

Synthesis of Polyvinyl Chloride Based Copolymer and Its Usage for Ultrafiltration

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Introduction

Polyvinyl chloride is widely used for ultrafiltration membrane material, due to its stiffness, excellent physical properties, mechanical performance, especially low price. However, due to the hydrophobicity of PVC, the pure membranes tend to be fouled when exposed to wastewater, which has detrimental effects on the efficiency and economics of the membrane process. In order to improve the hydrophilic properties of the PVC membranes, numerous strategies have been developed to endow the hydrophobic material with hydrophilic substance

In this work, PVC based copolymer was synthesized by ATRP process. And its ultrafiltration membranes were prepared by traditional non-solvent induced phase separation (NIPS) process.

Experimental



Step: 2 NIPS process

Results and Discussion

1. Synthesis of PVC copolymer

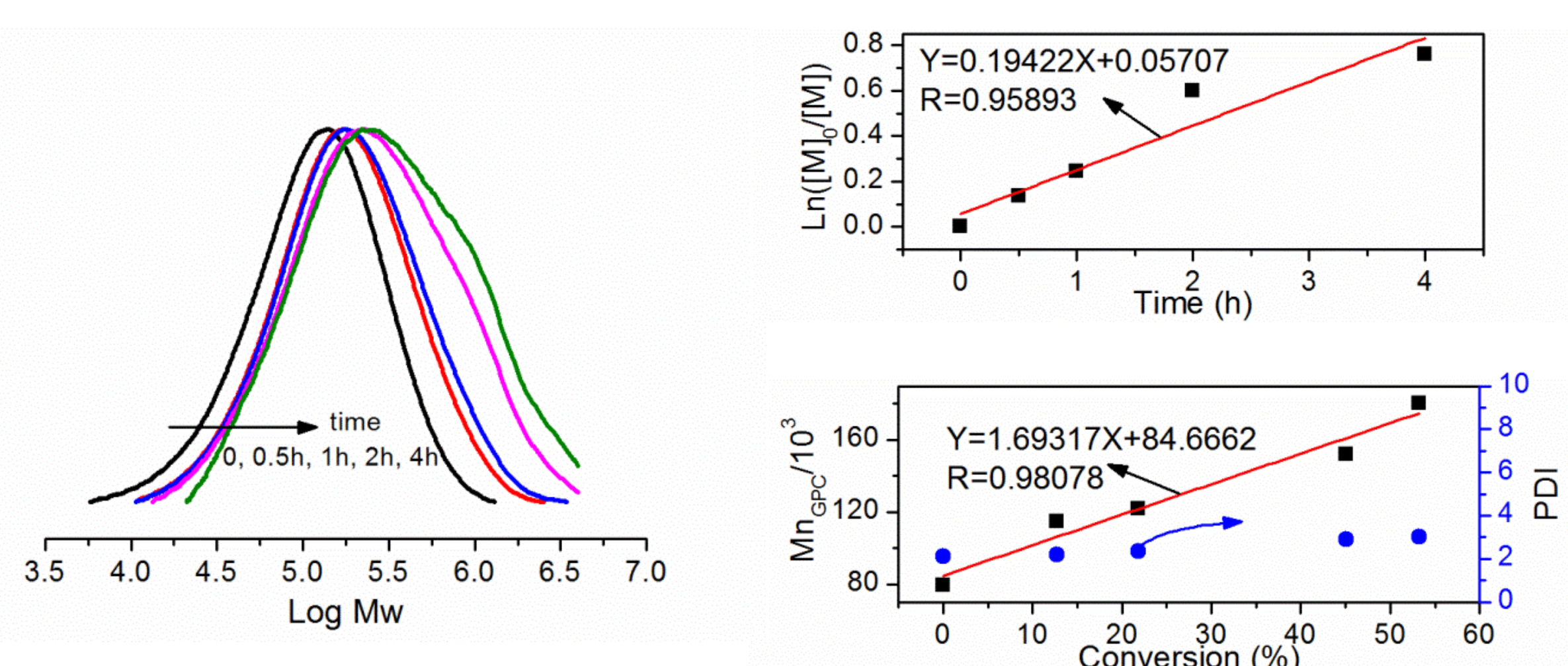


Figure 1. GPC traces, pseudo-first-order kinetic plot and dependence of M_n and PDI on conversion of PVC-g-PDMA via ATRP.

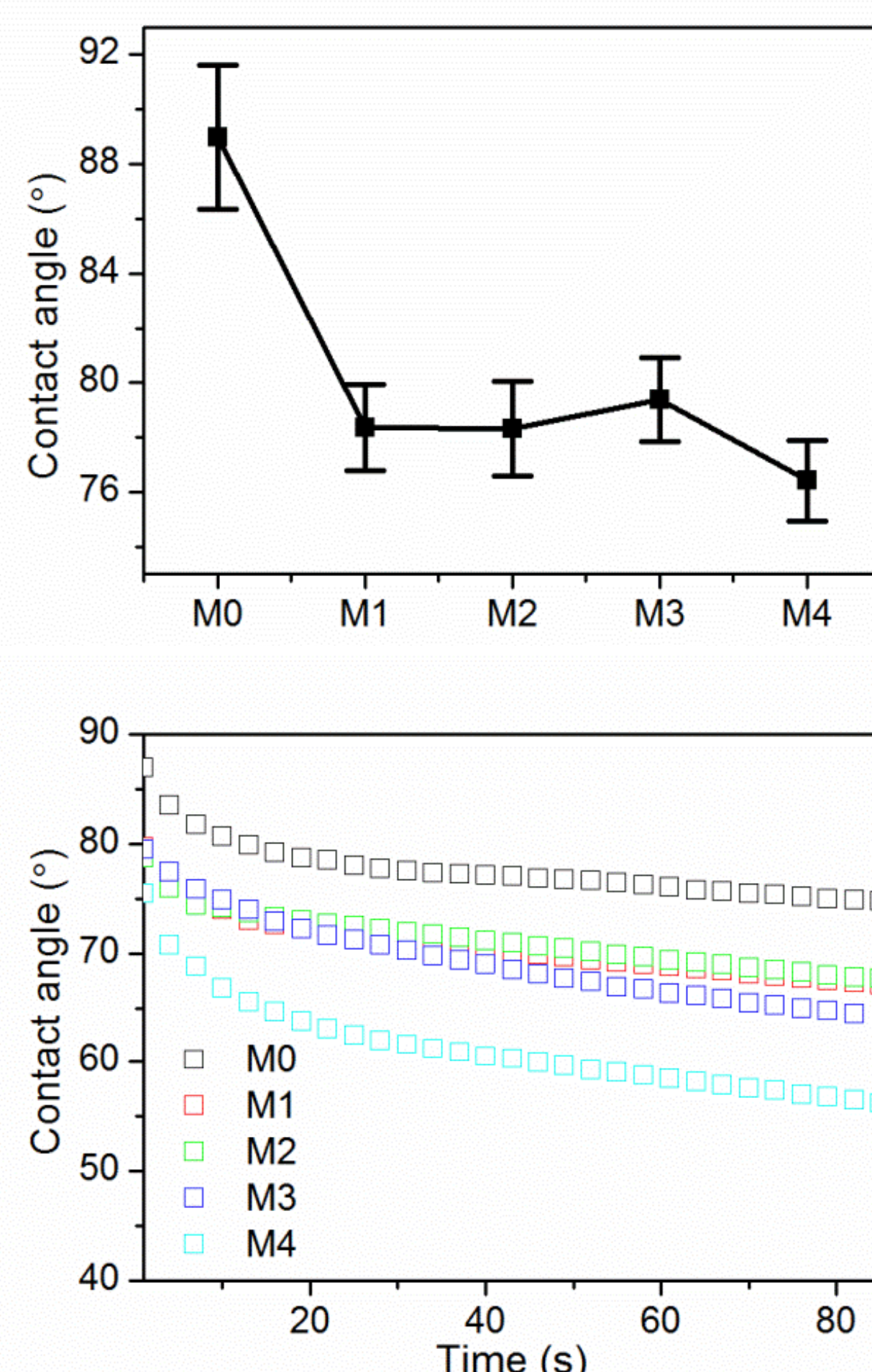
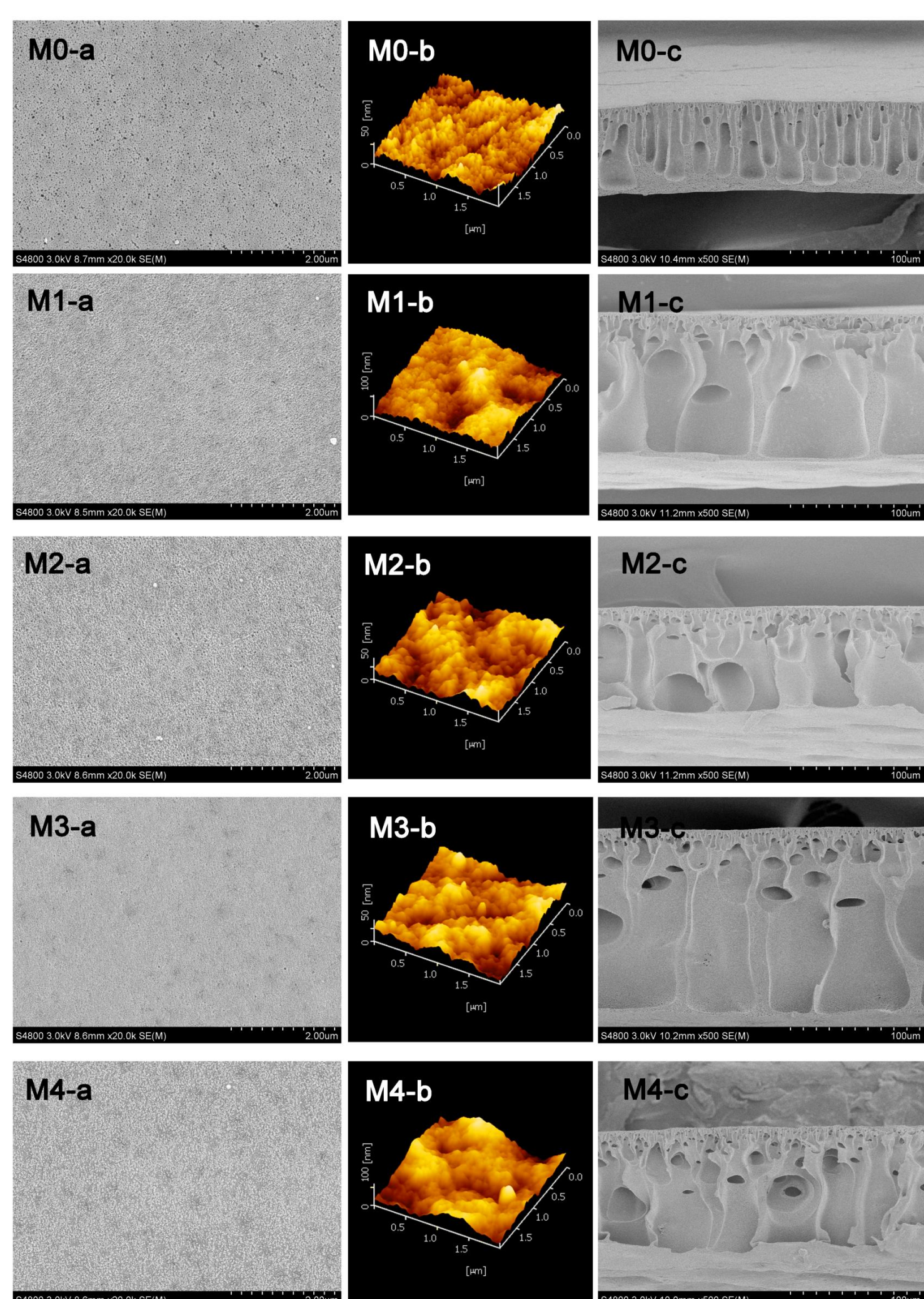
Polymer	Time/h	$M_{n, GPC}$	PDI	DMA % ^b	Grafting length ^c	Units of chain	Membranes
PVC ^a	-	79308	2.10	-	-	-	M0
PDMA0.5	0.5	114854	2.18	20.9%	13757	87.5	M1
PDMA1.0	1.0	121727	2.34	31.1%	23757	151.1	M2
PDMA2.0	2.0	151718	2.89	53.9%	49162	312.7	M3
PDMA4.0	4.0	180425	3.01	56.9%	57973	368.8	M4

a Every PVC chain contains about 1300 VC units.

b Calculated according to NMR data.

c Every 1000 VC units contains 1.85 initiation points.

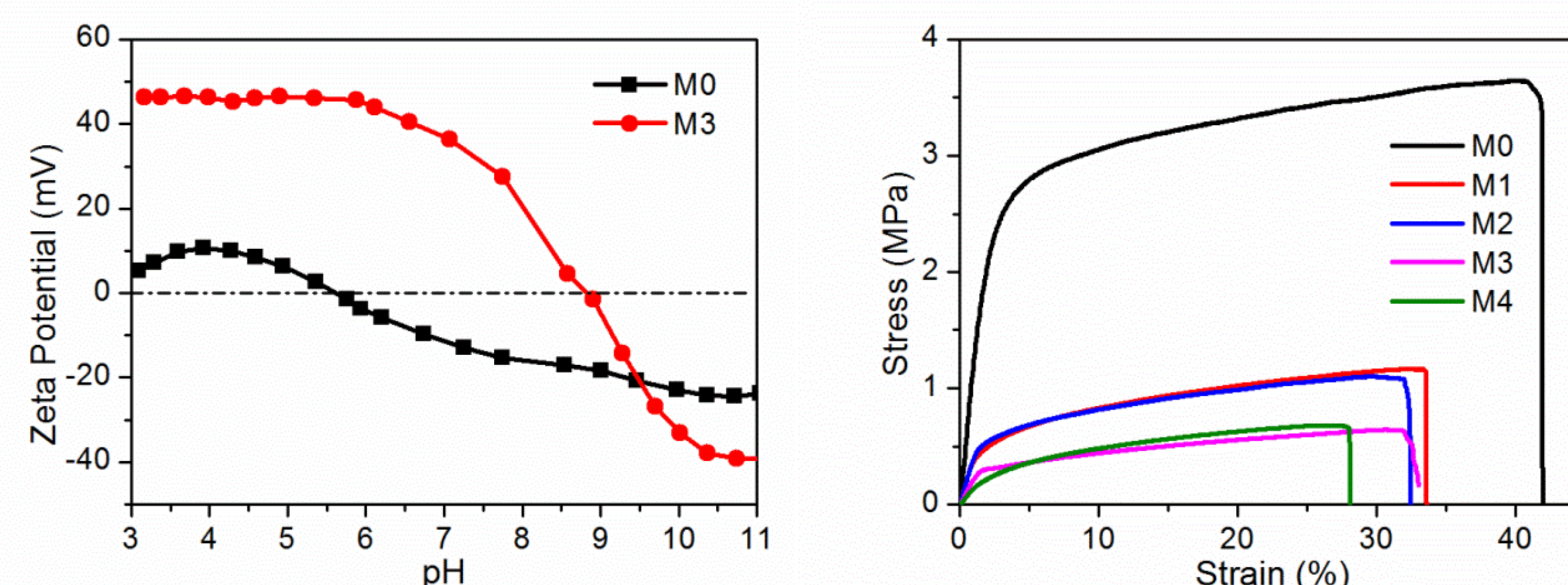
2. Surface morphology and wettability



3. Permeation and separation performances

	Water Flux/L.m ⁻² .h ⁻¹	BSA Rejection/%	LYS Rejection/%
M0	44.9	87.4	<10
M1	182.5	>99	45.7
M2	176.3	>99	80.4
M3	210.0	88.2	63.7
M4	204.1	-	-

4. Surface charge and mechanical property



Conclusion

PVC-g-PDMA was successfully synthesized by ATRP process. The ultrafiltration membranes with positive charge were directly prepared from the copolymer. The membranes showed better wettability, and higher water flux and BSA/LYS rejection. However, the membranes exhibited the worse mechanical property than PVC pristine membrane.

Acknowledgements

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