Supporting Information

A Family of Linear Phenolic Polymers with Controlled Hydrophobicity, Adsorption and Antioxidant Properties

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Tables S1-S3. Specific amounts of monomers and deprotecting agents used for synthesis of antioxidant polymers of targeted compositions.

Table S1. P2H$_Z$Hex series and PHex

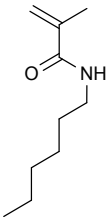
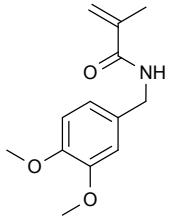
Targeted molar content, %	Polymerization			Deprotection reaction	
	 N-hexyl methacrylamide (**1**)	 N-(3,4-dimethoxybenzyl) methacrylamide (**5**)	Yield (%)	Polymer	2M BBr_3 in CH_2Cl_2
0	1.94 g	-	88	-	-
5	1.84 g	0.135 g	83	0.500 g	0.300 mL
10	1.75 g	0.270 g	83	0.509 g	0.500 mL
15	1.65 g	0.405 g	77	0.520 g	0.700 mL
100	-	2.70 g	73	0.680 g	4.50 mL

Table S2. PBrH$_Z$Hex series

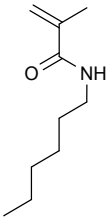
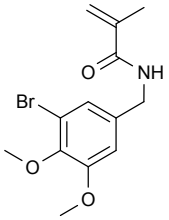
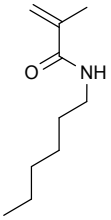
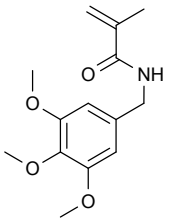
Targeted molar content, %	Polymerization			Deprotection reaction	
	 N-hexyl methacrylamide (**1**)	 N-(3,4-dimethoxy-5-bromobenzyl) methacrylamide (**6**)	Yield (%)	Polymer	2M BBr_3 in CH_2Cl_2
5	1.84 g	0.180 g	75	0.500 g	0.300 mL
10	1.75 g	0.361 g	73	0.532 g	0.500 mL
15	1.65 g	0.541 g	68	0.550 g	0.700 mL
100	-	3.60 g	59	0.910 g	4.50 mL

Table S3. P3H$_Z$Hex series

Targeted molar content, %	Polymerization			Deprotection reaction	
	 N-hexyl methacrylamide (**1**)	 N-(3,4,5-trimethoxybenzyl) methacrylamide (**7**)	Yield (%)	Polymer	2M BBr_3 in CH_2Cl_2
5	1.84 g	0.152 g	81	0.503 g	0.400 mL
10	1.75 g	0.307 g	79	0.517 g	0.700 mL
15	1.65 g	0.457 g	82	0.530 g	1.00 mL
100	-	3.04 g	76	0.770 g	6.50 mL

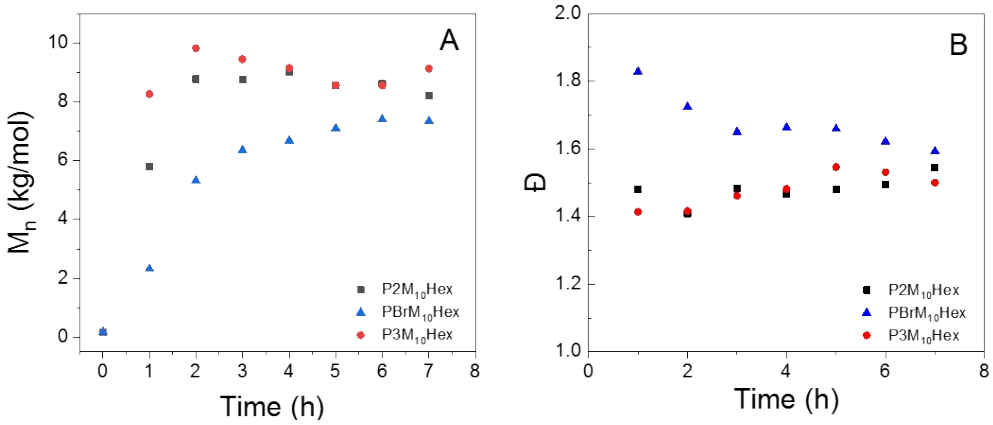


Fig. S1. The number-average molecular weight M_n (A) and molar mass dispersities (B) as a function of polymerization time during synthesis of P2M$_{10}$Hex, PBrM$_{10}$Hex, or P3M$_{10}$Hex at 80°C.

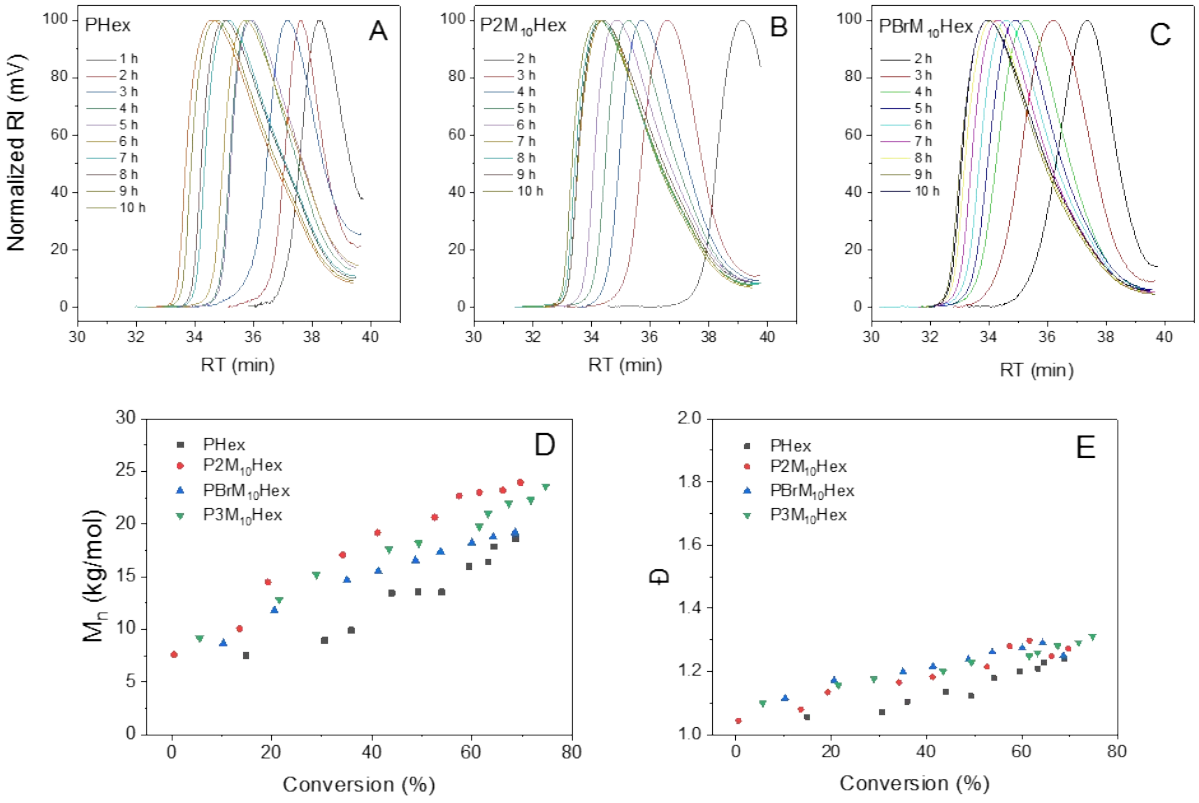


Fig. S2. GPC traces of PHex (A), P2M$_{10}$Hex (B), PBrM$_{10}$Hex (C) for different polymerization times, as well as M_n (D) and molar mass dispersities (E) as a function of monomer conversion during polymerization of PHex homopolymer and copolymers containing 10% of phenolic precursor groups at 70°C.

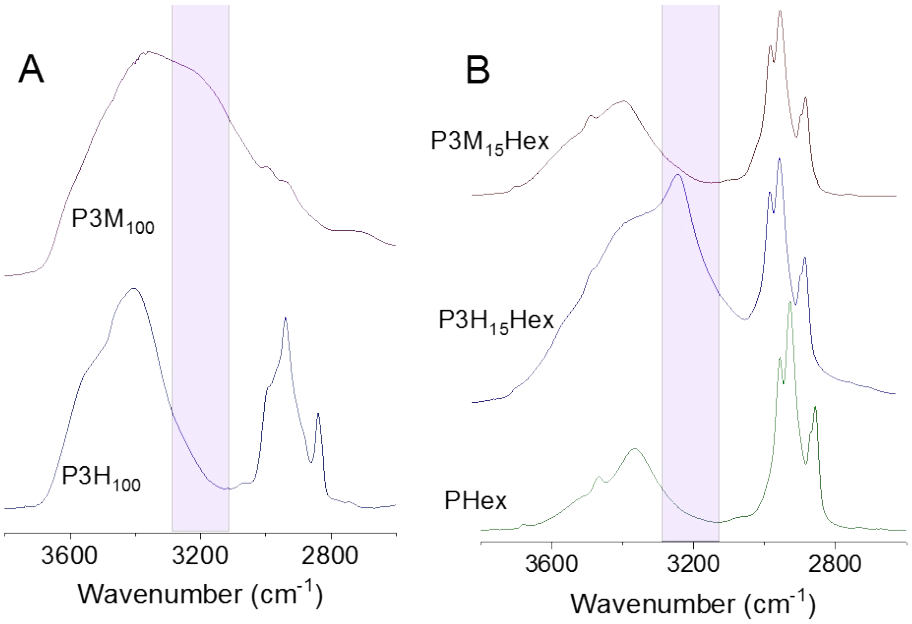


Fig. S3. FTIR spectra of protected and deprotected $P3M_{100}$ and $P3H_{100}$ homopolymers (A), $P3M_{15}Hex$ and $P3H_{15}Hex$ copolymers (B, top) and PHex control polymer (B, bottom).

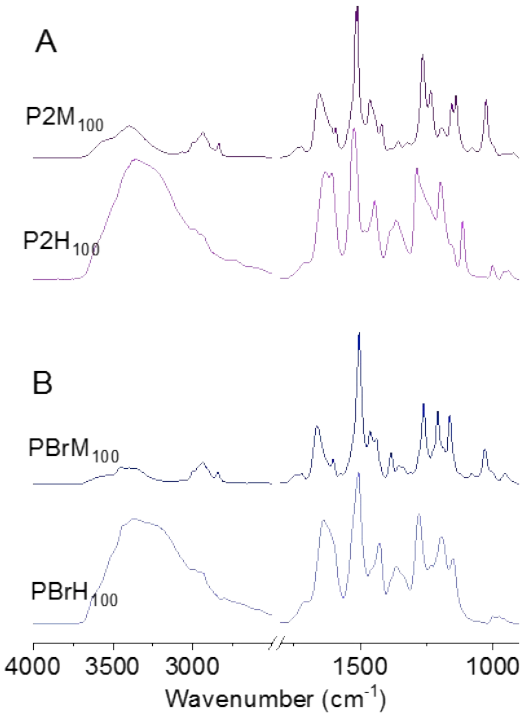


Fig. S4. FTIR spectra of protected and deprotected homopolymers: $P2M_{100}$ and $P2H_{100}$ (A), and $PBrM_{100}$ and $PBrH_{100}$ (B).

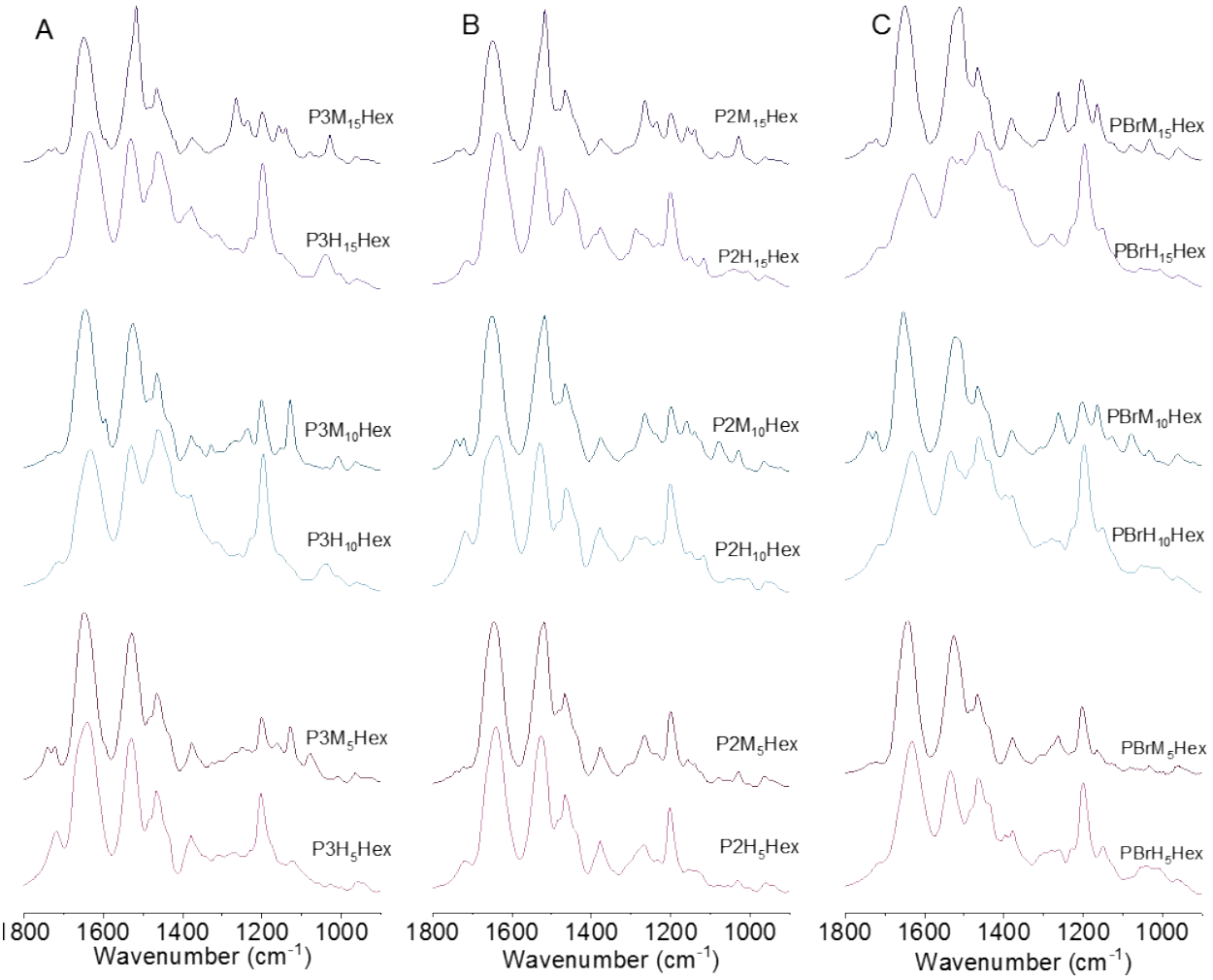


Fig. S5. FTIR spectra of the copolymers of P3M$_Z$Hex and P3H$_Z$Hex series (A), P2M$_Z$Hex and P2H$_Z$Hex series (B), as well as PBrM$_Z$Hex and PBrH$_Z$Hex series (C).

TGA analysis. TGA data indicated the overall similar behavior of all polymers in the temperature range below 200 °C, *i.e.* phenol-containing polymers showed an initial small loss of mass upon heating up to ~100 °C, and retained their mass when further heated to 200°C. Specifically, for homopolymers, the mass loss due to dehydration was ~2, 5, 7 and 10% for PHex, PBrH$_{100}$, P2H$_{100}$, and P3H$_{100}$, respectively. Heating to temperatures significantly higher than 150 °C revealed dramatic differences in the thermal behavior of phenol-containing and phenol-free polymers, as shown in Fig. S6. In particular, phenol-free hexyl homopolymer demonstrated a single wide decomposition step with an onset temperature at 210°C, with the fastest decomposition between

390 °C and 410 °C. In contrast, all phenolic copolymers showed two-step decomposition profiles. The first step in the temperature range between 250 and 300 °C, also seen for phenolic homopolymers, most likely corresponds to crosslinking/decomposition that involves polyphenolic rings. The mass loss of phenolic homopolymers lacked this high-temperature decomposition peak, but instead showed a continuous and gradual mass loss at temperatures between 200 and 500 °C, leaving behind high percentage (42% - 55%) of solid residues after heating to 500 °C.

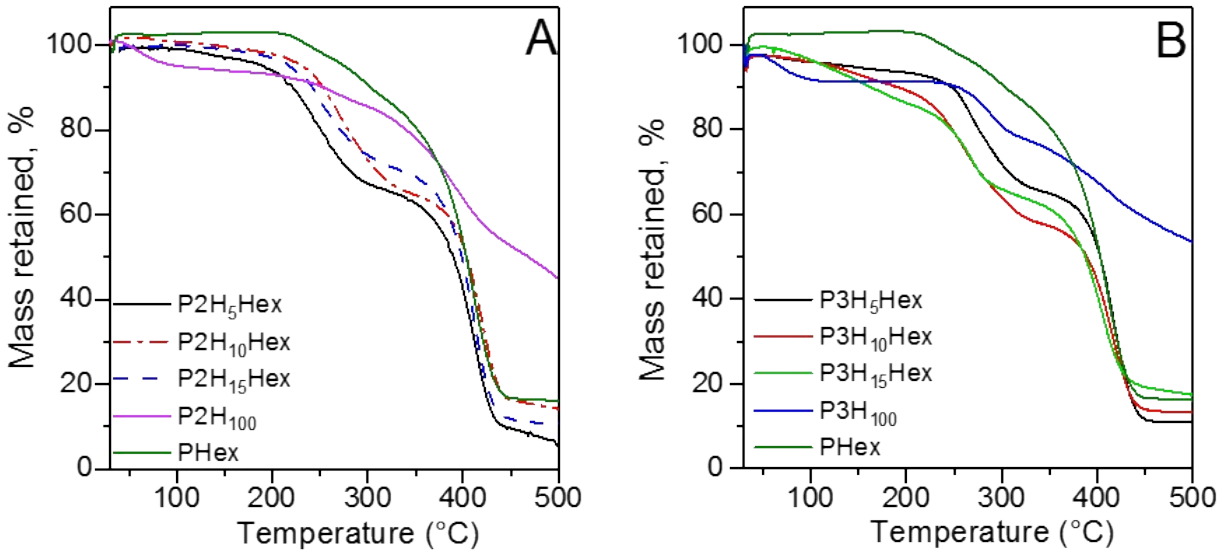


Fig. S6. TGA analysis of P2H$_Z$Hex (A) and P3H$_Z$Hex (B) polymer series.