

Supporting Information

**Zwitterionic-based cyclic brush polymer nanomicelles with
improved lubrication and antioxidation properties**

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Determination of RSV standard curve

Firstly, the UV absorption spectrum of Resveratrol (RSV) was determined through a UV-Vis spectrophotometer, revealing the maximum absorption wavelength at 304nm. Subsequently, various concentrations of RSV solutions were assessed for their absorbance at 304 nm. By fitting the data, the standard curve for RSV was ultimately derived.

Sample	DLE (%)	EE (%)
CP1	1.67	10.46
CP2	5.72	35.75
CP3	4.43	27.71
CP4	4.69	29.36

Table. S1 Drug loading and encapsulation rates of polymers with different monomer concentrations.

	1Hz 1N	1Hz 3N	3Hz 3N
H ₂ O	0.042	0.036	0.036
CP	0.036	0.026	0.029
CP@RSV	0.038	0.029	0.031

Table. S2 The COF values for H₂O, CP and CP@RSV at 1Hz 1N, 1Hz 3N and 3Hz 3N conditions.

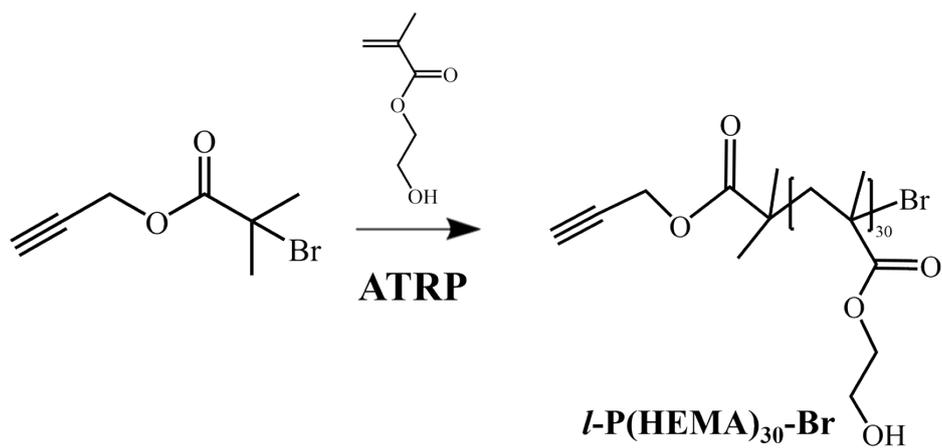


Fig. S1 Synthesis route of *l*-P(HEMA)₃₀-Br

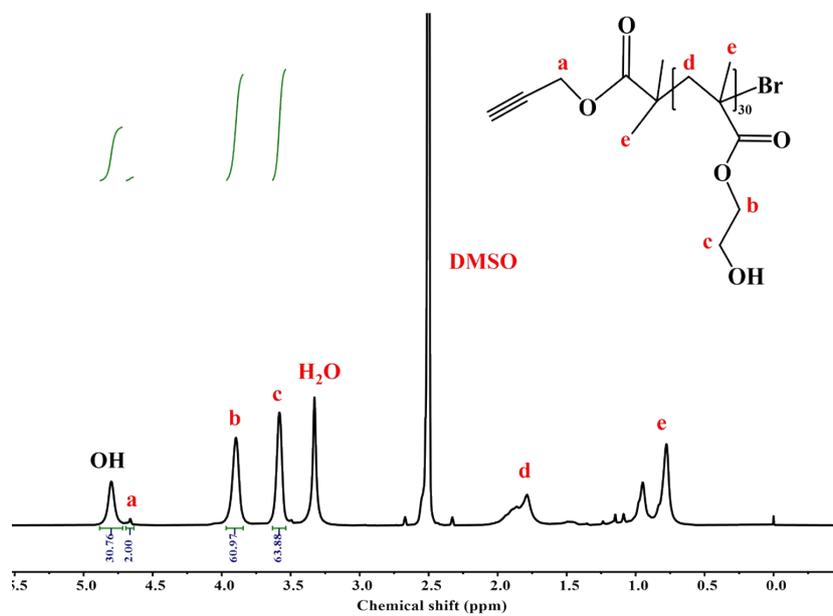


Fig. S2 ¹H NMR spectrum of *l*-P(HEMA)₃₀-Br in DMSO-*d*₆.

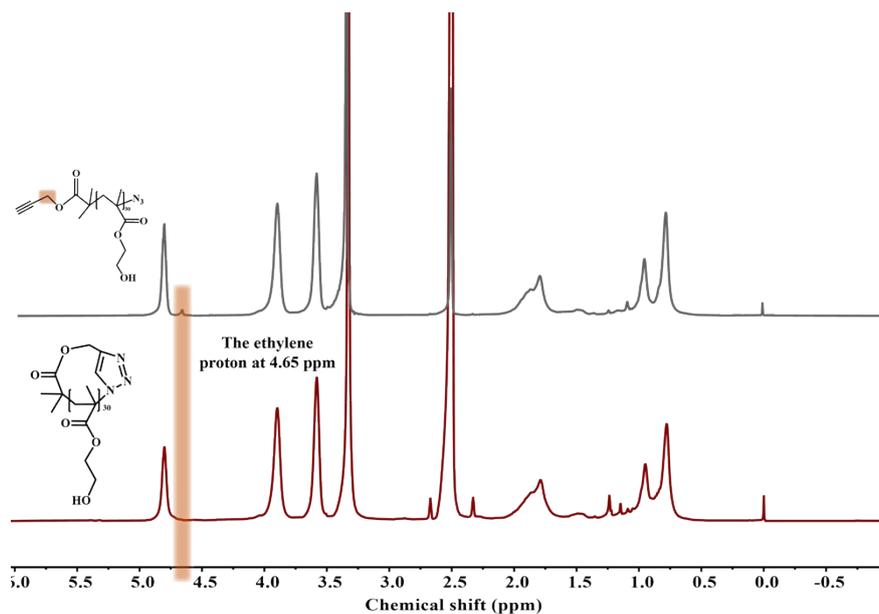


Fig. S3 ¹H NMR spectrum of *l*-P(HEMA)₃₀-N₃ and *c*-P(HEMA)₃₀ in DMSO-*d*₆.

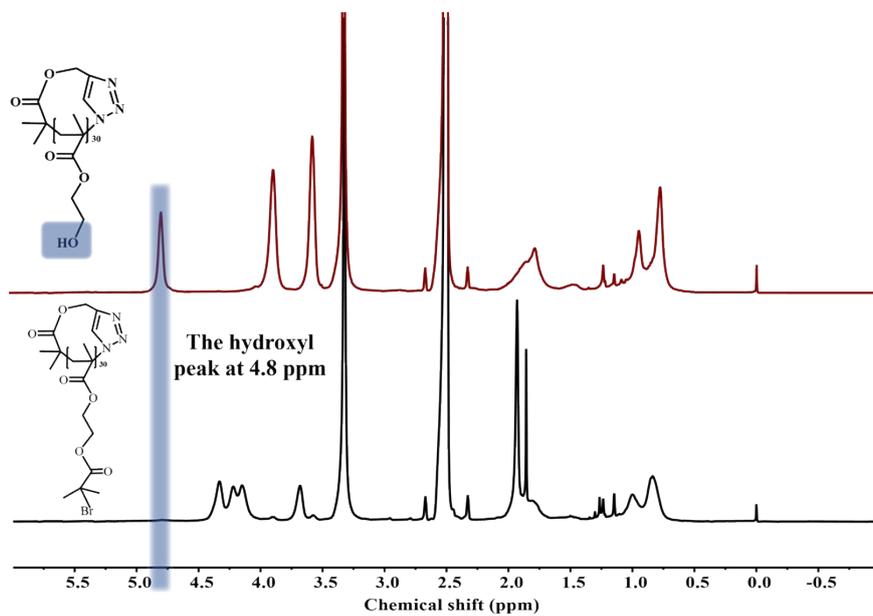


Fig. S4 ¹H NMR spectrum of *c*-P(HEMA)₃₀ and *c*-P(HEMA)₃₀-Br in DMSO-*d*₆.

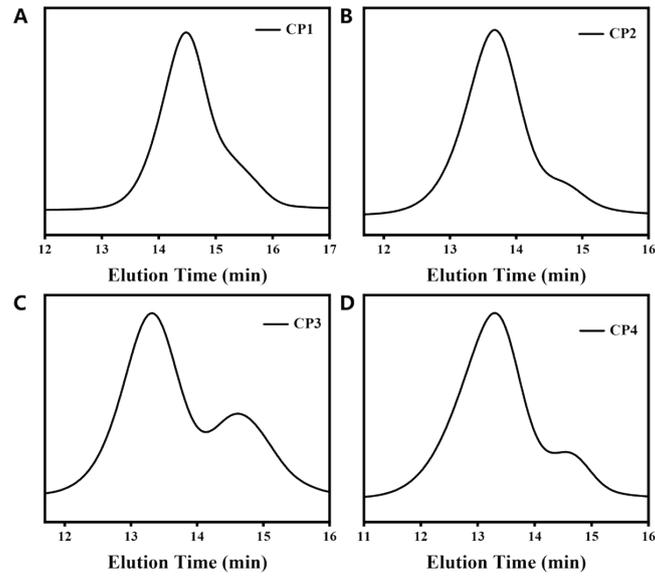


Fig. S5 GPC curves of (A) CP1, (B) CP2, (C) CP3 and (D) CP4 polymers.

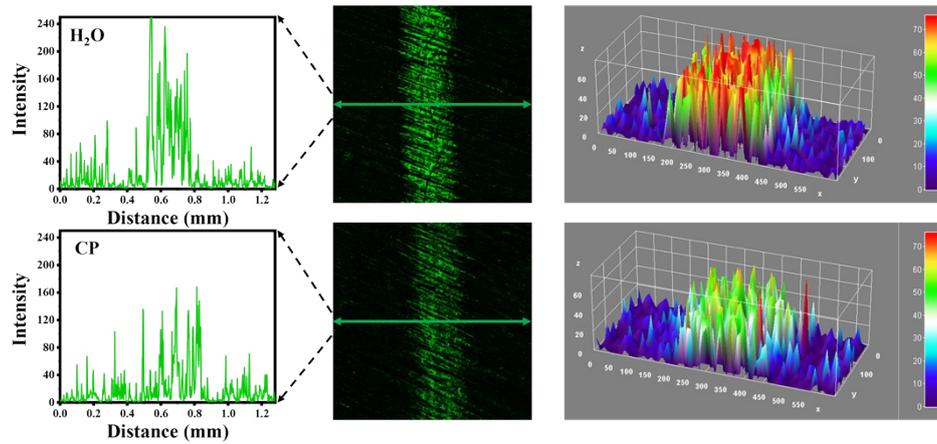


Fig. S6 2D and 2.5D images of surface wear and distance-wear intensity curves for water and CP groups after friction tests at 1 Hz with 1 N load.

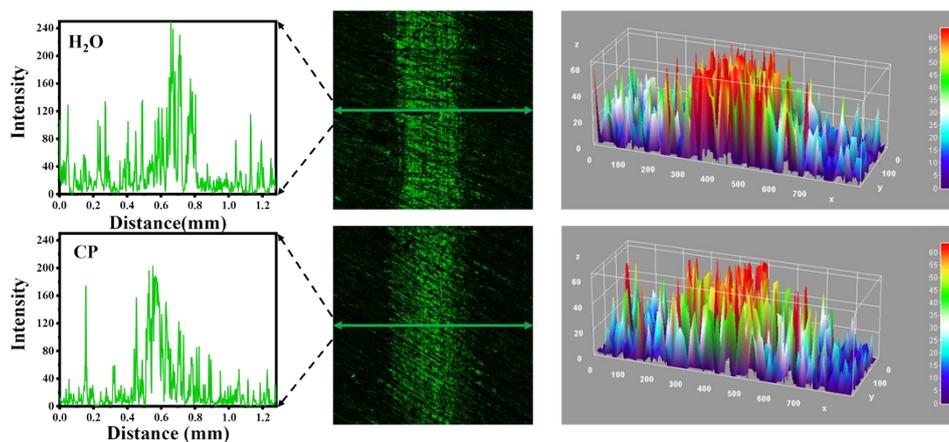


Fig. S7 2D and 3D images of surface wear and distance-wear intensity curves for water and CP groups after friction tests at 1Hz with 3 N load.

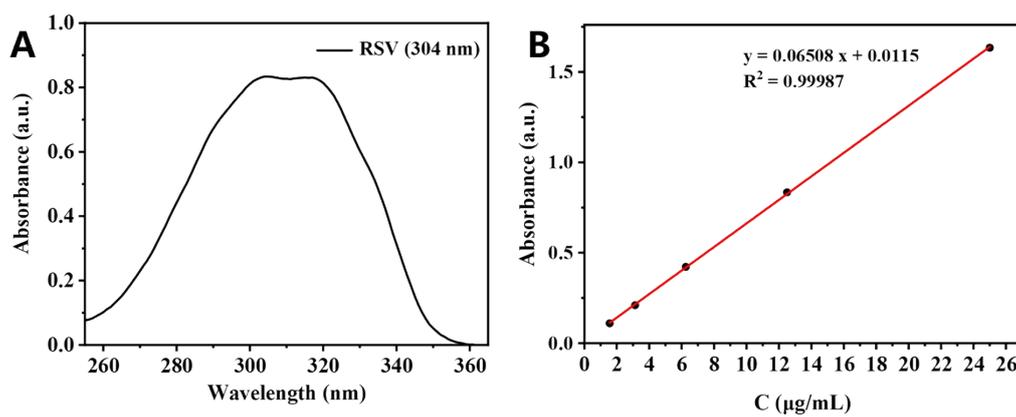


Fig. S8 (A) The UV-Vis absorbance spectra of RSV. (B) The standard calibration curve of RSV.

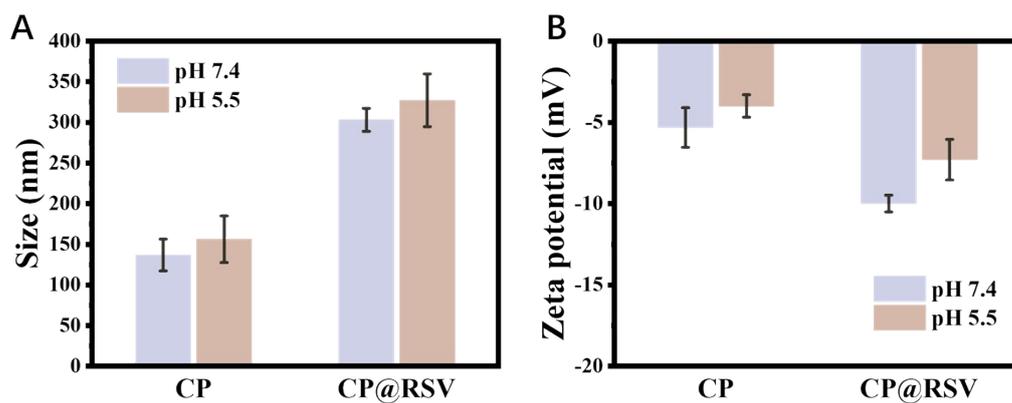


Fig. S9 The (A) particle size and (B) zeta potential of CP and CP@RSV in PBS

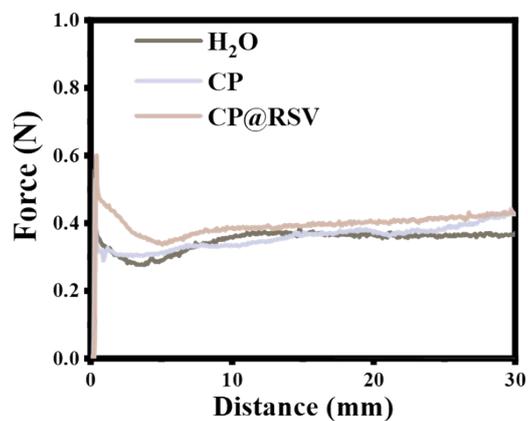


Fig. S10 Injection force-distance curve of H₂O, CP and CP@RSV.

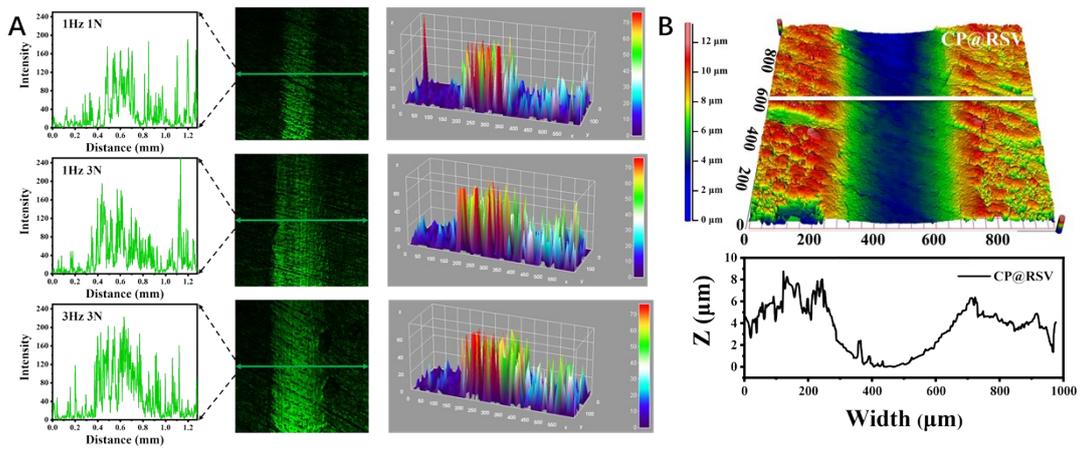


Fig. S11 (A) 2D and 3D images of surface wear and distance-wear intensity curves for CP@RSV after friction tests at 1Hz 1N, 1Hz 3N and 3Hz 3N conditions. (B) WLI morphology and cross-sectional profiles of wear marks on PTFE surfaces at 3Hz with 3 N load.

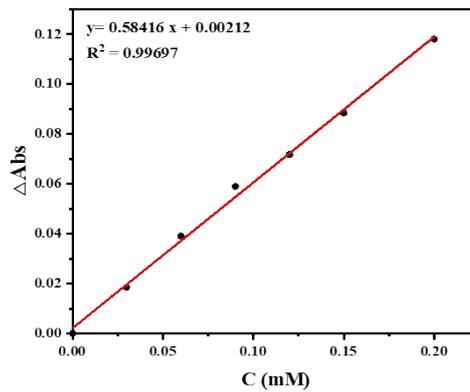


Fig. S12 The standard curve of total antioxidant capacity