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Preparation and characterization of flame retardant polyurethane foams containing phosphorus-nitrogen-functionalized lignin

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Supporting Information

List of Figures and Tables

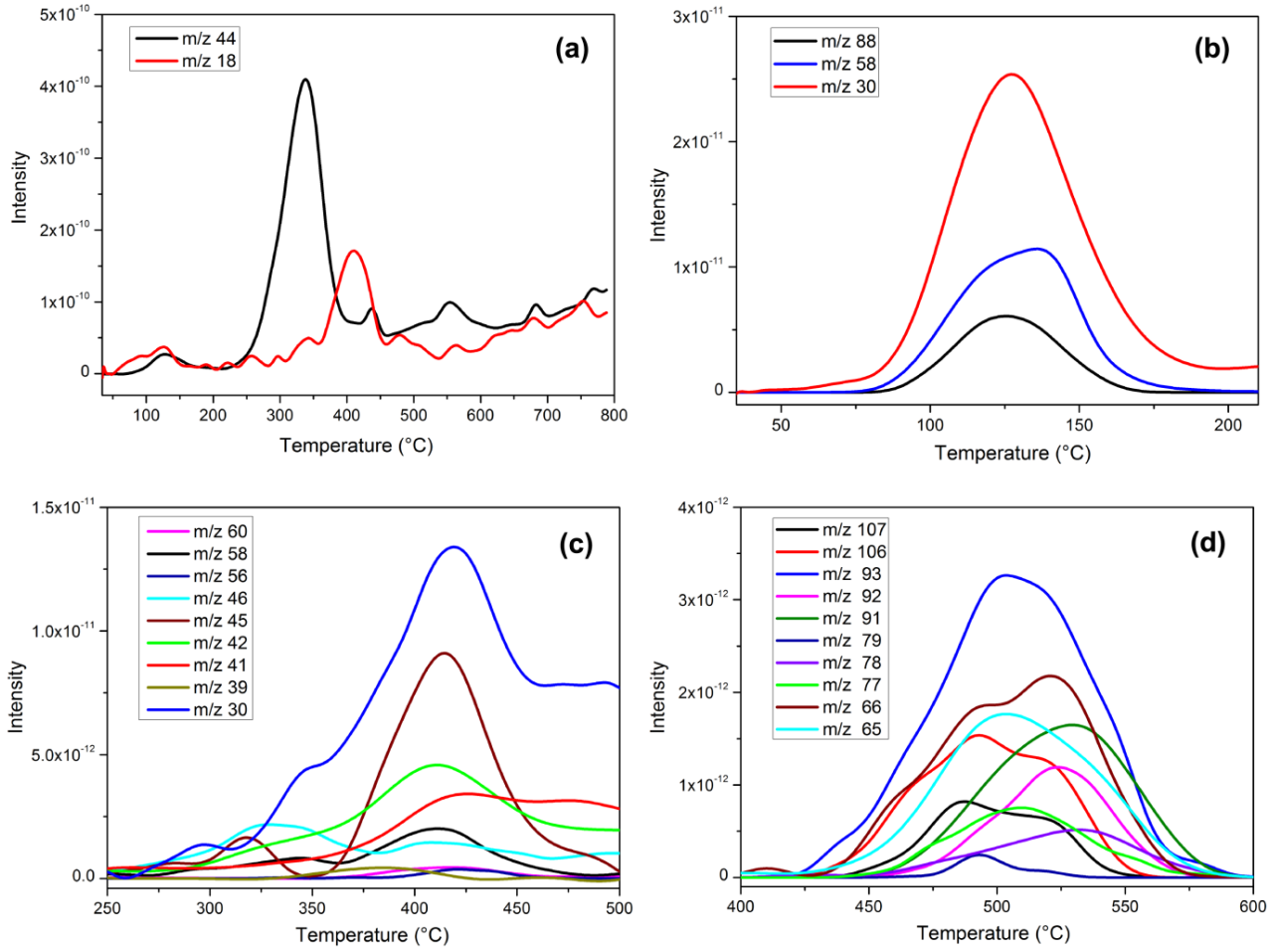


Fig. S1 Mass spectra of gas products during the thermal degradation of PU

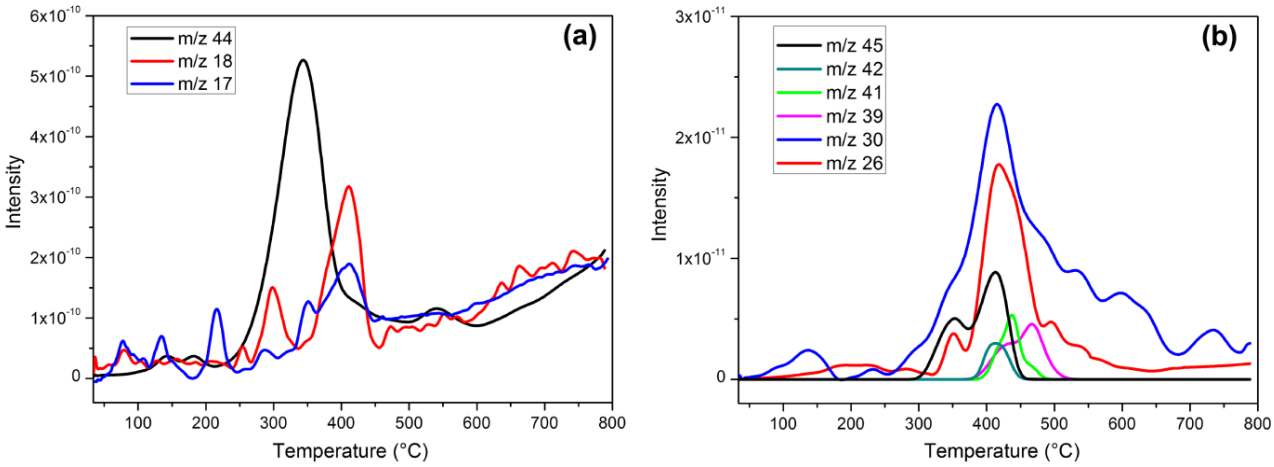
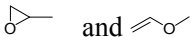
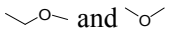
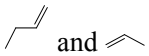
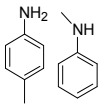


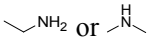
Fig. S2 Mass spectra of gas products during the thermal degradation of PU-LPMC$_{15}$

Table S1 Identification of gas products during the degradation of PU.

Temperature (°C)	Products	[a] FTIR (cm^{-1})	Mass (m/z)
126.5		2968,2864,1456,1369 (C-H in CH_2) 1261,1126 (C-O-C) 881 (cyclic C-O-C)	88, 58, 43, 30 (Fig. S1b)
290-450	H_2O	3500-4000	18 (Fig. S1a)
	CO_2	2312, 2359, 670	44 (Fig. S1a)
	CH_3-CH_3	2955, 2868 (C-H in CH_3)	30 (Fig. S1c)
		2955, 2868 (C-H in CH_2 or CH_3) 1589 (C=C) 1126 (C-O-C) 881 (cyclic C-O-C)	58 (Fig. S1c)
		2955, 2868 (C-H in CH_2 or CH_3) 1126 (C-O-C)	60, 46, 45 (Fig. S1c)
		2955, 2868 (C-H in CH_2 or CH_3) 1589 (C=C)	56, 42, 41, 39 (Fig. S1c)
450-570		2935 (C-H in CH_3), 1622(N-H) 1516 (aromatic ring) 744 (N-H)	107, 106, 79, 77, 65 (Fig. S1d)
		1622(N-H) 1516 (aromatic ring) 744 (N-H)	93, 66, 65 (Fig. S1d)
		2955, 2868 (C-H in CH_2 or CH_3) 1516 (aromatic ring)	106, 91 (Fig. S1d)
		2955, 2868 (C-H in CH_2 or CH_3) 1516 (aromatic ring)	92, 91, 65 (Fig. S1d)
		1516 (aromatic ring)	78, 77 (Fig. S1d)

[a] The absorption peaks of FTIR are shown in Fig. 5 in the paper.

Table S2 Identification of gas products during the degradation of PU-LPMC$_{15}$.

Temperature (°C)	Products	[a] FTIR (cm^{-1})	Mass (m/z)
126.5		2966, 2864 (C-H in CH_2) 1263, 1126 (C-O-C) 881 (cyclic C-O-C)	
290-570	H_2O	3500-4000	18 (Fig. S2a)
	CO_2	2312, 2359, 670	44 (Fig. S2a)
	NH_3		17 (Fig. S2a)
	CH_3-CH_3	2935, 2881 (C-H in CH_3)	30 (Fig. S2b)
	CH≡CH		26 (Fig. S2b)
		2935, 2881 (C-H in CH_2 or CH_3) 1622 (N-H)	45, 30 (Fig. S2b)

[a] The absorption peaks of FTIR are shown in Fig. 6 in the paper.

References

(1) L. Jiao, H. Xiao, Q. Wang and J. Sun, *Polym. Degrad. Stab.* 2013, ***98***, 2687-2696.

(2) X. Chen, L. Huo, C. Jiao and S. Li, *J. Anal. Appl. Pyrol.* 2013, **100**, 186-191.

(3) K. Pielichowski and D. Slotwinska, *Thermochim. Acta* 2004, ***410***, 79-86.