

## Supporting information

### MMP-2 Sensitive Poly (malic acid) Micelles Stabilized by $\pi$ - $\pi$ Stacking Enable High Drug

#### Loading Capacity

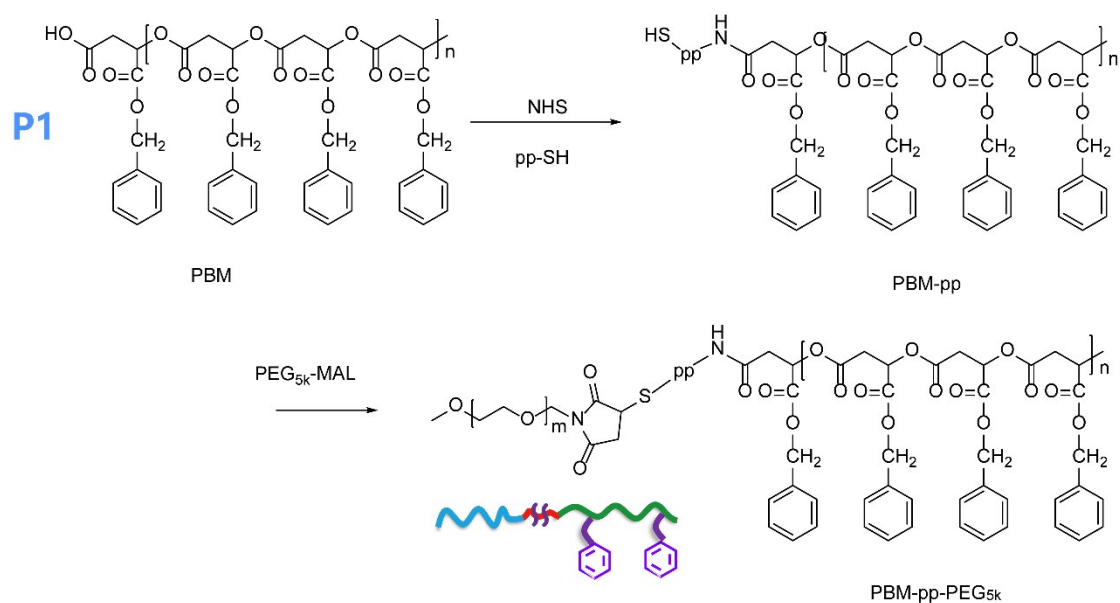


Fig. S1. The synthetic routes for amphipathic polymer PBM-pp-PEG<sub>5k</sub> (P1)

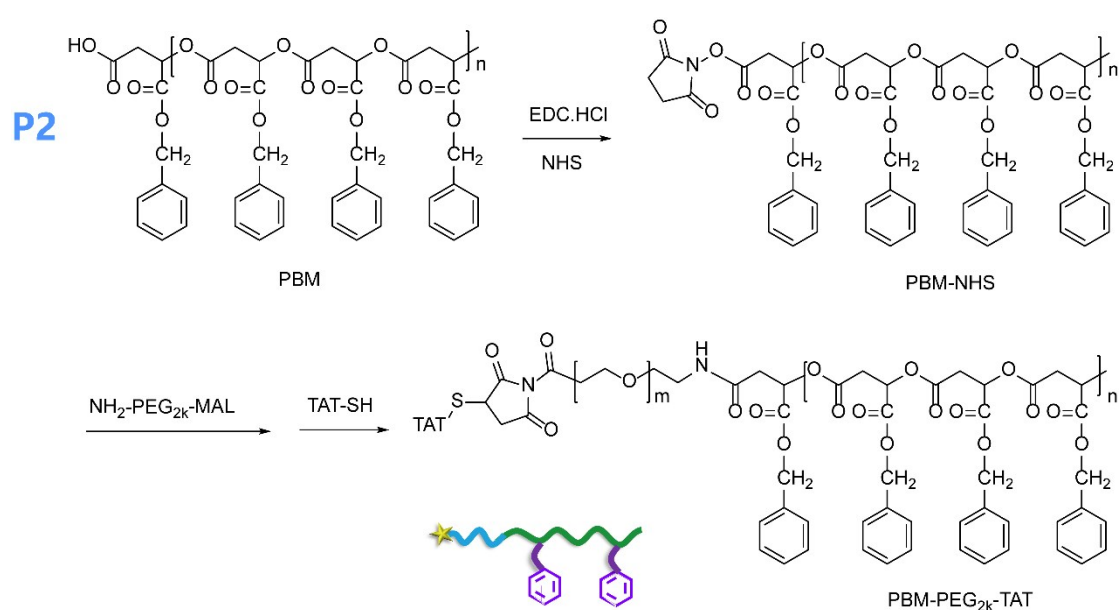


Fig. S2. The synthetic routes for amphipathic polymer PBM-PEG<sub>2k</sub>-TAT (P2)

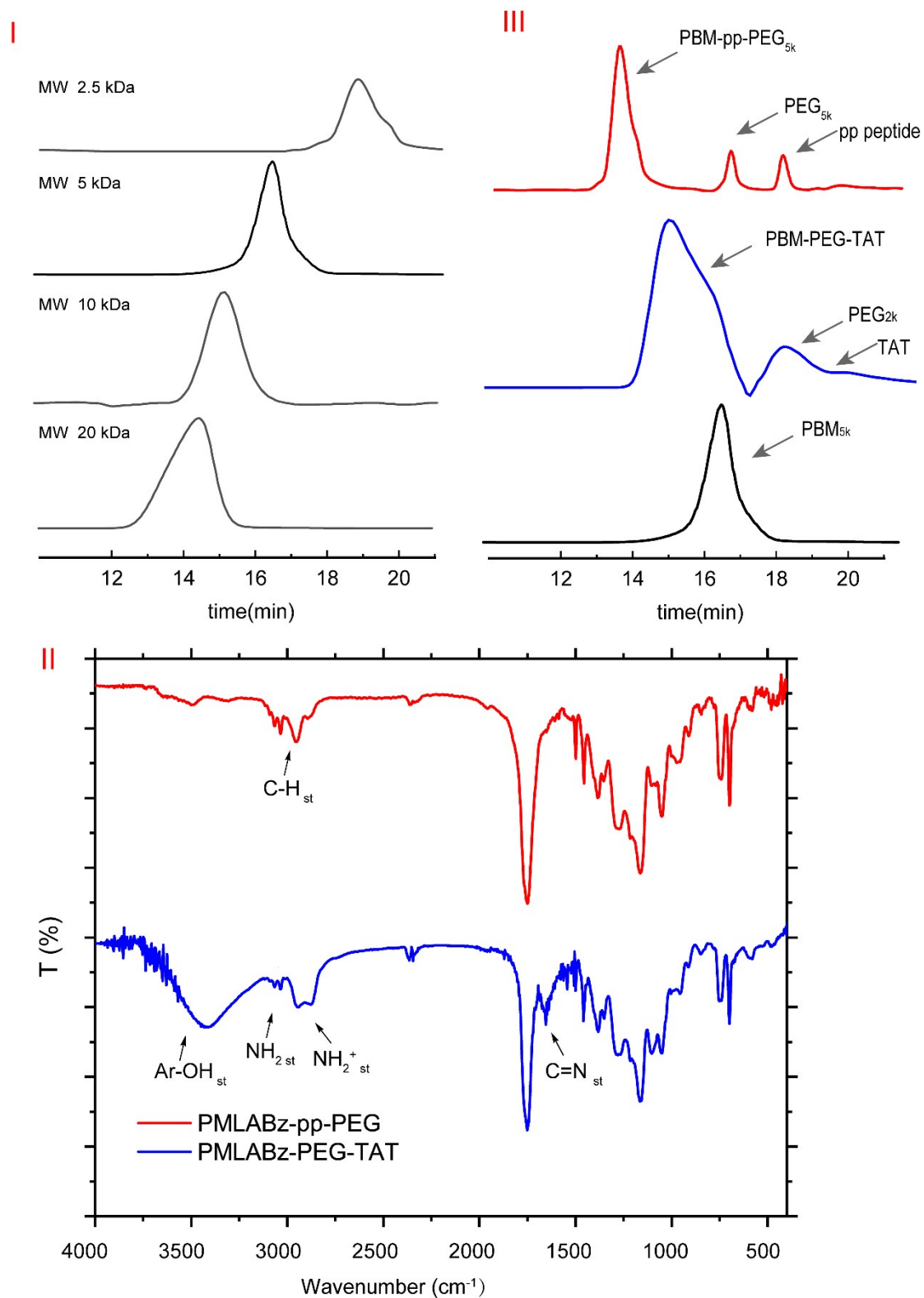


Fig. S3. II. GPC of PBM with different molecular weight; II. FTIR spectrum of two polymers: PBM-pp-PEG<sub>5k</sub> (P1, red) and PBM-PEG<sub>2k</sub>-TAT (P2, blue); III. GPC of before and after TAT and

PEG conjugate

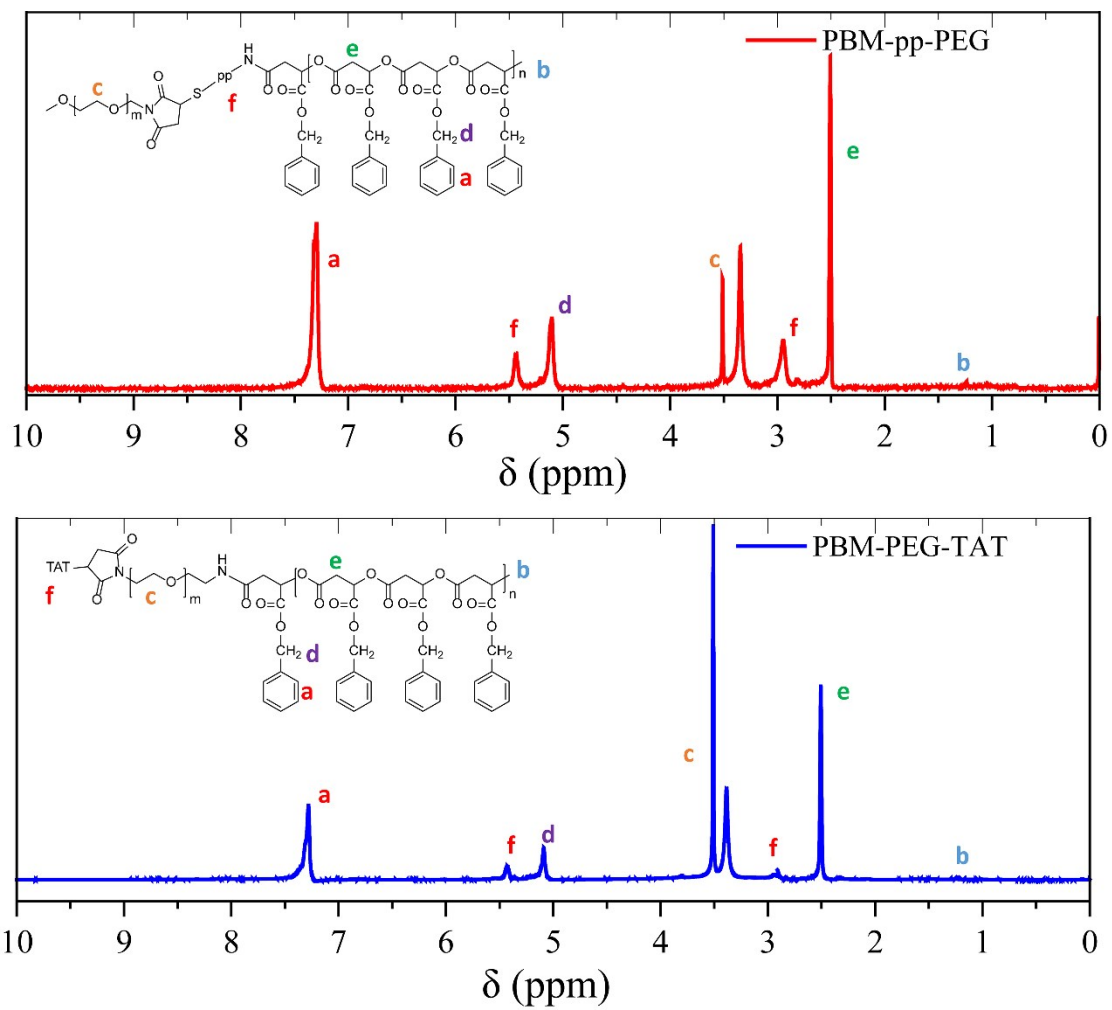


Fig. S4. <sup>1</sup>H-NMR spectrum of two polymers: PBM-pp-PEG<sub>5k</sub> (P1, red) and PBM-PEG<sub>2k</sub>-TAT (P2, blue).

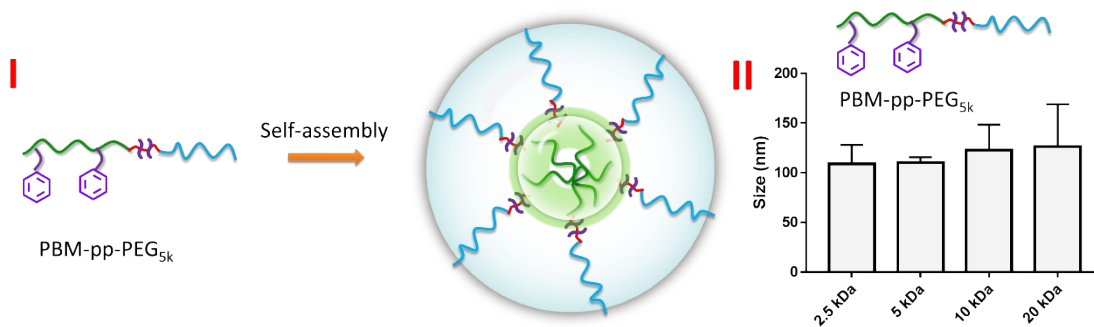


Fig. S5. I: a schematic of micellar preparation; II: size of micelles with different molecular of PBM.

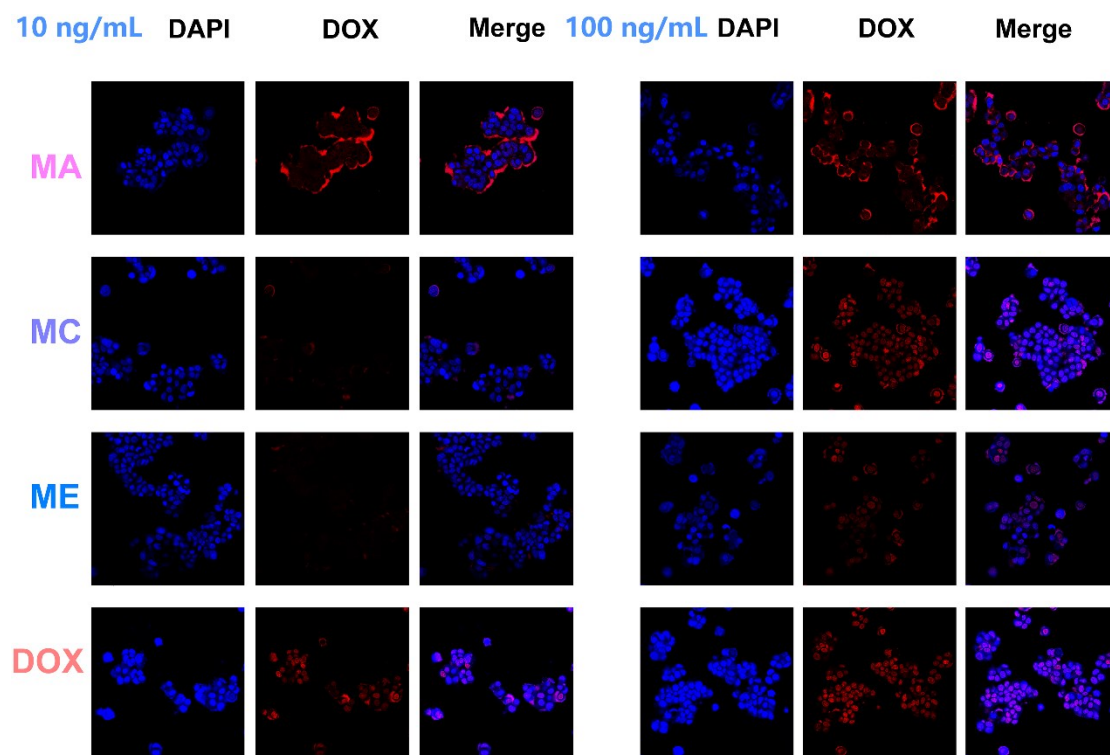


Fig. S6. CLSM images of MCF-7 cells after 4 h incubation with free DOX and DOX-loaded micelles MA, MC and ME at different MMP-2 concentration, 37 °C, 40 X.

Table S1. Size, zeta potential, and CMC of empty micelles. (MA: P2; MB: P1/P2, 5/1; MC: P1/P2, 10/1; MD: P1/P2, 20/1; ME: P1)

<b>Blank micelle</b>	<b>Molar ratio of P1/P2</b>	<b>Size (nm)</b>	<b>PDI</b>	<b>Zeta potential (mV)</b>	<b>CMC (<math>\mu\text{g/mL}</math>)</b>
MA	0:1	91.8 $\pm$ 32.7	0.098 $\pm$ 0.074	12.91 $\pm$ 0.80	2.6
MB	5:1	128.2 $\pm$ 8.1	0.210 $\pm$ 0.094	-5.6 $\pm$ 0.32	2.3
MC	10:1	133.63 $\pm$ 13.5	0.124 $\pm$ 0.091	-6.45 $\pm$ 0.24	3.3
MD	20:1	130.93 $\pm$ 6.5	0.156 $\pm$ 0.097	-9.28 $\pm$ 0.46	9.4
ME	1:0	106.1 $\pm$ 38.2	0.21 $\pm$ 0.061	-4.5 $\pm$ 0.66	16.6

Table S2. Size, zeta potential, drug loading efficiency, and encapsulation efficiency of DOX-loaded micelles. (MA: P2; MB: P1/P2, 5/1; MC: P1/P2, 10/1; MD: P1/P2, 20/1; ME: P1)

<b>Drug micelle</b>	<b>Molar ratio of P1/P2</b>	<b>Size (nm)</b>	<b>PDI</b>	<b>Zeta potential</b>	<b>Drug loading efficiency (%)</b>	<b>Encapsulation efficiency (%)</b>
MA	0:1	134.50±34.44	0.35±0.669	14.26±0.55	17.52±1.67	64.03±6.09
MB	5:1	136.53±22.79	0.029±0.102	3.26±0.36	19.16±2.39	72.01±2.38
MC	10:1	150.90±25.76	0.196±0.373	2.35±0.51	19.82±1.57	72.22±1.45
MD	20:1	149.87±14.98	0.328±0.126	-1.25±0.11	19.58±1.95	68.98±6.88
ME	1:0	155.80±34.87	0.0402±0.124	-1.7±0.74	20.27±1.95	68.68±9.26

Table S3. The IC<sub>50</sub> values (μg/mL) of micelles and free DOX against HT1080, MCF-7, and MDA-MB-231 cells with different MMP-2 concentration (10 ng/mL and 100 ng/mL) for 48 h, 37 °C.

Drug micelle	HT 1080		MCF-7		MDA-MB-231	
	10 ng/mL	100 ng/mL	10 ng/mL	100 ng/mL	10 ng/mL	100 ng/mL
MA	0.1128	0.06219	0.7075	0.1964	1.421	1.394
MC	0.1135	0.06283	2.199	0.7171	3.67	1.908
ME	0.1983	0.1205	3.303	1.865	3.716	4.66
DOX	0.09409	0.07372	0.6452	0.4102	1.065	1.48