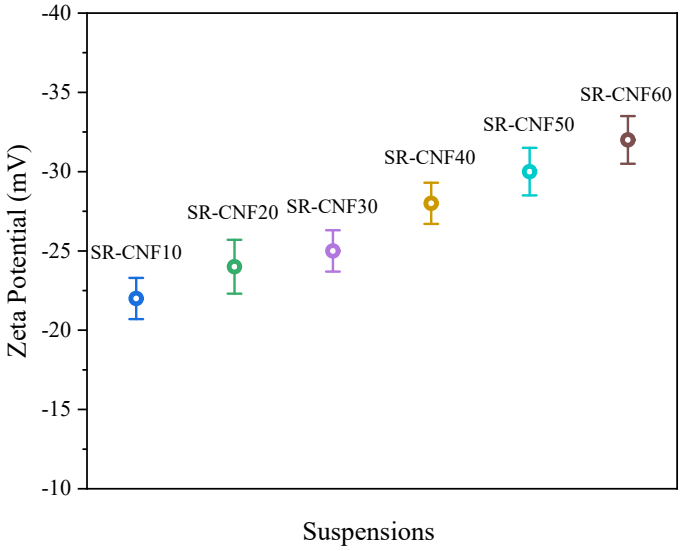

Fig. S4 Zeta potentials of the suspensions of prepared SR-CNFs.

Table S5 U_{VA} and U_{VB} blocking rates of composite films

	PNG20	PNG60	PMG	PCG
$B_{UV\text{-}A\%}$	95.8	95.8	91.2	88.8
$B_{UV\text{-}B\%}$	98.7	98.9	97.7	94.9

Fig. S5 The ultraviolet shielding performance of the PBSRG composite film

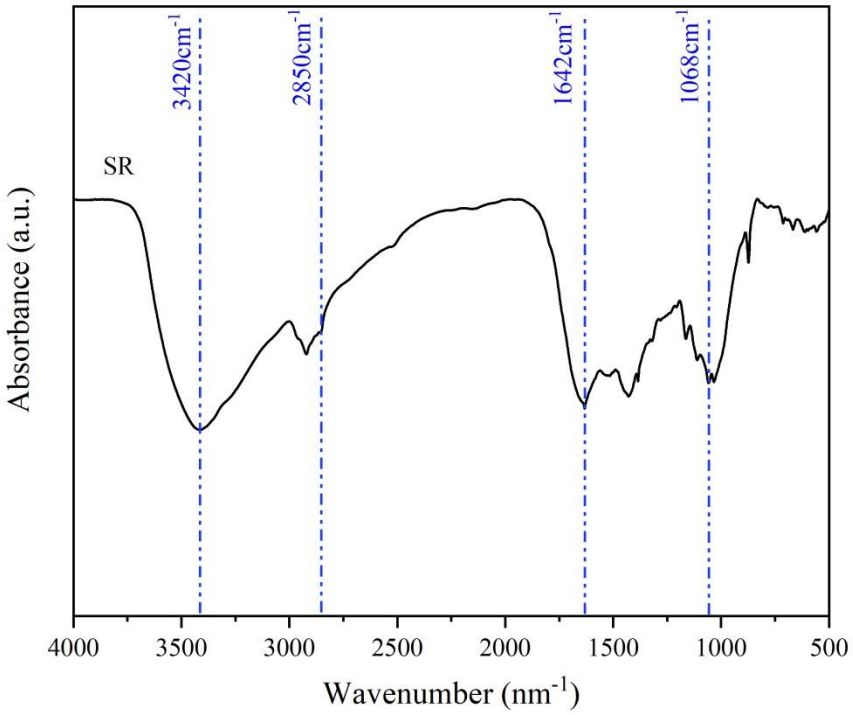

Fig. S6 FT-IR spectrum of SR.

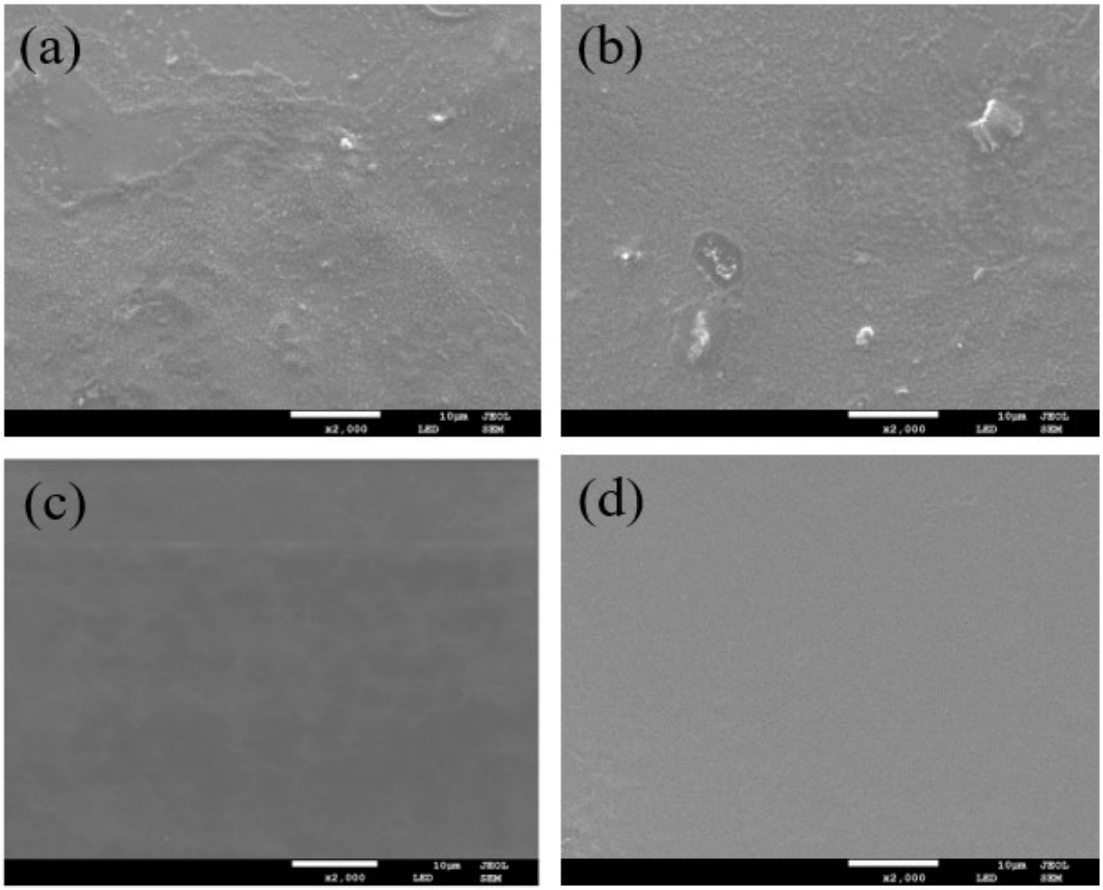

Fig. S7 SEM images of the composite film surfaces: PMG (a), PCG (b), PNG20 (c), and PNG60 (d).

Table S6 Physical and mechanical properties of composite films reported in literatures.

sample	tensile strength (MPa)	elongation at break (%)	ref.
SR-CNF/CMC	13.9	83.2	this work
potato peel/chitosan	4.8	31.0	S1
coconut shells	6.7	102.4	S2
rice straw/starch	6.6	19.3	S3
bagasse/maize starch	12.8	16.4	S4
ginger	44.2	45.4	S5
cotton linter pulps/lactic acid/[VBIm][BF_4]-CNC	101.3	130.0	S6

(note: All samples contained PVA, [VBIm][BF_4]is a kind of ionic liquid (IL): 1-vinyl-3-butylimidazolium tetrafluoroborate)

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