Supplementary Information

Pd-anchored Poly(vinyl chloride-*co*-maleic acid monoamide)/ polyvinyl chloride Ultrafiltration Membrane for Efficiently Degrading 4-Nitrophenol

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The polymerization of VCM is susceptible to the react temperature because of the high reactivity of chain radicals, which tend to side reactions such as chain transfer to monomer or solvent. As a result, both the reaction rate and the molecular weight of the produced copolymer might decrease. A series of experiments were run to study the influence of T_r on the copolymerization of VCM and MALA (Table S1). With the rise of T_r, the reaction rate is accelerated and the highest monomer conversion (C%=48%) is achieved at 55 °C (Figure S1(a)). While when the T_r was up to 60°C, the monomer conversion decreased. The reason is likely attributed to the much high chain transfer reaction of PVC propagating chain radicals to the VCM. The composition of the copolymer at different T_r was calculated by combining the results of EA and ^{1}H NMR. As the T_r raised, the fraction of MALA in the copolymer decreased while the mass ratio of MAM to MALA was increased slightly, which indicated that high T_r caused esterification reaction more readily. Therefore, low T_r (40°C) was utilized in the following polymerizations to obtain copolymers of high MALA content.

The effects of monomer concentration (Figure S1(b)) and TBCP concentration (Figure S1(c)) on the polymerization kinetic, Mn of obtained copolymer, and the content of MAM in the produced copolymers were investigated. Both reaction rate and monomer conversion increased gradually with the increasing of monomer concentration. In addition, the auto acceleration occurred and becomes more obvious with the increase of monomer concentration, which can also increase the M_n of the copolymer (Table S3). Particularly, the content of MALA segment in copolymer increases and the mass ratio of MAM to MALA decreased dramatically. As to the relationship of reaction kinetic and TBCP concentration, the copolymerization could not be initiated at a low concentration (1%) of TBCP. Continuously increase the TBCP from 2% to 6%, both reaction rate and conversion enhanced significantly. However, the increasing of initiator inevitably leads to a decrease in M_n. When the initiator concentration increased to 6%, the M_n drops to 5700 (Table S2). It is well known that too low M_n will reduce the mechanical properties of PVMA, which is not conducive to utilization and should be avoided as far as possible.

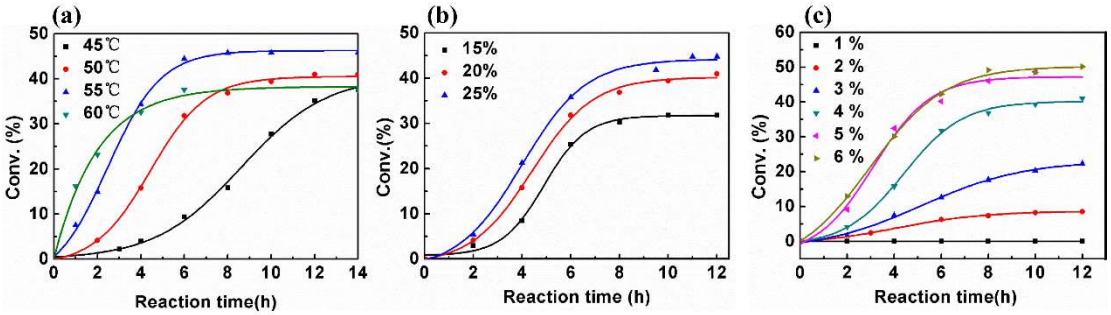

Figure S1. The curve of conversion over time at different (a) reaction temperature, (b) monomer concentration, (c) initiator concentration.

Table S1. The characteristics of PVMA at different T_r

T_r (℃)	M_n	PDI	N (wt%)	MALA (wt%)	MAM (wt%)
45	12800	1.71	0.75	3.53	2.62
50	10700	1.52	0.60	2.35	2.65
55	10300	1.75	0.59	2.18	2.72
60	7400	1.57	0.44	0.86	2.78

Table 2. The characteristics of PVMA at different initiator concentration

Initiator Concentration(%)	M_n	PDI	N (wt%)	MALA (wt%)	MAM (wt%)
2	8200	1.31	1.29	6.26	3.96
3	8100	1.66	0.68	2.07	3.46
4	7600	1.63	0.57	2.58	2.24
5	6700	1.67	0.53	2.22	2.52
6	5700	1.91	0.55	2.18	2.47

Table S3. The characteristics of PVMA at different monomer concentration

Monomer concentration (%)	M_n	PDI	N (wt%)	MALA (wt%)	MAM (wt%)
15	6900	1.50	0.69	2.06	3.74
20	10700	1.52	0.60	2.35	2.65
25	12100	1.83	0.45	2.42	1.44

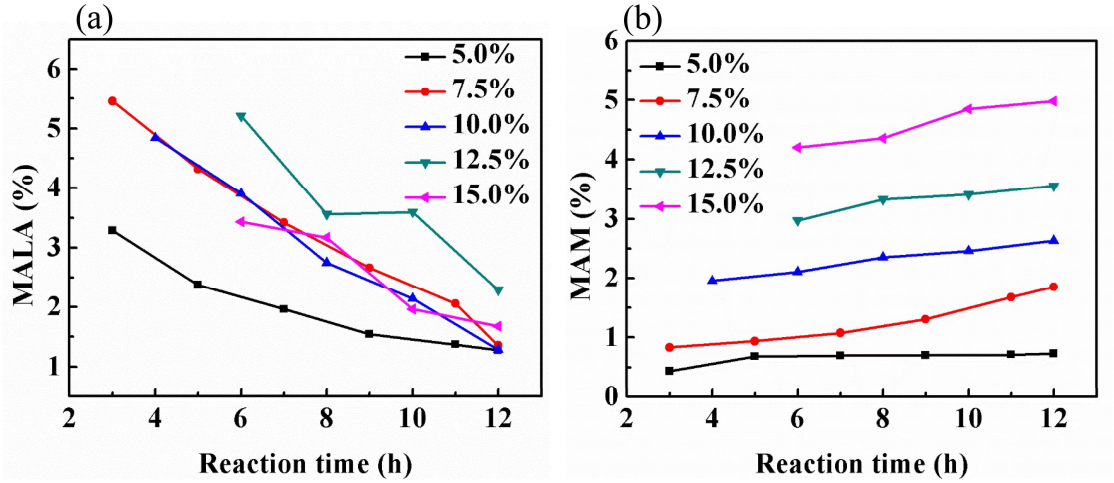

Figure S2. The graphs of (a) the mass fraction of MALA and (b) MAM over time at different monomer ratio.

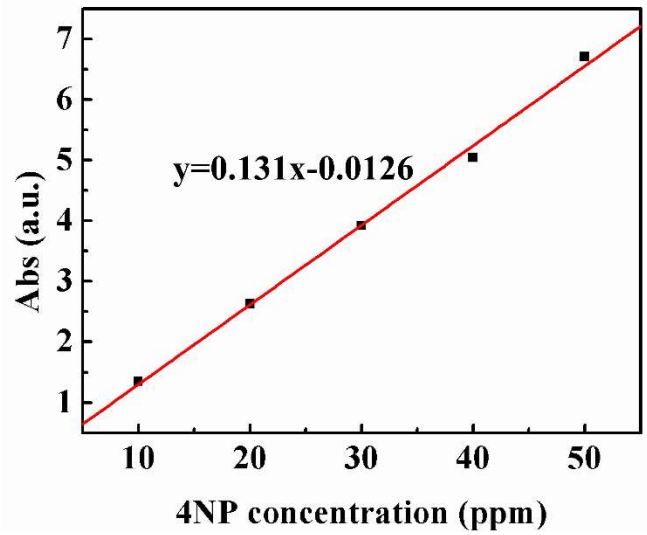

Figure S3. The standard curve of absorbance on the concentration of 4-NP