Supplementary Information

1. Tables of wet finishing processes

Tab. S1 Traditional wet finishing process

Process	Materials	Dosage/ %	Temperature /ºC	Time/ min	pH
Degreasing	Water	200	45		
	Degreasing agent	1		60	
Washing	Water	300	37	10	
Neutralizing	Water	100	37		
	Neutralizing agent	2			
	Sodium formate	1		40	
	Sodium bicarbonate	0.2		40	5.0
Retanning②	**Water**	**100**	**40**		
	Acrylic retanning agent	**6**		**60**	
Fatliquoring	**Water**	**150**	**50**		
	Anionic fatliquoring agent	**20**		**50**	
Dyeing	**Yellow dyes**	**2**		**50**	
	Formic acid③	**1.2**			**3.5**
Washing	Water	300	25	5	
	Hang drying				

Tab. S2 Wet finishing process of pADD-DMENA

Process	Materials	Dosage/ %①	Temperature/ ºC	Time/ min	pH
Degreasing	Water	200	45		
	Degreasing agent	1		60	
Washing	Water	300	37	10	
Neutralizing	Water	100	37		
	Neutralizing agent	2			
	Sodium formate	1		40	
	Sodium bicarbonate	0.2		40	5.5
Wet finishing	**Water**	**150**	**50**		
	pADD/ pADD-DMENA②	**18**		**60**	
	Yellow dyes	**2**			
Washing	Water	300	25	5	

Hang drying

Note: ① The dosage of chemicals was calculated based on the weight of the TWS tanned leather.

② In the pADD-DMENA trial, the yellow dye was not added.

2 ^{1}H-NMR of pADD, DMNA and DMENA

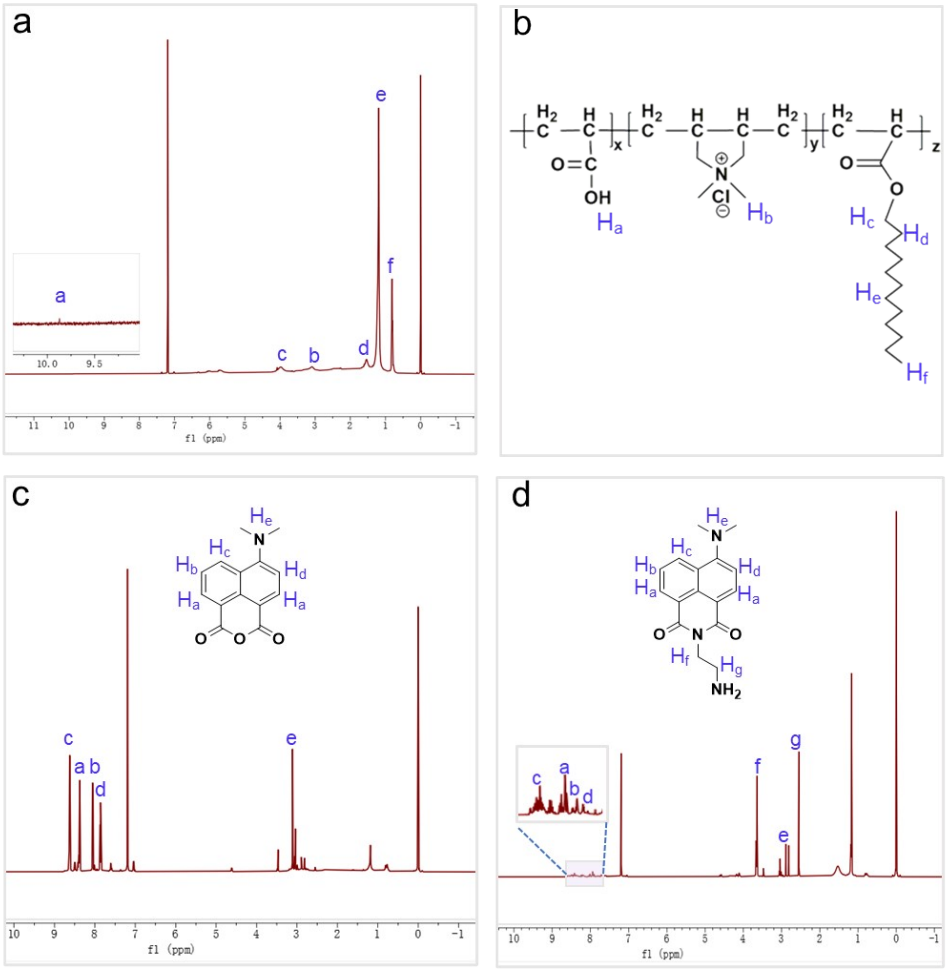

Fig. S1 ^{1}H-NMR spectrum of pADD (a), DMNA (c) and DMENA (d). (b) Structure of pADD.

The spectra of pADD are shown in Fig. S1a, and the signal at 10.05 ppm is attributed to the carboxyl group of AC, and the signal at 3.06 ppm is from the -CH_3 of DMDAAC [1]. Furthermore, the signals at 3.98 ppm, 1.17 ppm and 0.80 ppm are attributed to DA alkyl groups. Also, no signal appeared at almost 5.5 ppm, indicating that each monomer's unsaturated double bond was involved in the reaction [2], demonstrating the synthesis of pADD. The signal peak of the methyl group in dimethylamine appears at 3.11 ppm[3], as shown in Fig. S1c, indicating that dimethylamine has been successfully grafted onto naphthalimide. The ^{1}H-NMR spectra of DMENA show the signal peak characteristics of monomeric DMNA, but also, the

methylene signal peaks in ethylenediamine were close to 3.64 and 2.53 ppm, indicating that DMENA was prepared successfully (Fig. S1d).

3 ^{1}H-NMR of pADD-DMENA

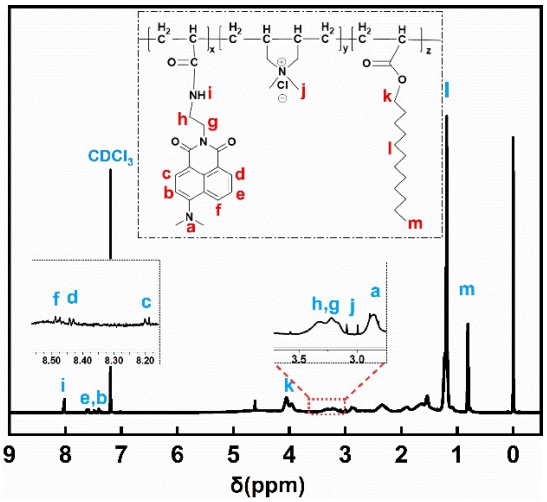

Fig. S2 ^{1}H-NMR spectrum of pADD-DMENA.

4 GPC of pADD

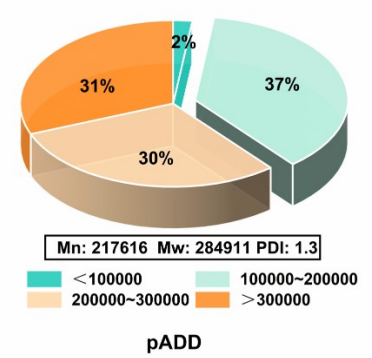

Fig. S3 The molecular weight of pADD.

5 DTG curves of crust leathers

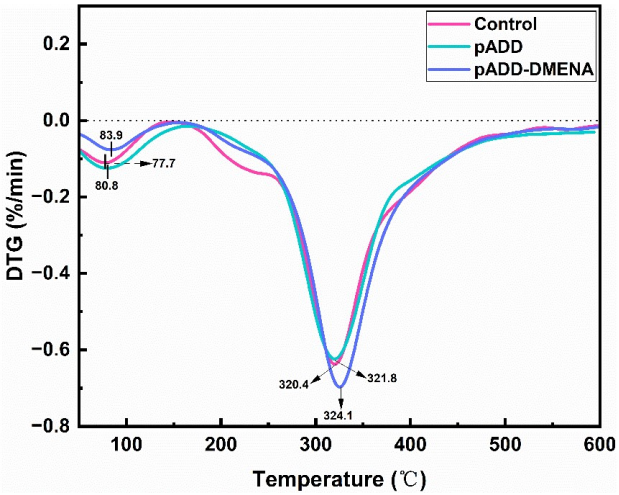

Fig. S4 DTG curves of different treated crust leathers.

6 Lightfastness comparison of different leather samples

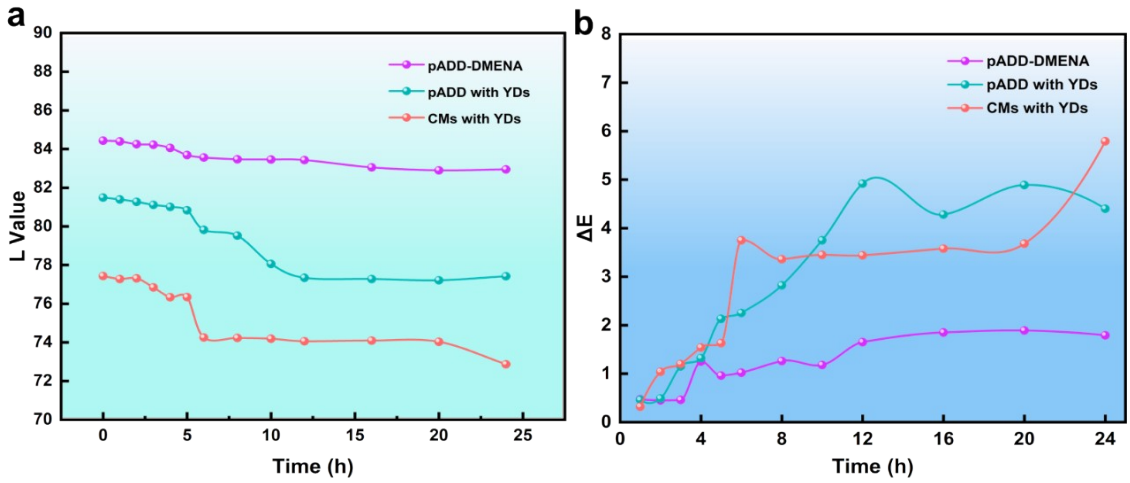

Fig. S5 (a) L value and (b) color change (ΔE) of different leather samples under UV irradiation for 24 h.

Tab. S3 Color comparison of different leather samples with various UV irradiation time

	pADD-DMENA	pADD with YDs	CMs with YDs
0 h			
4 h			
8 h			
12 h			
16 h			
20 h			
24 h			

7 Environmental impact assessment

Tab. S4 The TOC value of different wet finishing wastewater

Samples	TOC (mg/L)		Absorption rate (%)
	Initial	Residual	
pADD-DMENA	67445.5 ± 1.27	9432.2 ± 3.82	86.01%
pADD	85997.8 ± 2.56	10701.7 ± 2.35	87.55%
CMs	108077.7 ± 3.41	36445.9 ± 2.64	66.58%

Tab. S5 The value of BOD_5 and COD_{Cr} of different wet finishing wastewater

Samples	BOD_5 (mg/L)	COD_{Cr} (mg/L)	BOD_5/COD
pADD-DMENA	3325.3 ± 0.54	9379.1 ± 0.48	0.35 ± 0.0045
pADD	3545.9 ± 0.27	11068.1 ± 0.33	0.32 ± 0.0003
CMs	6137.9 ± 0.59	22895.2 ± 0.62	0.27 ± 0.0007

References

1 X. Xia, Y. Feng, J. Guo, S. Liu, J. Jin and Y. Yu, *Polym. Eng. Sci.*, 2017, **57**, 78–88.

2 D. Hao, X. Wang, X. Liu, X. Zhu, S. Sun, J. Li and O. Yue, *J. Hazard. Mater.*, 2020, **399**, 123048.

3 L. De Smet, G. Vancoillie, P. Minshall, K. Lava, I. Steyaert, E. Schoolaert, E. Van De Walle, P. Dubruel, K. De Clerck and R. Hoogenboom, *Nat Commun*, 2018, **9**, 1123.