Electronic Supplementary Material (ESI) for Green Chemistry.

Electronic Supplementary Information

Deep eutectic solvent assisted zero-waste electrospinning of lignin fiber aerogels

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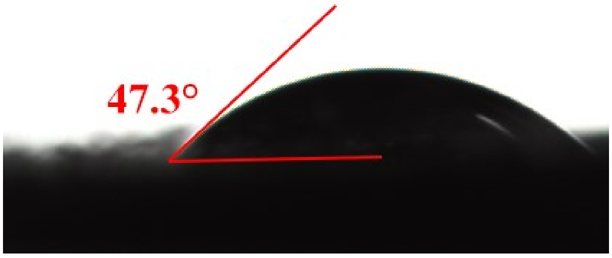

Fig. S1 Water contact angle of LFA.

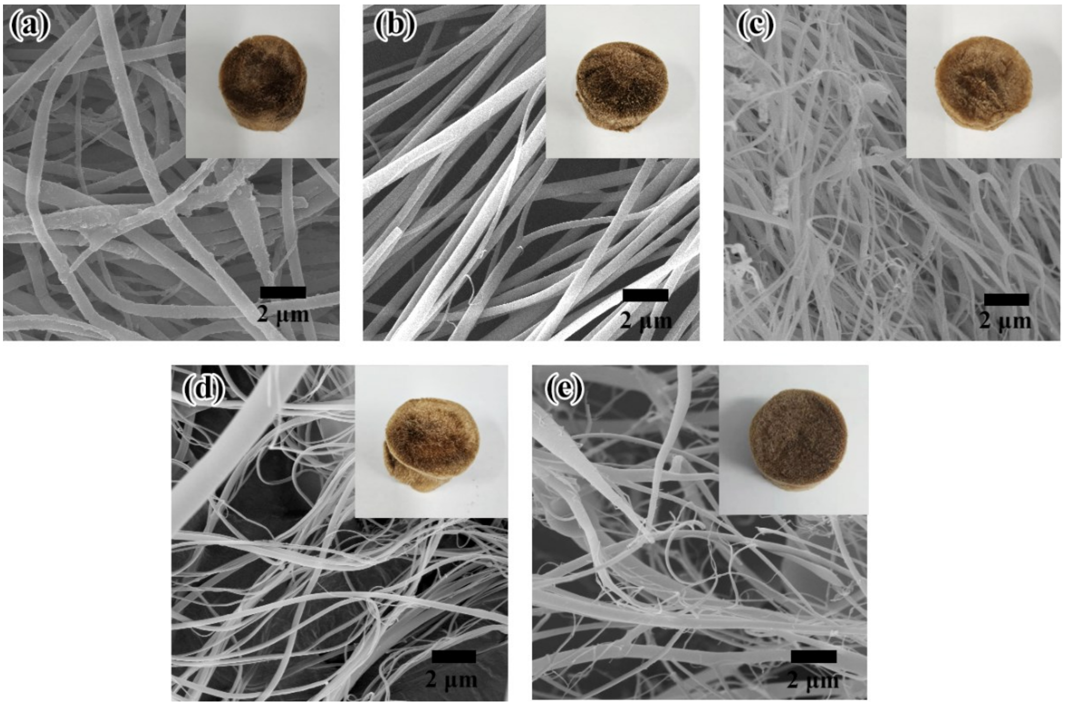

Fig. S2 (a-e) Photographs (inset) and SEM images of RLFA synthesized with recycled electrospinning solution from the first to the fifth cycle.

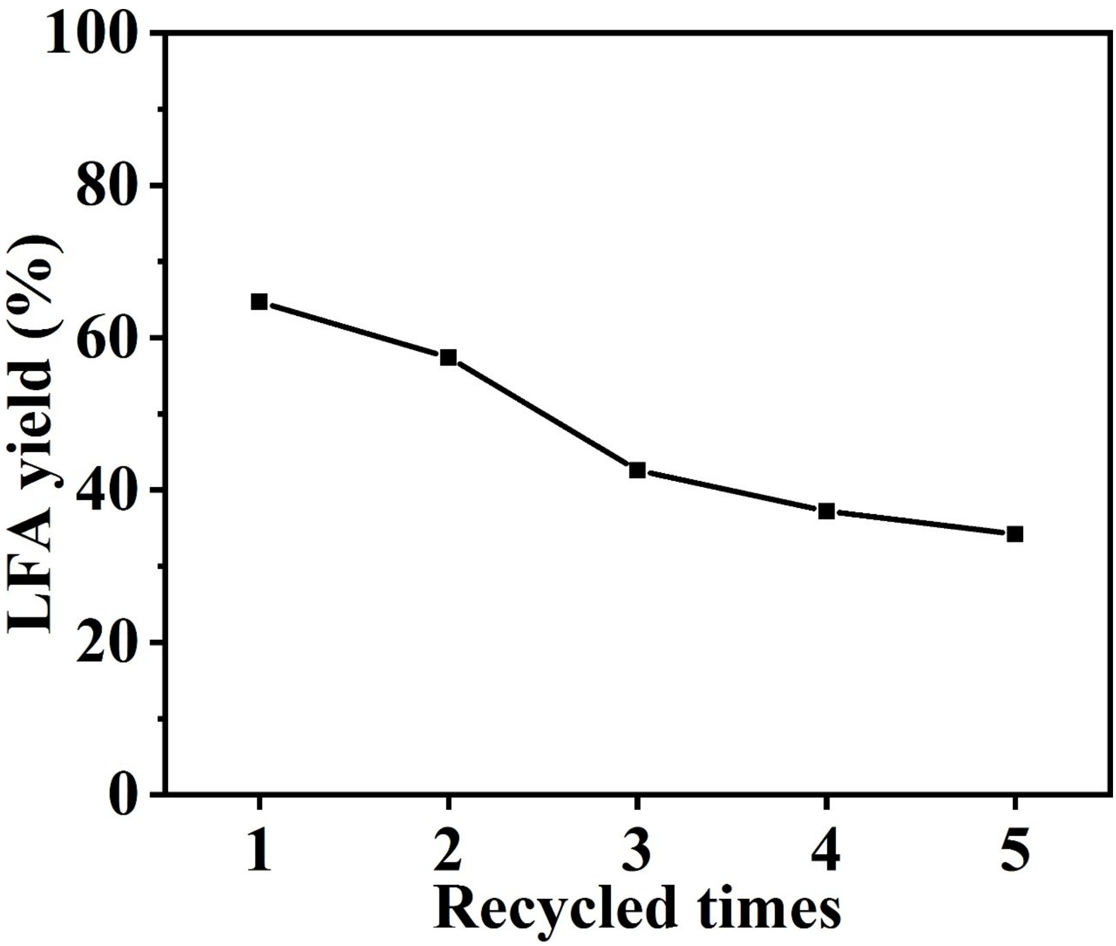

Fig. S3 LFA yield for every cycle.

Table S1. DES recovery rates, lignin, PVA, and H_2O contents of initial electrospinning solution and recycled black liquid for every cycle.

Electrospinning solution	DES recovery rates (wt%)	Lignin content (wt%)	PVA content (wt%)	H_2O content (wt%)
Initial electrospinning solution	-	10	2	<1
Recycled black liquid for the first time	57.1	3.12	1.7	<1
Recycled black liquid for the second time	64.8	1.31	1.8	<1
Recycled black liquid for the third time	68.4	1.56	1.5	<1
Recycled black liquid for the fourth time	51.6	1.07	1.9	<1
Recycled black liquid for the fifth time	81.0	1.33	1.5	<1

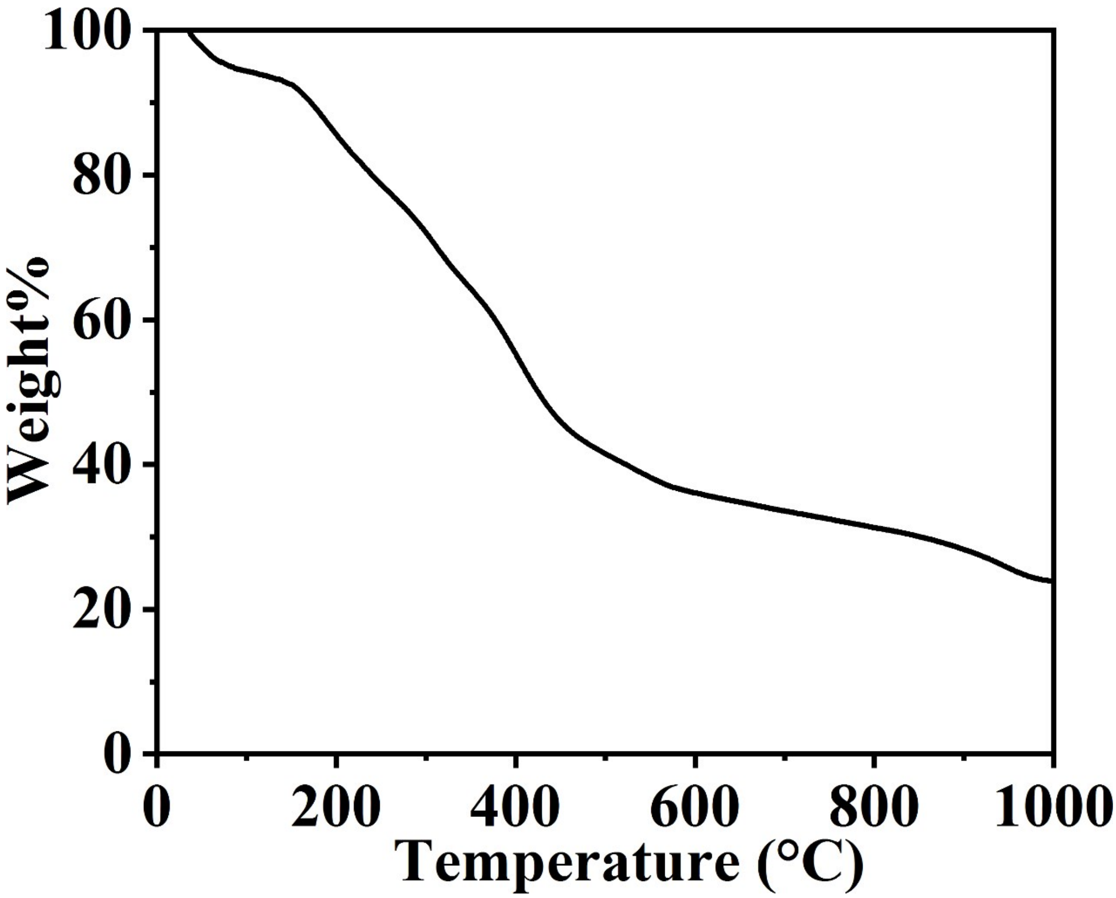

Fig. S4 TGA curve of calcining LFA in N_2 atmosphere.

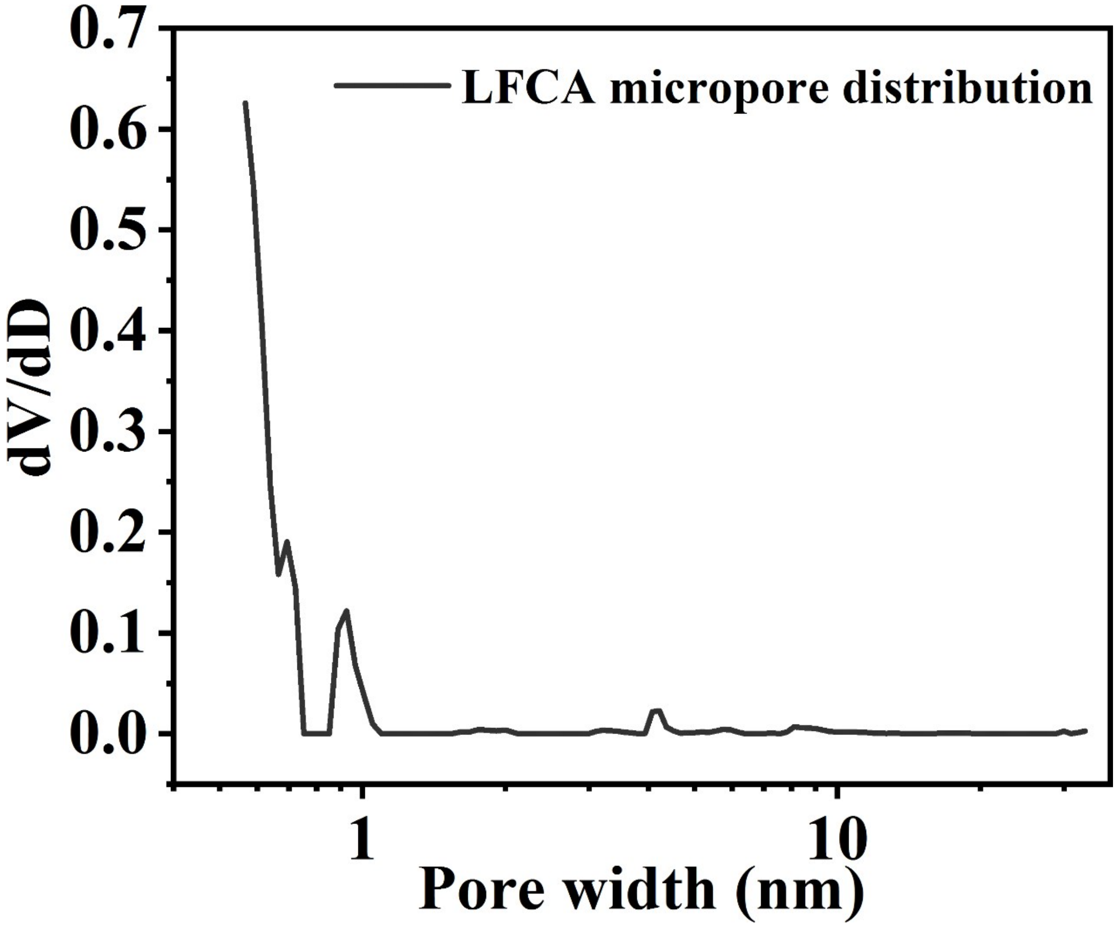

Fig. S5 The micropore distribution of LCFA.

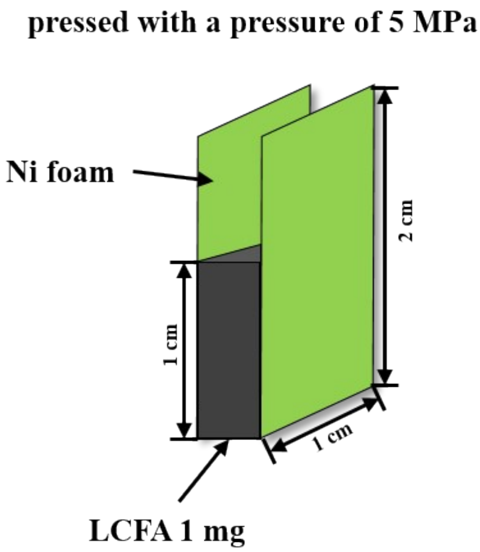

Fig. S6 Illustration of supercapacitor electrodes made by LCFA material and Ni foams.

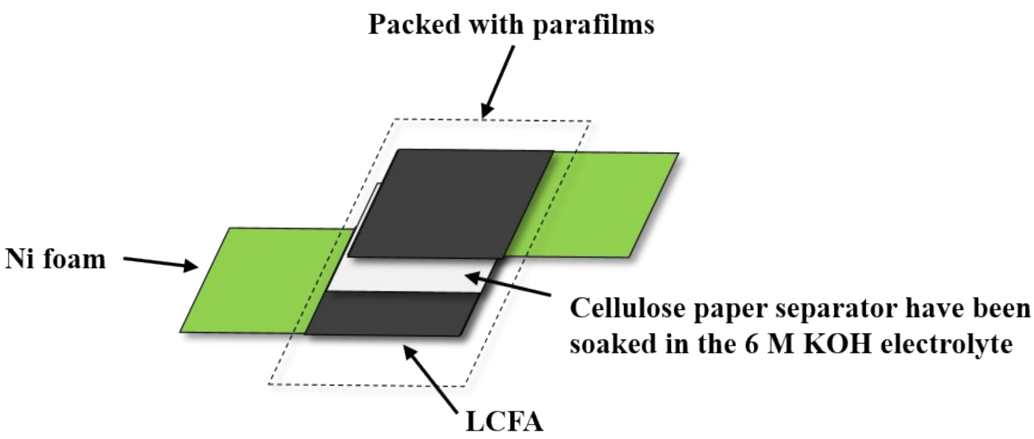

Fig. S7 Illustration of supercapacitor cell.

Table S2. Comparison of supercapacitor cell performances for lignin-based carbon materials.

Lignin-based supercapacitor material	Specific surface area (m^2 g^{-1})	Electrolyte	Specific capacitance (F g^{-1})	Energy density (Wh kg^{-1})	Capacitance retention	Reference
Lignin-based carbon fiber aerogel	580	6 M KOH	146.8 (at 0.5 A g^{-1})	5.04	98% 5000th	This work
Lignin fiber mats	583	6 M KOH	64 (at 0.4 A g^{-1})	5.67	90% 6000th	[1]
Lignin-derived nanoporous carbon	1092	1 M H_2SO_4	91 (at 0.5 A g^{-1})	12.8	80% 10000th	[2]
Lignin-derived carbon aerogels	1681.6	1 M H_2SO_4	198.4 (at 0.5 A g^{-1})	14.4	97.4th 10000th	[3]
PAN/PMMA/Lignin cross-linking carbon nanofibers	364	6 M KOH	233 (at 0.5 A g^{-1})	6.84	95.8% 50000th	[4]

References

1 C. L. Lai, Z. P. Zhou, L. F. Zhang, X. X. Wang, Q. X. Zhou, Y. Zhao, Y. C. Wang, X. F. Wu, Z. T. Zhu and H. Fong, *J. Power Sources*, 2014, **247**, 134-141.

2 J. W. Jeon, L. B. Zhang, J. L. Lutkenhaus, D. D. Laskar, J. P. Lemmon, D. Choi, M. I. Nandasiri, A. Hashmi, J. Xu, R. K. Motkuri, C. A. Fernandez, J. Liu, M. P. Tucker, P. B. McGrail, B. Yang and S. K. Nune, *ChemSusChem*, 2015, **8**, 428-432.

3 Y. F. Zhang, C. Y. Zhao, W. K. Ong and X. H. Lu, *ACS Sustain. Chem. Eng.*, 2019, **7**, 403-411.

4 D. P. Xuan, J. Liu, D. C. Wang, Z. Lu, Q. Liu, Y. X. Liu, S. R. Li and Z. F. Zheng, *Energy Fuels*, 2021, **35**, 796-805.