Supplementary Material

Cellulose Nanofibril/Carbon Nanomaterial Hybrid Aerogels for Adsorption Removal of Cationic and Anionic Organic Dyes

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Figures

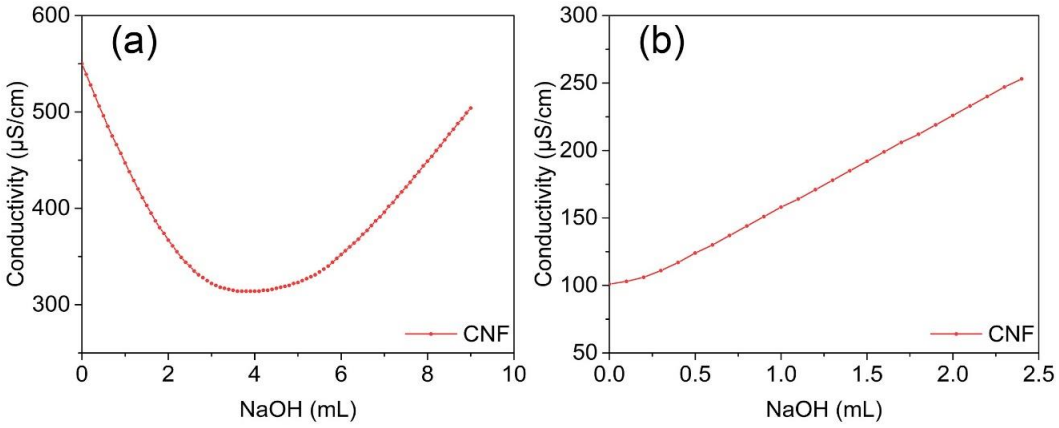


Figure S1 Conductometric titration curves of CNF (a) with HCl added and (b) without HCl added. In Figure a, before titration, hydrochloric acid of 1 mL (0.1N) was added to CNF suspension (0.1 wt%) of 50 mL to protonate the carboxyl groups. After that, the suspension was titrated with 0.02 M NaOH solution. The COOH+COO- content of the original CNF was calculated based on the NaOH amount added in the plateau region. In Figure b, the CNF suspension (0.1 wt%) of 50 mL was directly titrated with 0.02 M NaOH solution. The COOH content of the original CNF was calculated based on the NaOH amount added in the plateau region.

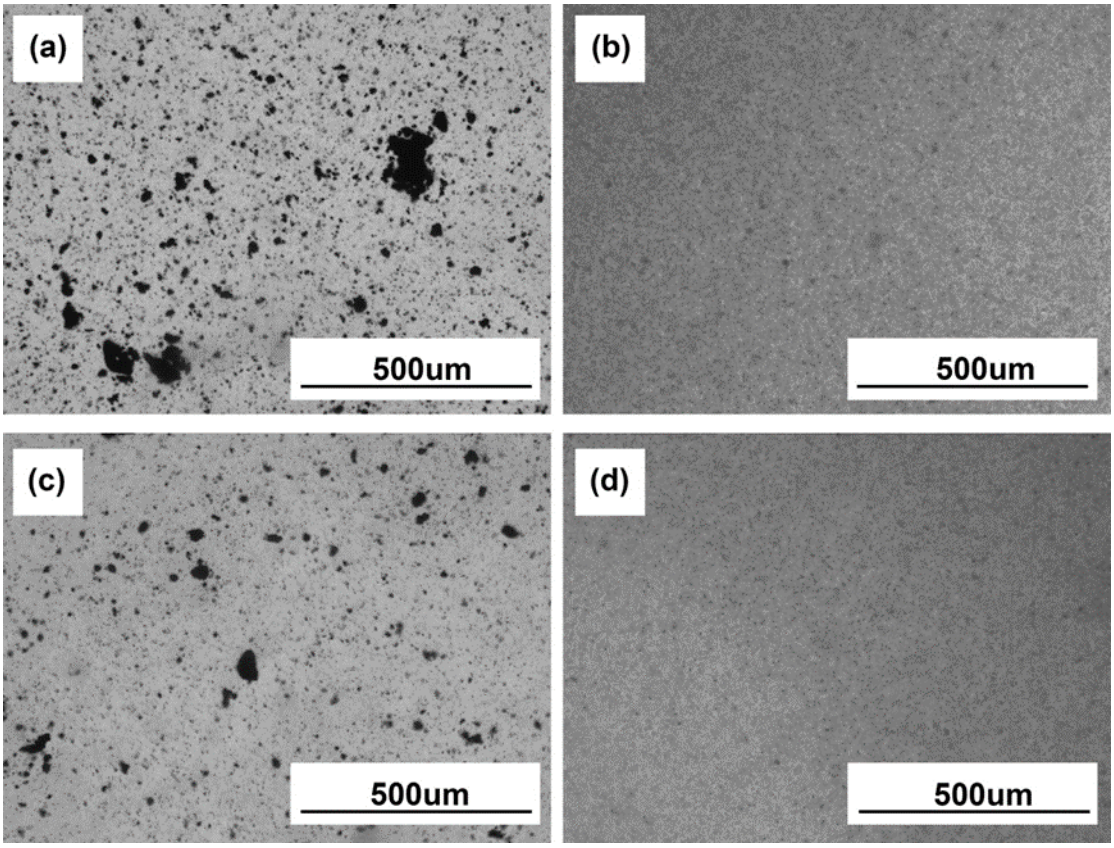


Figure S2. Optical micrographs of (a) CNF/CNT 3:1 after 5 min ultrasonic treatment; (b) CNF/CNT 3:1 after 30 min ultrasonic treatment; and (c) CNF/GnP 3:1 after 5 min ultrasonic treatment; (d) CNF/GnP 3:1 after 30 min ultrasonic treatment.

Tables

Table S1. Chemical structure, molecular weight, maximum absorption wavelength and electrical property of methylene blue and Congo red.

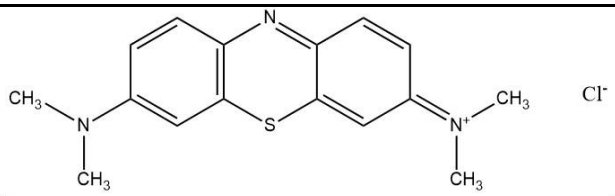
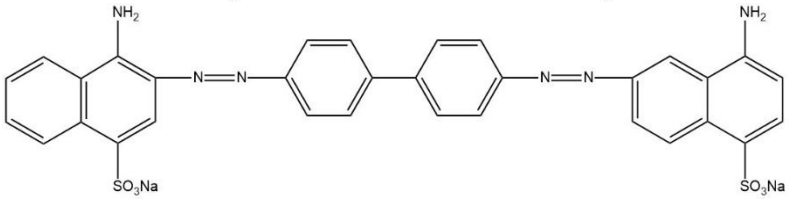
Dyes	Chemical formula	Molar mass (g mol^{-1})	λ_{max}(nm)	Electrical property
methylene blue (MB)		319.9	664	Cationic
Congo red (CR)		696.7	498	Anionic

Table S2. Group statistics of the final adsorption of MB.

	Type	N	Mean	Std. Deviation	Std. Error Mean
The final adsorption of MB	CNF–GnP 3:1	3	1166.082	25.7257	14.8528
	CNF–CNT 3:1	3	1130.145	14.2890	8.2498

Table S3. Independent samples test of the final adsorption of MB onto CNF–GnP 3:1 and CNF–CNT 3:1. Whether these two materials had significantly different effects on the final adsorption of MB was investigated. Sig.=0.48>0.05, so the variances are equal. In this case, Sig.(2-tailed) =0.102>0.01. Therefore, the effect of these two materials on the final adsorption of MB had no significant difference.

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
The final adsorption of MB	Equal variances assumed	.604	.480	2.115	4	.102	35.9370	16.9901	-11.2350	83.1090
	Equal variances not assumed			2.115	3.127	.121	35.9370	16.9901	-16.9136	88.7875

Table S4. Group statistics of the final adsorption of CR

	Type	N	Mean	Std.Deviation	Std.Error Mean
The final adsorption of CR	CNF–GnP 3:1	3	507.059	36.0784	20.8299
	CNF–CNT 3:1	3	381.387	14.1596	8.1751

Table S5. Independent samples test of the final adsorption of CNF–GnP 3:1 and CNF–CNT 3:1to CR. Whether these two materials had significantly different effects on the final adsorption of CR was investigated. Sig. = 0.336 > 0.05, so the variances are equal. In this case, Sig.(2-tailed) = 0.005 < 0.01. Therefore, the effect of these two materials on the final adsorption of CR had significant difference.

		Levene's Test for Equality of Variances		*t-test for Equality of Means*						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
The final adsorption of MB	Equal variances assumed	1.191	.336	5.616	4	.005	125.6722	22.3767	63.5445	187.7998
	Equal variances not assumed			5.616	2.602	.016	125.6722	22.3767	47.8795	203.4648