

## Supplementary Information

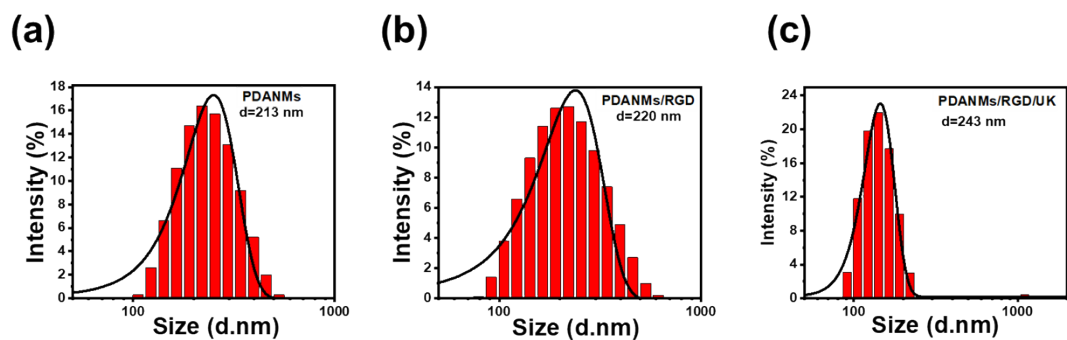
# Dual drive mode polydopamine nanomotors for continuous treatment of inferior vena cava thrombus

Dan Fang,<sup>‡a</sup> Ting Li,<sup>‡a</sup> Ziyu Wu,<sup>b</sup> Qi Wang,<sup>a</sup> Mimi Wan,<sup>\*a</sup> Min Zhou<sup>b</sup> and Chun Mao<sup>\*a</sup>

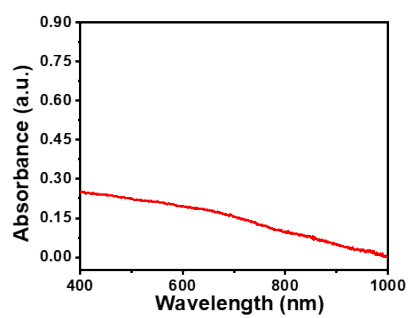
<sup>a</sup> National and Local Joint Engineering Research Center of Biomedical Functional Materials, School of Chemistry and Materials Science, Nanjing Normal University, 210023, China.

<sup>b</sup> Department of Vascular Surgery, Nanjing Drum Tower Hospital, The Affiliated Hospital of Nanjing University Medical School, Nanjing 210008, China.

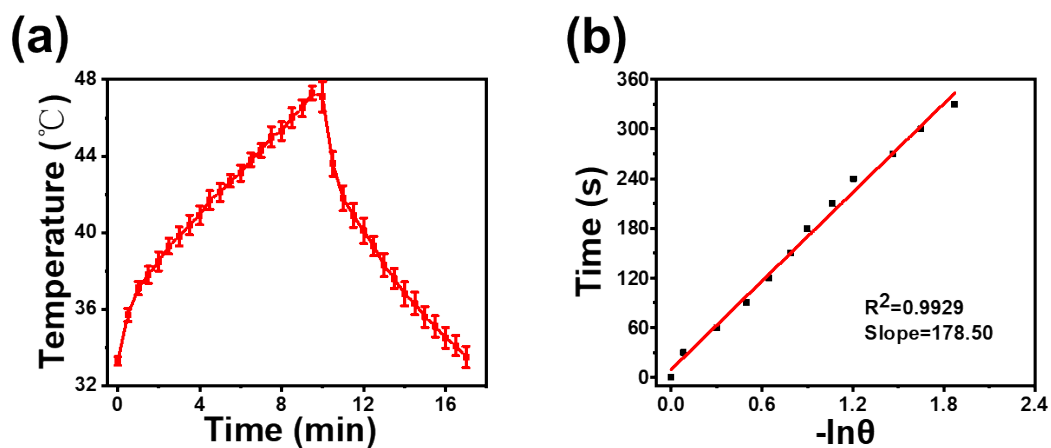
<sup>‡</sup> These authors contributed equally to this work.



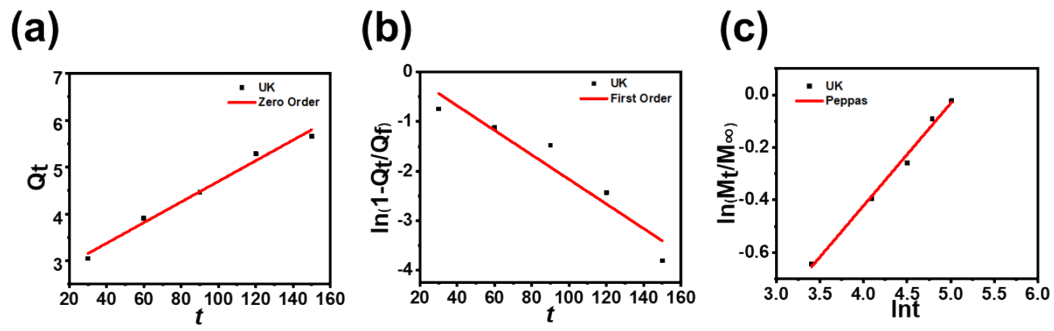
**Fig. S1** Dynamic light scattering (DLS) of (a) PDANMs, (b) PDANMs/RGD and (c) PDANMs/RGD/UK.



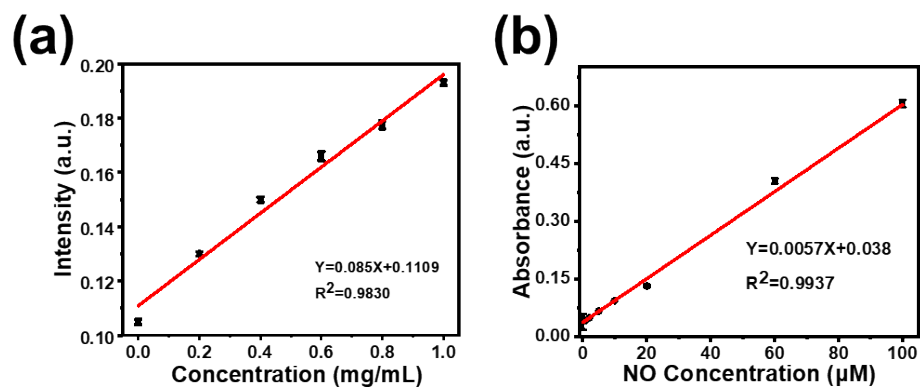
**Fig. S2** The UV-vis-NIR spectrum of PDANMs/RGD/UK ( $0.3 \text{ mg}\cdot\text{mL}^{-1}$ ).



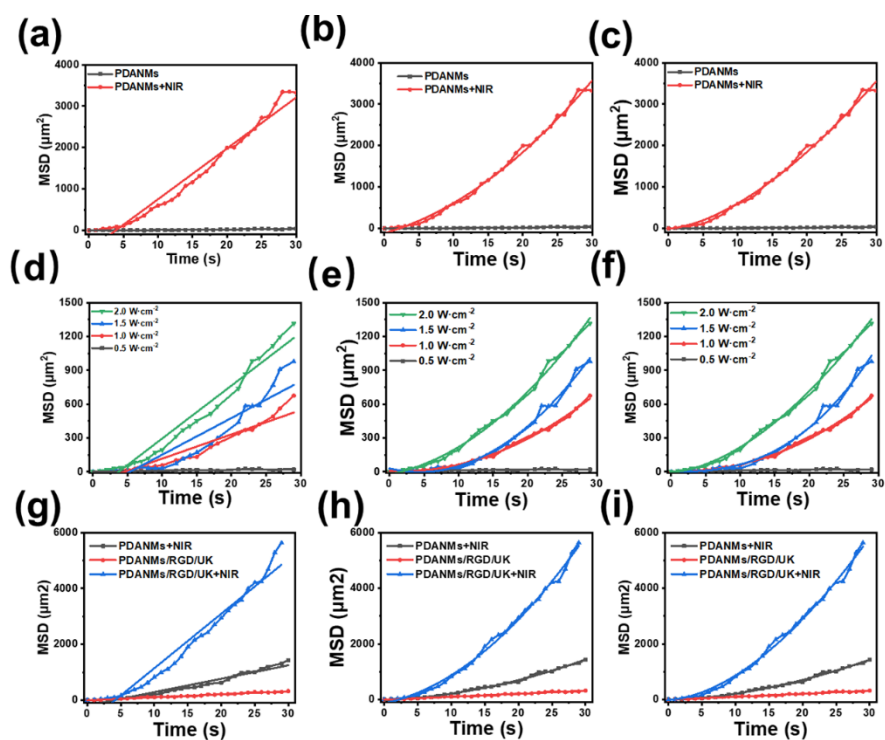
**Fig. S3** (a) The relationship between temperature and time of PDANMs/RGD/UK ( $0.3 \text{ mg}\cdot\text{mL}^{-1}$ ) aqueous solution after irradiating by NIR for 10 min and cooling to room temperature ( $808 \text{ nm}$ ,  $2 \text{ W}\cdot\text{cm}^{-2}$ ). (b) The relationship between cooling time and negative natural logarithm function of temperature during the cooling stage when the concentration of PDANMs/RGD/UK is  $0.3 \text{ mg}\cdot\text{mL}^{-1}$ .



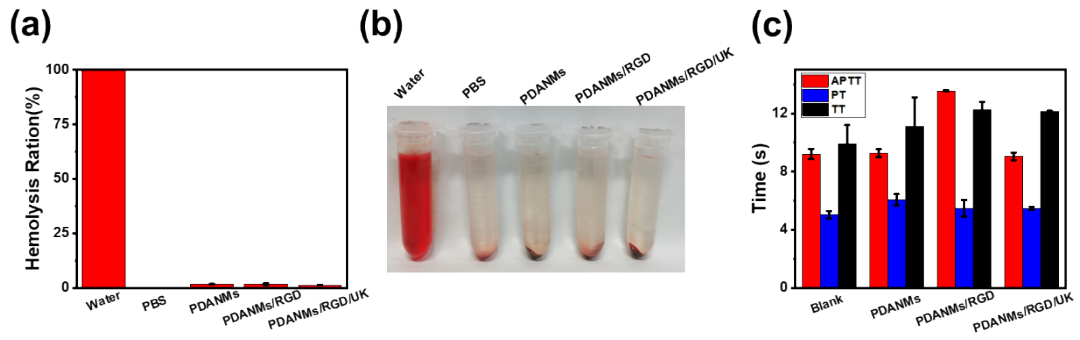
**Fig. S4** Three classical models to study release mechanism of UK. (a)Zero-order release model, (b)First-order release model and (c) Peppas release model.



**Fig. S5** The standard curves for (a) RGD detection and (b) NO detection.

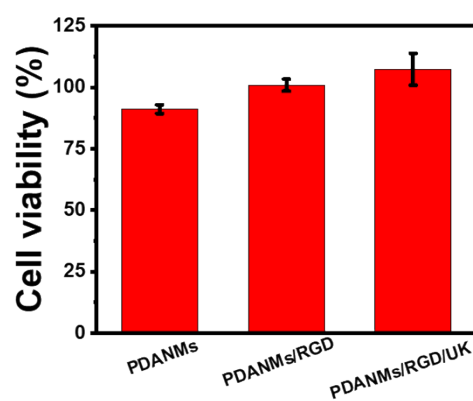


**Fig. S6** The motion behavior study of nanomotors. (a) Linear, (b) parabolic and (c) power function fitting results for MSD plot when PDANMs moved in PBS; (d) Linear, (e) parabolic and (f) power function fitting results for MSD plot when PDANMs irradiated by different NIR power densities in HUVECs stimulated by LPS; (g) Linear, (h) parabolic and (i) power function fitting results for MSD plot when nanomotors driving by different modes in HUVECs stimulated by LPS.

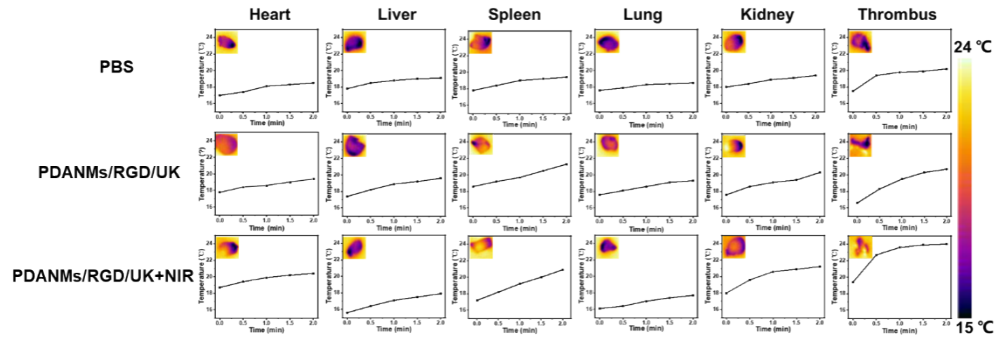


**Fig. S7** (a) The hemolysis rates of blood after incubating with different samples at 37°C and (b) their corresponding photograph of hemolysis; (c) Coagulation time of platelet poor plasma after incubating with different samples at 37°C.

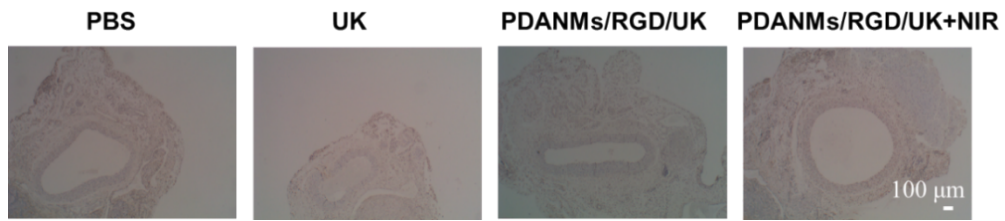




**Fig. S8** The cell viability of HUVECs incubated with  $0.3 \text{ mg}\cdot\text{mL}^{-1}$  PDANMs, PDANMs/RGD and PDANMs/RGD/UK.



**Fig. S9** The temperature curves of the main organs and thrombus irradiating by 808 nm NIR light ( $2 \text{ W} \cdot \text{cm}^{-2}$ , 2 min).



**Fig. S10** TUNEL staining sections of blood vessel in different groups.

**Table. S1** Parameters and coefficients obtained for Zero-order release model  $Q_t = K_0t$ , First-order release model  $\ln(1-Q_t/Q_f) = -K_1t$  and Peppas release model  $\ln(M_t/M_\infty) = \ln a + b \ln t$  fitted to the UK release profiles from PDANMs/RGD/UK.

Release models	Release parameters	UK
Zero order	$K_0$	0.022
	$R^2$	0.9864
First Order	$K_1$	0.025
	$R^2$	0.9157
Peppas	a	0.13
	b	0.39
	$R^2$	0.9902

**Table. S2** Linear function fitting parameters for MSD plot of PDANMs with/without NIR irradiation in PBS ( $y = a + bx$ ).

NIR	$R^2$	a	b
Without	0.8147	-3.31	1.29
With	0.9693	-478.16	122.93

**Table S3** Parabolic function fitting parameters for MSD plot of PDANMs with/without NIR irradiation in PBS ( $y = ax^2 + bx + c$ ).

NIR	$R^2$	a	b	c
Without	0.8616	0.036	0.21	1.90
with	0.9948	2.50	47.99	-115.93

**Table. S4** Power function fitting parameters for MSD plot of PDANMs with/without NIR irradiation in PBS ( $y = ax^b$ ).

NIR	$R^2$	a	b
Without	0.8496	0.21	1.55
with	0.9954	14.84	1.61

**Table. S5** Linear function fitting parameters for MSD plot of PDANMs with NIR irradiation under different power densities in HUVECs stimulated by LPS ( $y = a + bx$ ).

	Power density ( $W \cdot cm^{-2}$ )	$R^2$	a	b
NIR	0.5	0.6267	3.04	0.73
	1	0.9107	-98.16	21.52
	1.5	0.8620	-173.60	32.55
	2	0.9579	-173.94	46.94

**Table. S6** Parabolic function fitting parameters for MSD plot of PDANMs with NIR irradiation under different power densities in HUVECs stimulated by LPS ( $y = ax^2 + bx + c$ ).

	Power density ( $W \cdot cm^{-2}$ )	$R^2$	a	b	c
NIR	0.5	0.7322	-0.040	1.85	-1.80
	1	0.9960	0.87	-3.06	7.96
	1.5	0.9923	1.67	-14.74	30.56
	2	0.9958	1.23	12.06	-23.35

**Table. S7** Power function fitting parameters for MSD plot of PDANMs with NIR irradiation under different power densities in HUVECs stimulated by LPS ( $y = ax^b$ ).

	Power density ( $W \cdot cm^{-2}$ )	$R^2$	a	b
NIR	0.5	0.6383	2.75	0.63
	1	0.9960	0.44	2.17
	1.5	0.9917	0.16	2.60
	2	0.9963	4.22	1.71

**Table. S8** Linear function fitting parameters for MSD plot of nanomotors with different drive modes in HUVECs stimulated by LPS ( $y = a + bx$ ).

Nanomotors	Drive Mode	$R^2$	a	b
PDANMS	NIR	0.9536	-195.41	48.08
PDANMs/RGD/UK	NO	0.9819	-5.89	10.73
PDANMs/RGD/UK+NIR	NIR+NO	0.9591	-805.93	195.07

**Table. S9** Parabolic function fitting parameters for MSD plot of nanomotors with different drive modes in HUVECs stimulated by LPS ( $y = ax^2 + bx + c$ ).

Nanomotors	Drive Mode	R <sup>2</sup>	a	b	c
PDANMS	NIR	0.9954	1.26	10.77	-18.79
PDANMs/RGD/UK	NO	0.9819	0.0034	10.63	-5.40
PDANMs/RGD/UK+NIR	NIR+NO	0.9960	4.95	51.38	-135.40

**Table. S10** Power function fitting parameters for MSD plot of nanomotors with different drive modes in HUVECs stimulated by LPS ( $y = ax^b$ ).

Nanomotors	Drive Mode	R <sup>2</sup>	a	b
PDANMS	NIR	0.9955	3.84	1.74
PDANMs/RGD/UK	NO	0.9800	9.11	1.04
PDANMs/RGD/UK+NIR	NIR+NO	0.9962	15.95	1.74

**Table. S11** Blood routine analysis of rats after being treated with different samples for 7 d.

Group	PBS	UK	PDANMs/RGD/ UK	PDANMs/RGD/ UK+NIR
Percentage of monocytes (%)	1.8	3.2	1.8	2.5
Neutrophil count (10 <sup>9</sup> /L)	0.7	1.3	0.9	0.9
Red blood cell count (10 <sup>12</sup> /L)	6.68	6.42	6.8	6.72
Hemoglobin (HGB) (g/L)	129	124	141	137
Hematocrit (HCT) (%)	40	38.7	42.9	41.8
Mean corpuscular volume (MCV) (fl)	59.9	60.3	63.1	62.2
Mean hemoglobin content (MHC) (pg)	19.3	19.3	20.7	20.4
Mean corpuscular hemoglobin concentration (MCHC) (g/L)	323	320	329	328
RBC volume distributing width (RDW) (%)	12.4	12.2	12.3	12.2

**Table. S12** Values of serum enzymes in blood of rats after being treated with different samples for 7 d.

Group	PBS	UK	PDANMs/RGD/ UK	PDANMs/RGD/UK +NIR
Alanine transaminase (ALT)	26.8	46.9	24.8	25.2
Aspartate aminotransferase (AST)	124.4	319	132	148.9
Total protein (TP)	57.9	51.4	60.5	52.8
Albumin	31.3	30.3	34.1	31.2
Globulin	22.6	21.1	26.4	21.6
Urea	5.1	4.5	4.4	7
Creatinine	23	23	22	29