Liquefaction of waste pine wood and its application in the synthesis of a flame retardant polyurethane foam

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1. The carbon NMR analysis of liquefied polyol

Table S1.^{13}CNMR chemical shift of liquefied polyol

Position	Chemical shift δ (ppm)						
glycouse	C1	C2	C3	C4	C5	C6	□C1
	100.2	72.3	72.6	71.3	73.5	63.1	66.7
levulinate	L1	L2	L3	L4	L5	□L1	
	174.1	28	37.9	207.4	29.9	66.7	
Formic eater	F1	□F1					
	163.4	173.1					
glycerol	G1	G2					
	72.7	63.1					
PEG400	P1	P2					
	70.2	60.6					

2. Thermal behaviour and flammability properties of MWPU foam

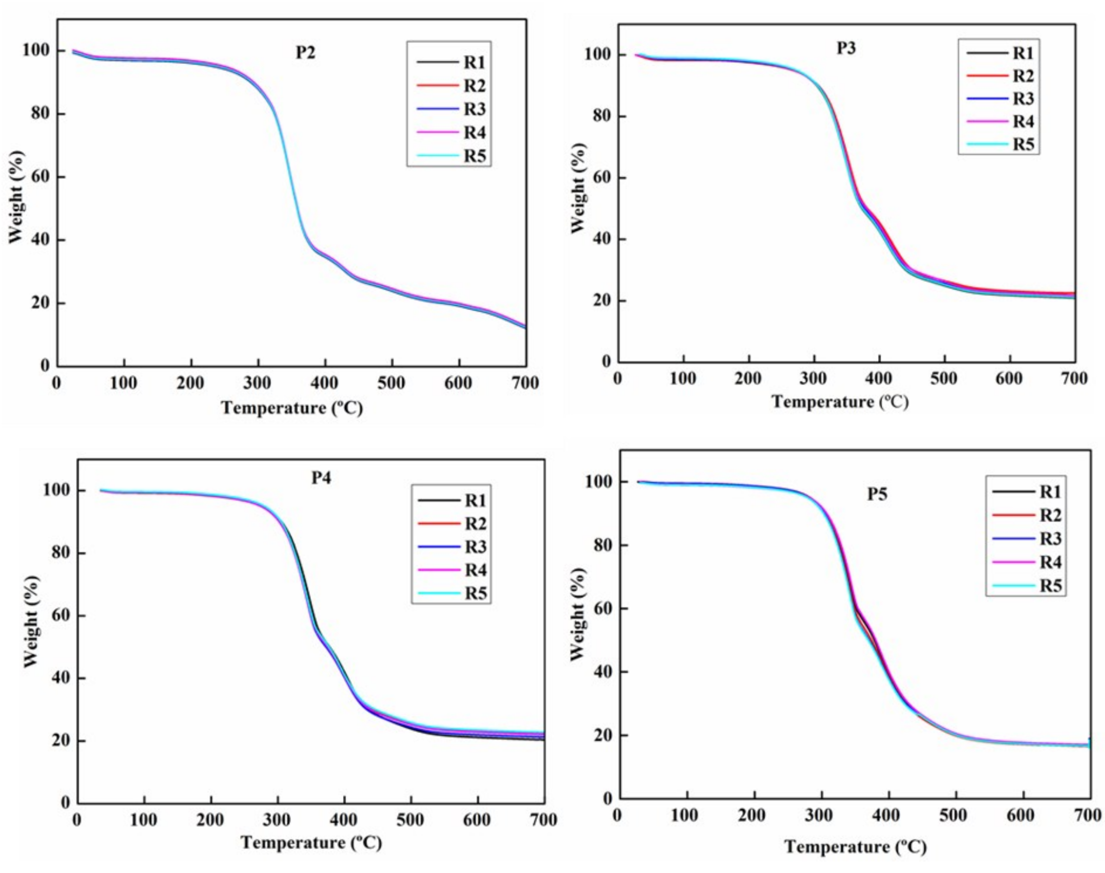

Fig.S1.The TGA spectra of samples P2 to P5 (The five independent samples measurement are R1, R2, R3, R4, R5 respectively)

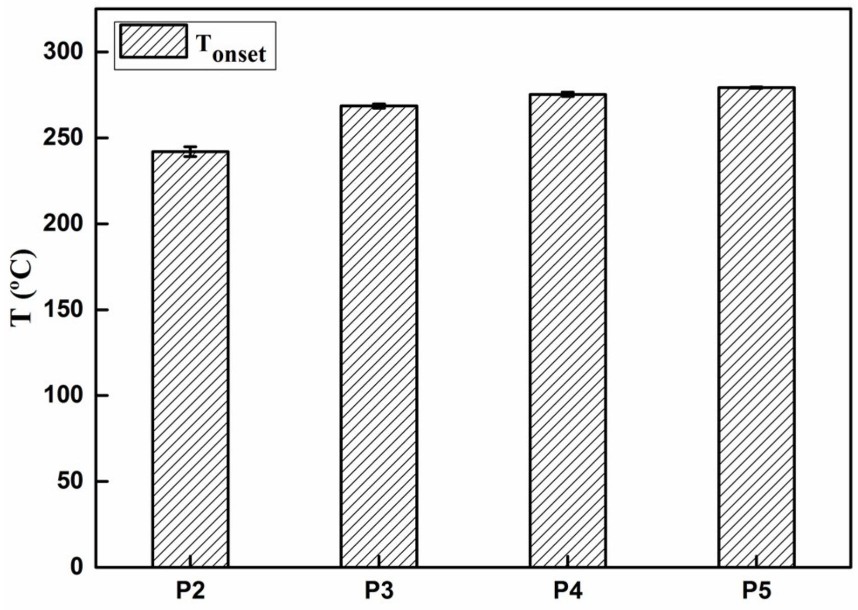

Fig.S2. T onset standard values of samples P2 to P5

3. FTIR-TGA analysis of evolved gases from MP

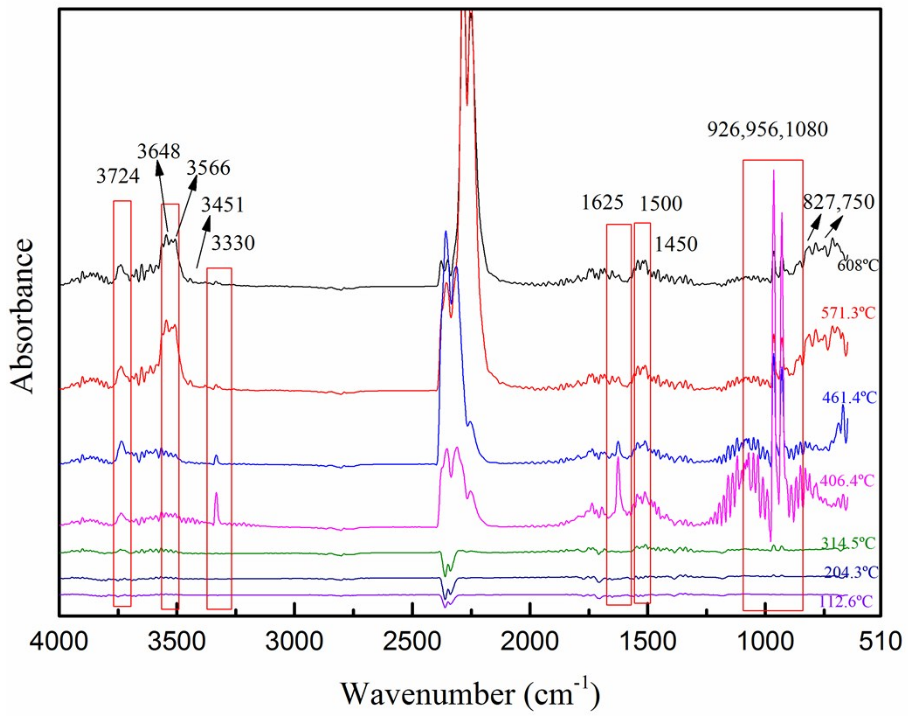

Fig.S3A: FTIR-TGA spectra of evolved gases from MP at different temperatures

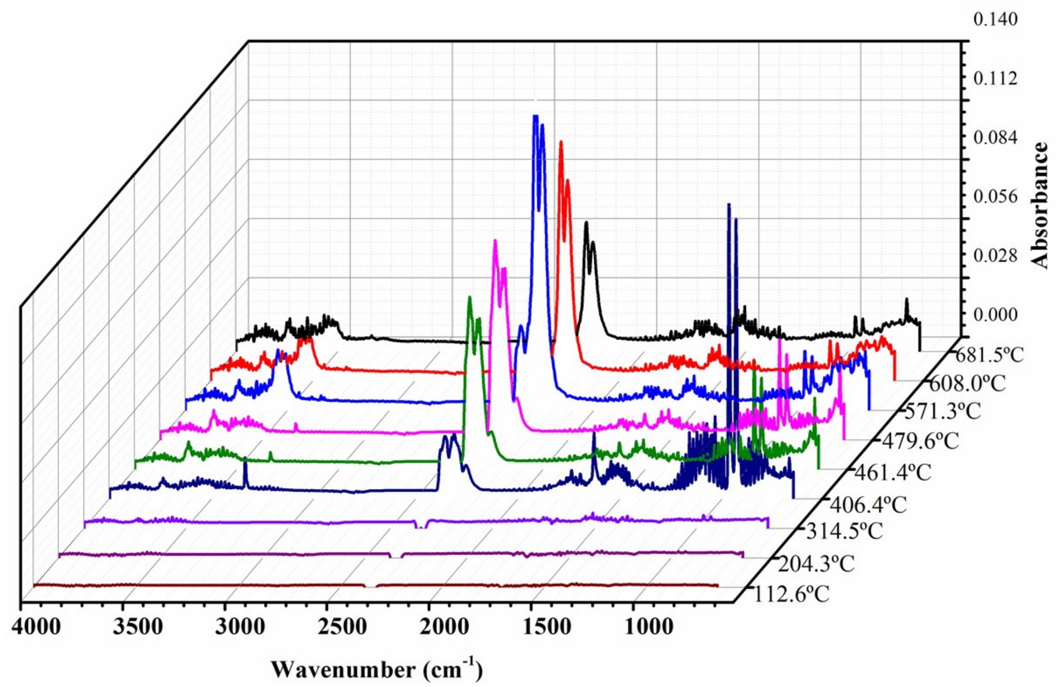

Fig.S3B: 3D view FTIR-TGA spectra of evolved gases from MP at different temperatures

From the FTIR-TGA spectra of MP at different temperatures as shown in Fig.S1A and S1B, no absorptions peak was below 204°C, indicating no gases evolved from MP. At 314°C, new peaks appear at 3566, 3451, 1450, 827 and 750 cm^{-1} which can be attributed to absorptions of melamine formed from the decomposition of MP. It can be observed that after 406°C, new peaks appears at 3330, 1625, 1500, 956 and 926 cm^{-1} are due to NH_3 absorptions, and the peaks at 3724,3648 and 1080 cm^{-1} are attributed to absorptions of water. [1-3]

1. Z. Wang, P. Lv, Y. Hu and K. Hu, *Journal of Analytical and Applied Pyrolysis*, 2009, **86**, 207-214.

2. B. CICHY, *CHEMIK*, 2013, **67**, 214-219.

3. X. Lai, X. Zeng, H. Li, F. Liao, C. Yin and H. Zhang, *Polymer Composites*, 2012, **33**, 35-43.

4. The combustion process of foams

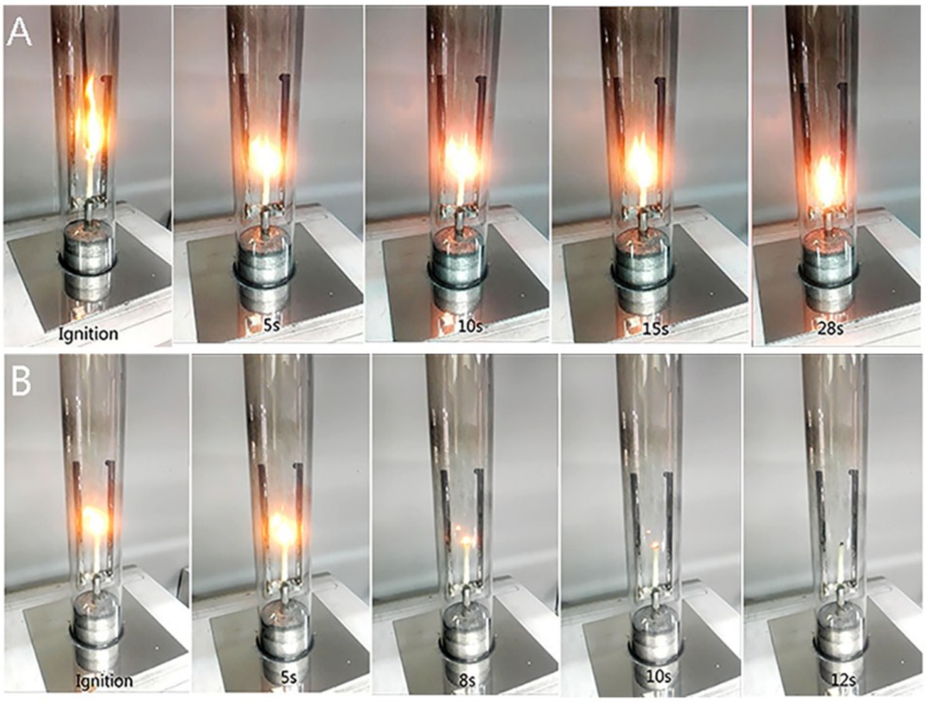

Fig.S4.The combustion process of (A) wood based foam and (B) MWPU foam with 10wt% MP at oxygen concentrations of 18.5vol % and 21.7vol %, respectively

5. **The SEM-EDS analysis of char of sample P5**

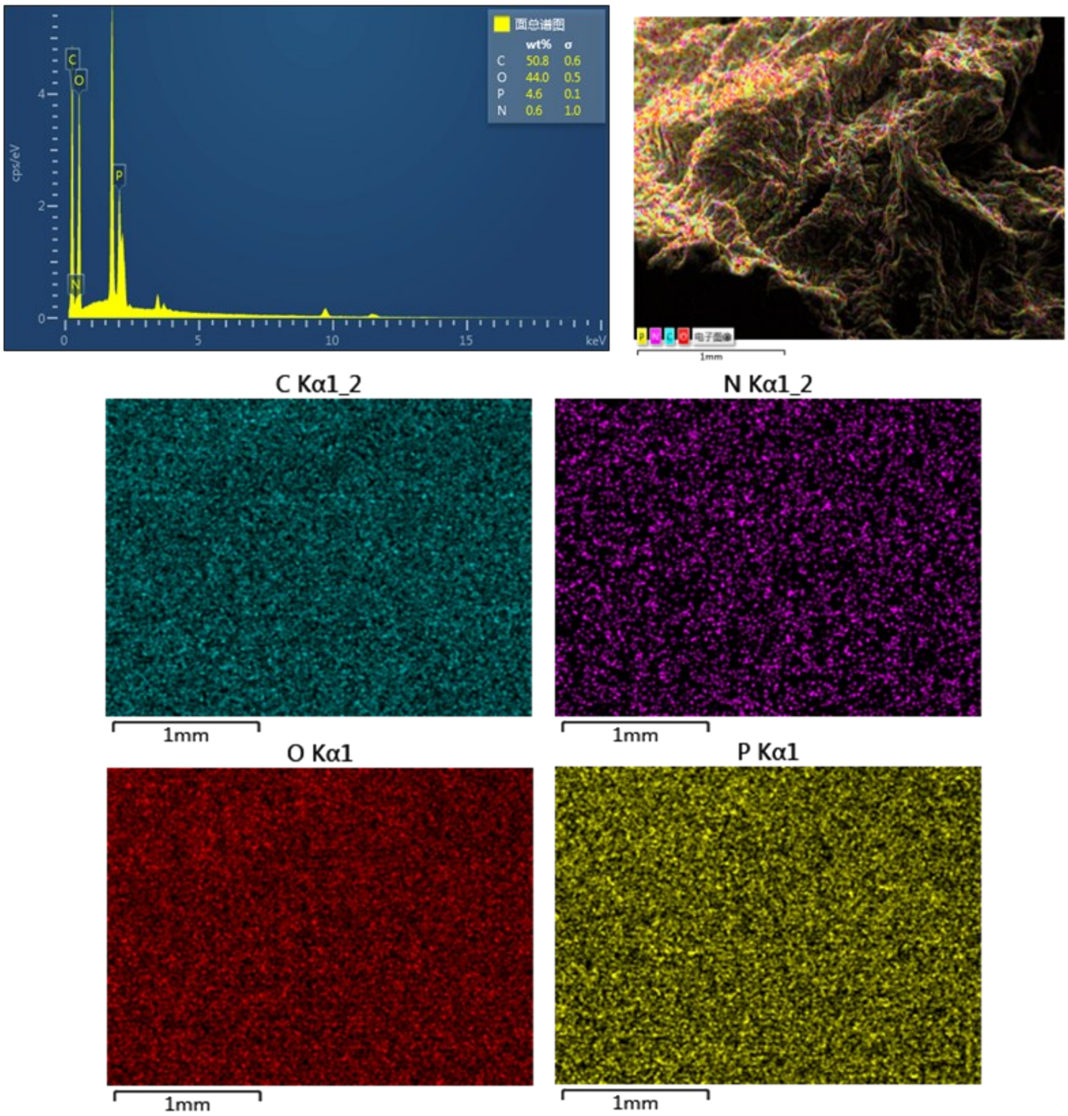

Fig.S5. The SEM-EDS analysis of the char of sample P5.

6. The mechanical property of MWPU foams

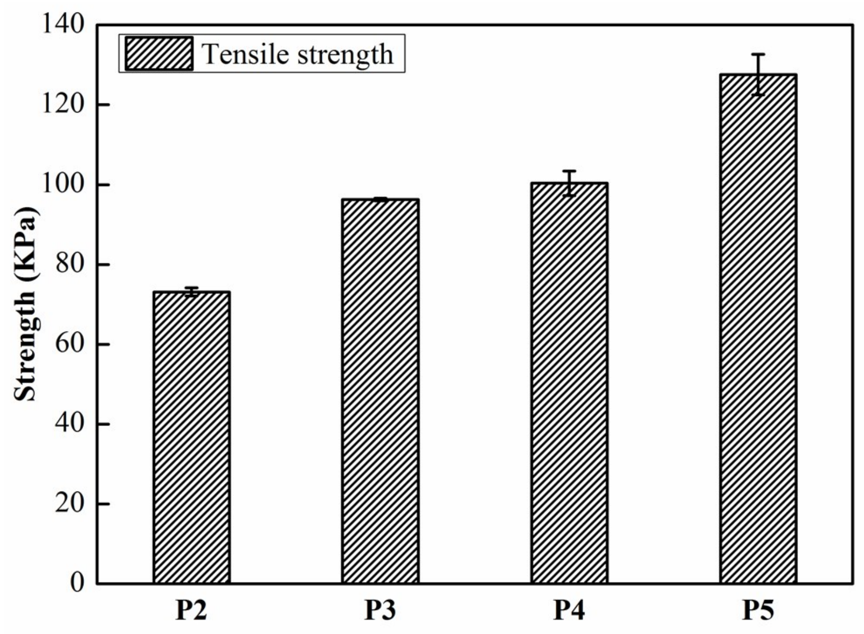

Fig. S6. The tensile strength of P2 to P5