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Immobilization of cellulase proteins on Zeolitic imidazolate framework (ZIF-8)/polyvinylidene fluoride hybrid membranes

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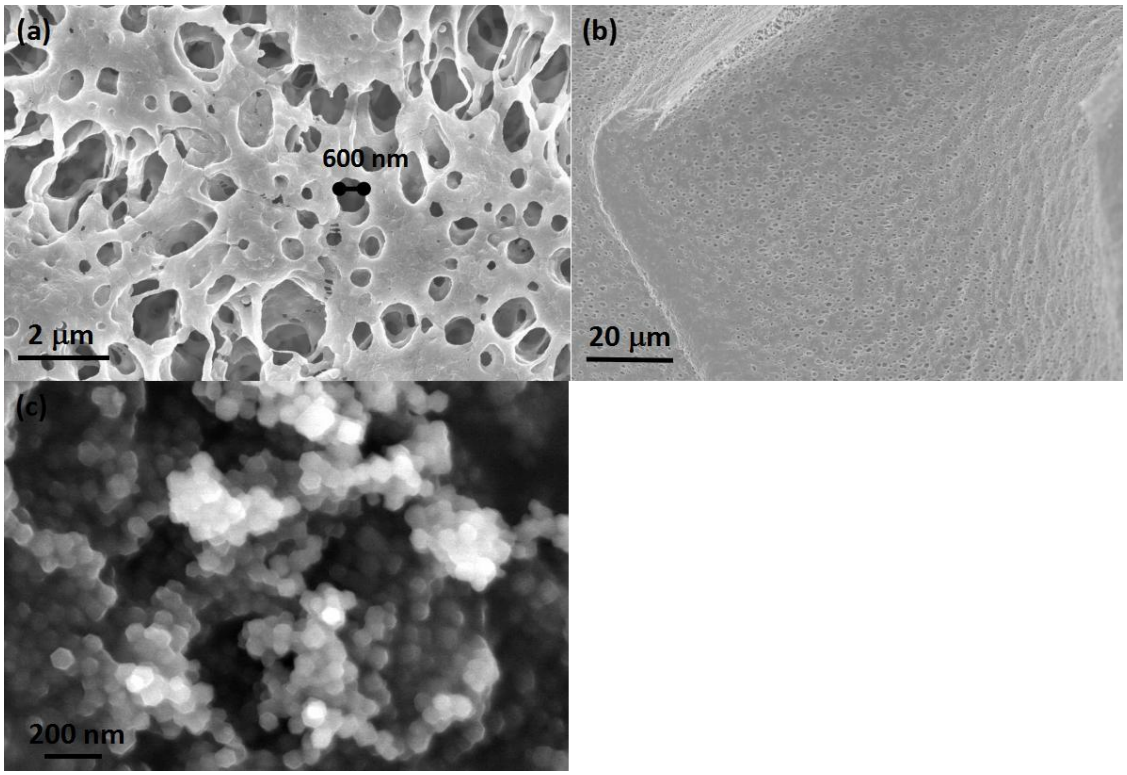

Fig. S1 SEM images of pristine PVDF membranes (a: front-section; b: cross-section) and single ZIF-8 particles (c)

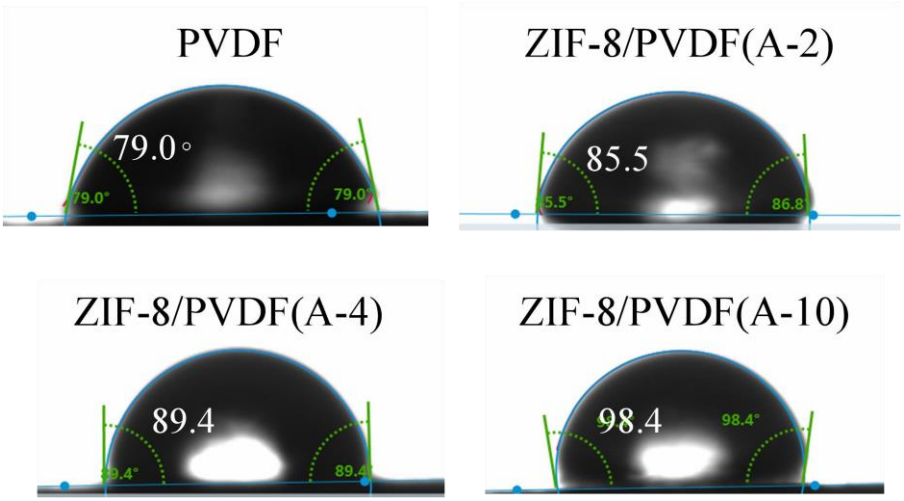

Fig. S2 Water contact angle for pristine PVDF and ZIF-8/PVDF hybrid membranes

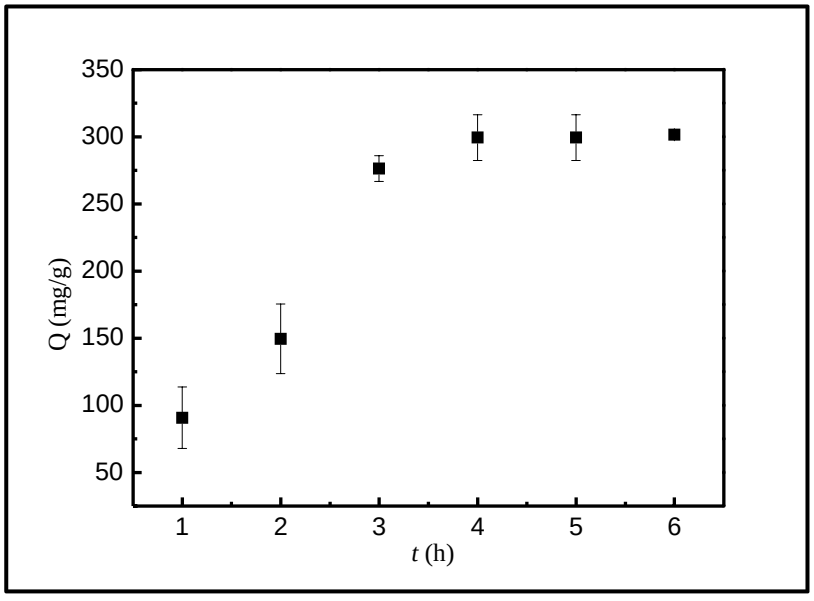

Fig. S3 The adsorption kinetics of cellulase on single ZIF-8 particles

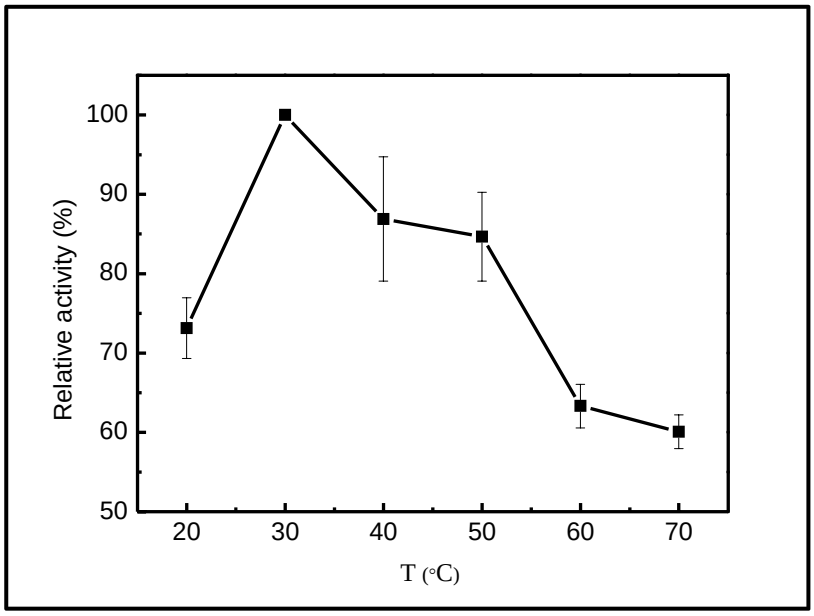

Fig. S4 Relative catalytic activities of ZIF-8 immobilized cellulase under temperature varied from 20 °C to 70 °C.

Table S1 Kinetic parameters using pseudo-first-order, pseudo-second order and intra-particle diffusion models for cellulase adsorption on PVDF and ZIF-8/PVDF hybrid membranes

	Pseudo-first-order		
Sample	q_e(μg cm^{-2})	k_1(min^{-1})	R^2
PVDF	76.00	0.526	0.8720
ZIF-8/PVDF（A-2）	86.40	0.057	0.9593
ZIF-8/PVDF（A-4）	89.43	0.407	0.9669
ZIF-8/PVDF（A-10）	83.99	0.684	0.9505
	Pseudo-second-order		
Sample	q_e(μg cm^{-2})	k_2(cm^2 μg^{-1} min^{-1})	R^2
PVDF	102.33	0.0044	0.8250
ZIF-8/PVDF（A-2）	112.38	0.0047	0.9253
ZIF-8/PVDF（A-4）	124.75	0.0026	0.9536
ZIF-8/PVDF（A-10）	104.97	0.0067	0.8949
	Intra-particle diffusion		
Sample	K_d(μg cm^{-2} $min^{-1/2}$)	R^2	
PVDF	32.00	0.7595	
ZIF-8/PVDF（A-2）	37.27	0.8311	
ZIF-8/PVDF（A-4）	34.58	0.9243	
ZIF-8/PVDF（A-10）	37.92	0.6918	