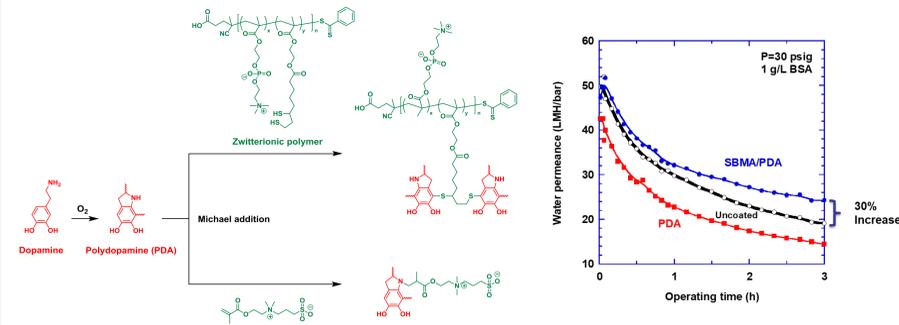
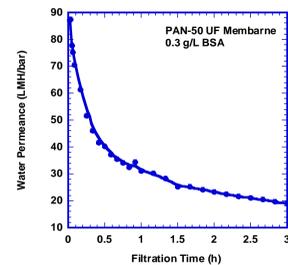
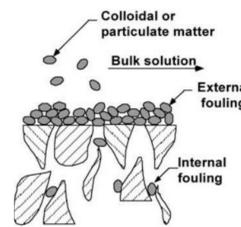


## Overview and Graphical Abstract

- Thiol-containing (PMD) and acrylate-containing (SBMA) zwitterions are successfully grafted onto UF membranes using two different techniques via bio-adhesive polydopamine (PDA).
- The modified membrane with PMD and PDA exhibits less flux decline than those of PDA-only coated and uncoated membranes in the long-term tests of BSA filtration.
- The facile SBMA/PDA surface modification has been applied for post-modification of NF membrane module.



## Challenge: Fouling

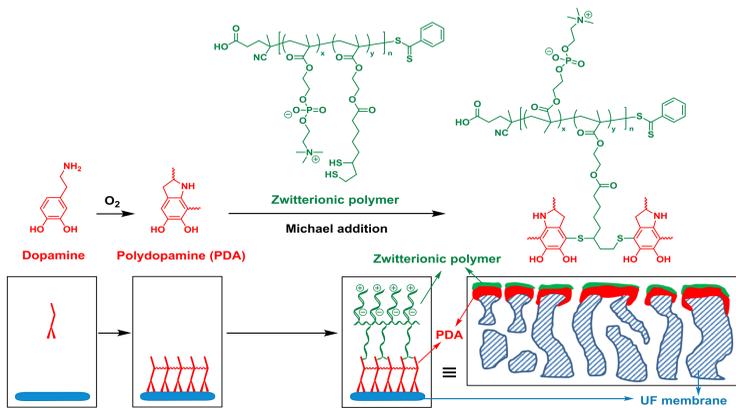


Geise, Lee, Miller, Freeman, McGrath and Paul, *J. Polym. Sci. Part B: Polym. Phys.* 2010, 48, (15), 1685.

Shahkaramipour, Tran, Ramanan and Lin, *Membranes* 2017, 7, (1), 13.

Membranes are often susceptible to fouling, which can greatly reduce the water flux.

## Our Approach (1): Two-Step Coating with Thiol-Containing Zwitterionic Polymers & PDA

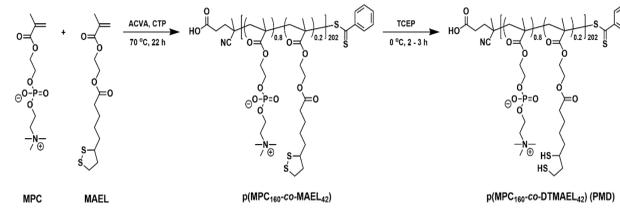


Shahkaramipour, Lai, Venna, Sun, Cheng and Lin, *Ind. Eng. Chem. Res.* 2018, 57, 2336.

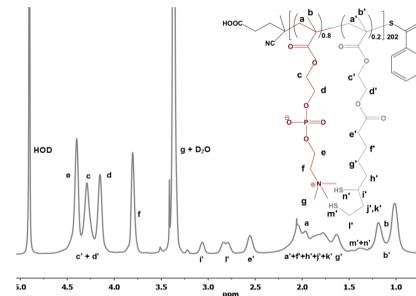
A PDA layer is first deposited onto the membrane surface.

Zwitterionic copolymers containing thiol groups are covalently anchored to the PDA layer.

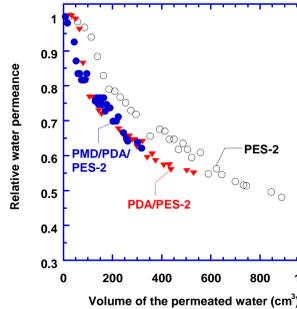
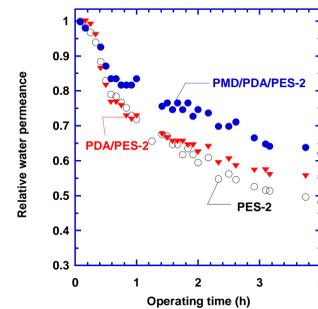
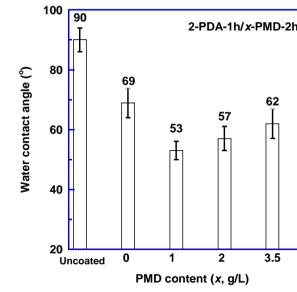
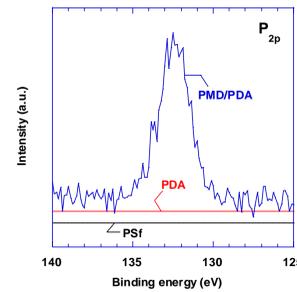
## Synthesis and Characterization of Thiol-Containing Copolymers



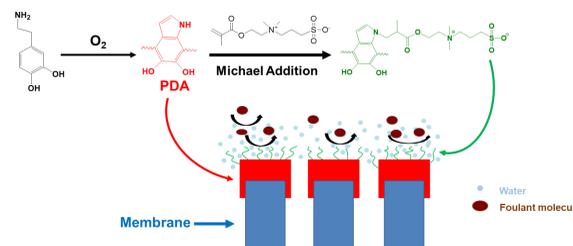
The successful synthesis of the PMD was verified through <sup>1</sup>H NMR analysis.



## Characterization & Antifouling Properties of PMD/PDA Modified Membranes



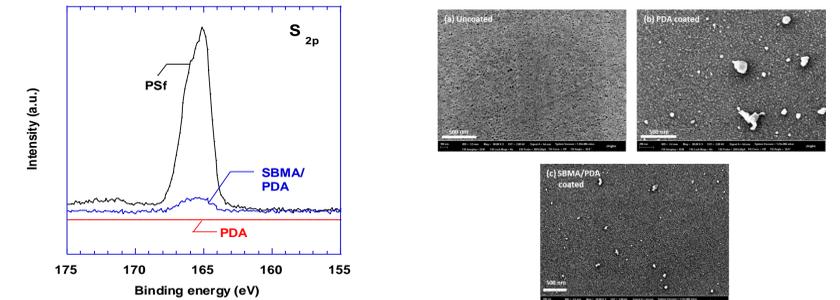
## Our Approach (2): One-Step Coating with Acrylate-Containing Zwitterions & PDA



Shahkaramipour, Ramanan, Fister, Park, Venna, Sun, Cheng and Lin, *Ind. Eng. Chem. Res.* 2017, 56, 9202.

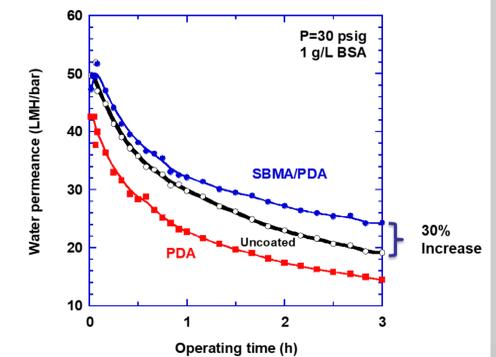
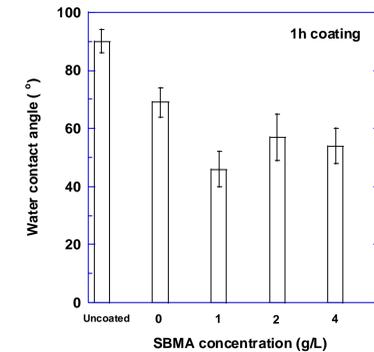
A facile one-step approach using SBMA and PDA is employed to modify the surface.

## Confirmation of SBMA/PDA Coated Layer

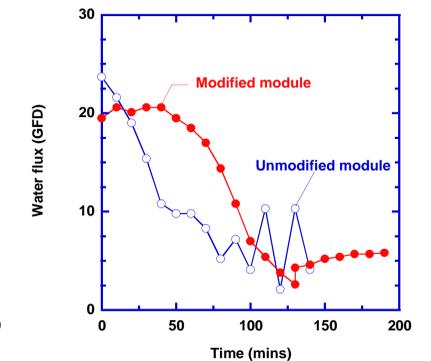
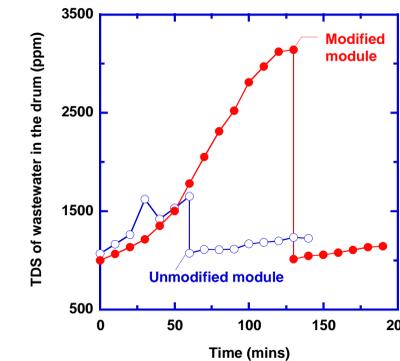


PDA anchors SBMA via Michael addition to form a robust thin layer.

## SBMA/PDA Coating Enhances Surface Hydrophilicity and Antifouling Properties



## Antifouling Properties of SBMA/PDA Modified Module



The facile SBMA/PDA co-deposition approach demonstrates superior antifouling properties for NF membrane module when tested with real wastewater.

## Conclusion and Acknowledgements

- Successful grafting of zwitterions containing thiol and acrylate functional groups onto PES-UF membranes has been confirmed via XPS, SEM and water contact angle measurements.
- Two-step coating of PMD/PDA and co-deposition of SBMA/PDA increase surface hydrophilicity of PES-UF membranes.
- The simplicity of SBMA/PDA co-deposition has been demonstrated for post modification of a membrane module, which shows improved water permeance when treating real wastewater at a wastewater treatment plant.