



# 2021「中技社科技獎學金」

## 2021 CTCI Foundation Science and Technology Scholarship

### 境外生研究獎學金

Research Scholarship for International Graduate Students

## Preparation of Superhydrophobic Polymer Composites for Oil/Water Mixtures and Water-in-Oil Emulsions Separation

超疏水高分子複合材料製備及其在油水分離與乳化液分離應用

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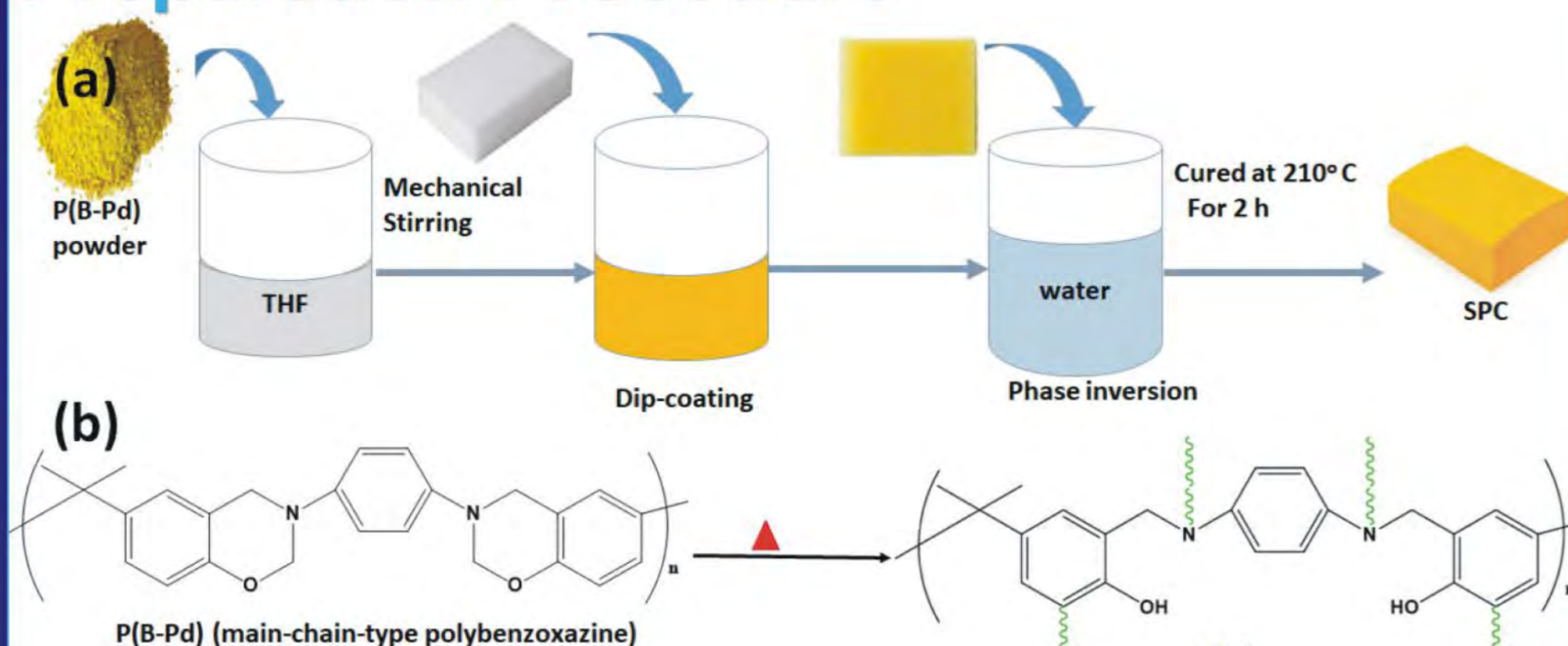
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National Taiwan University of Science and Technology

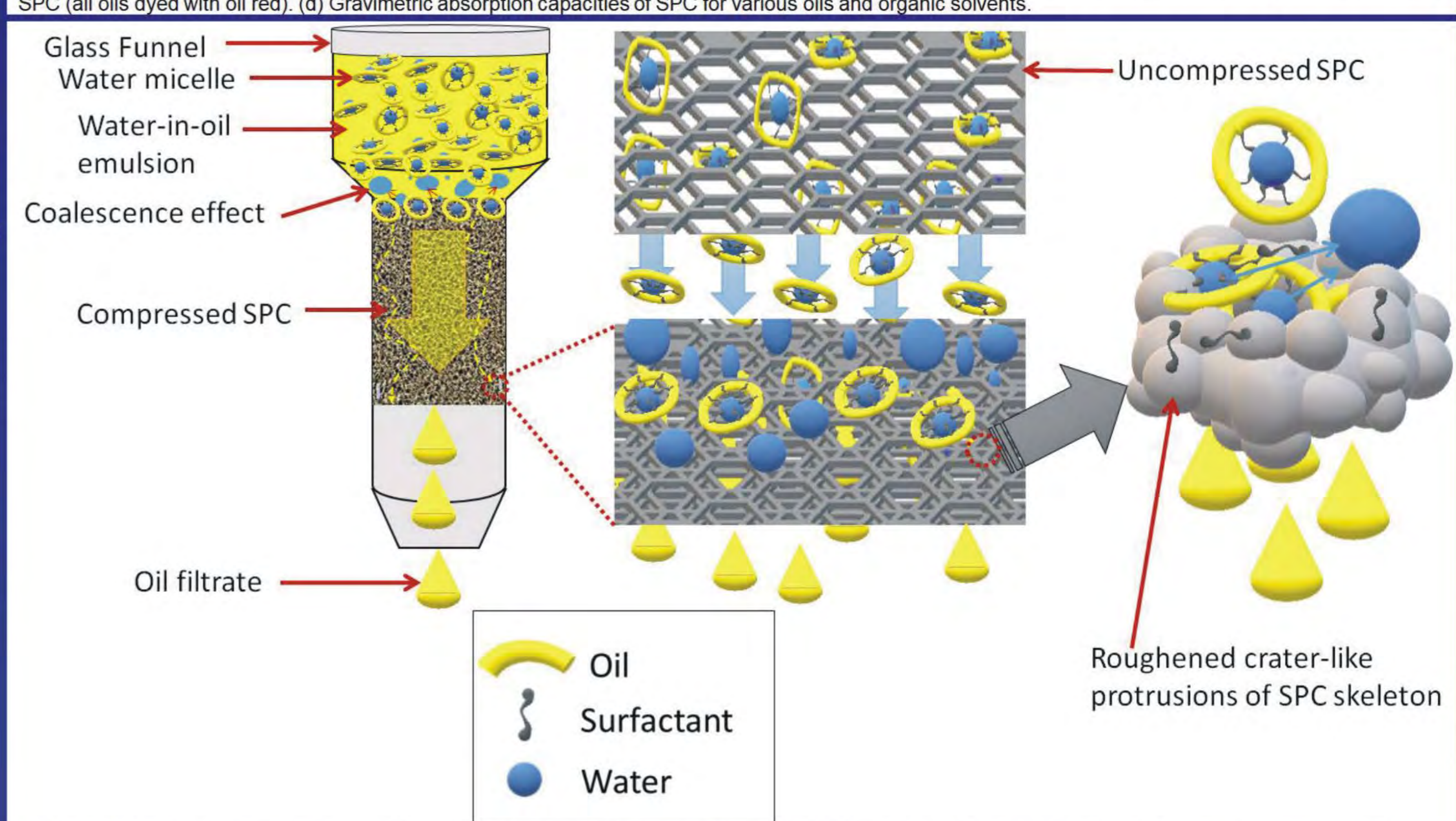
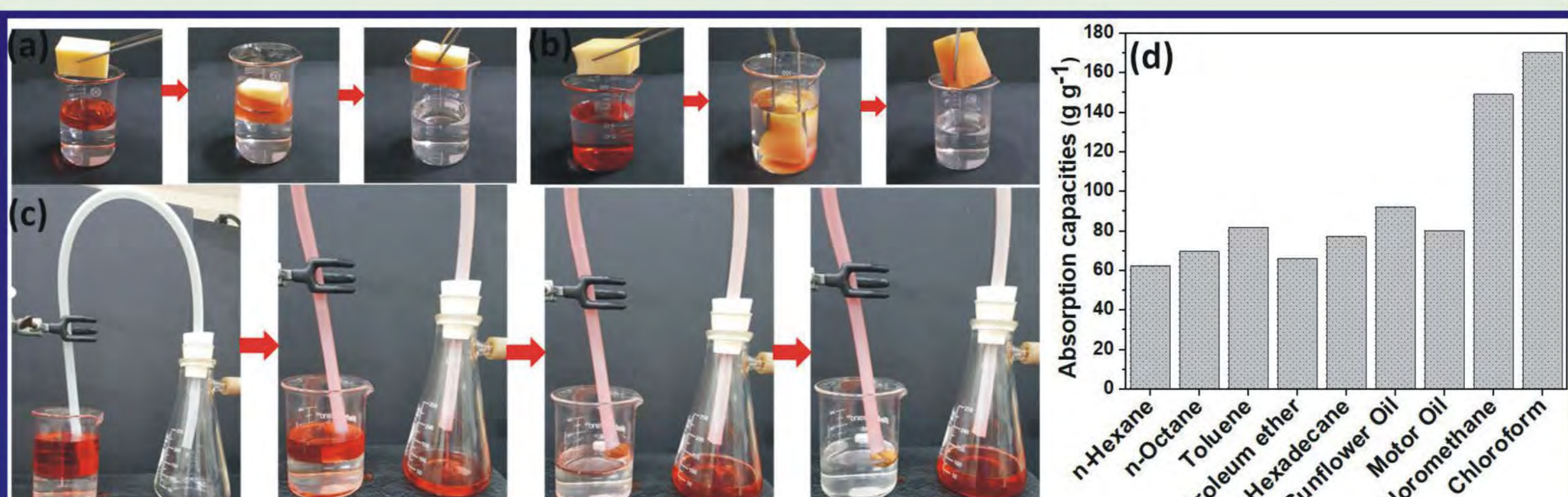
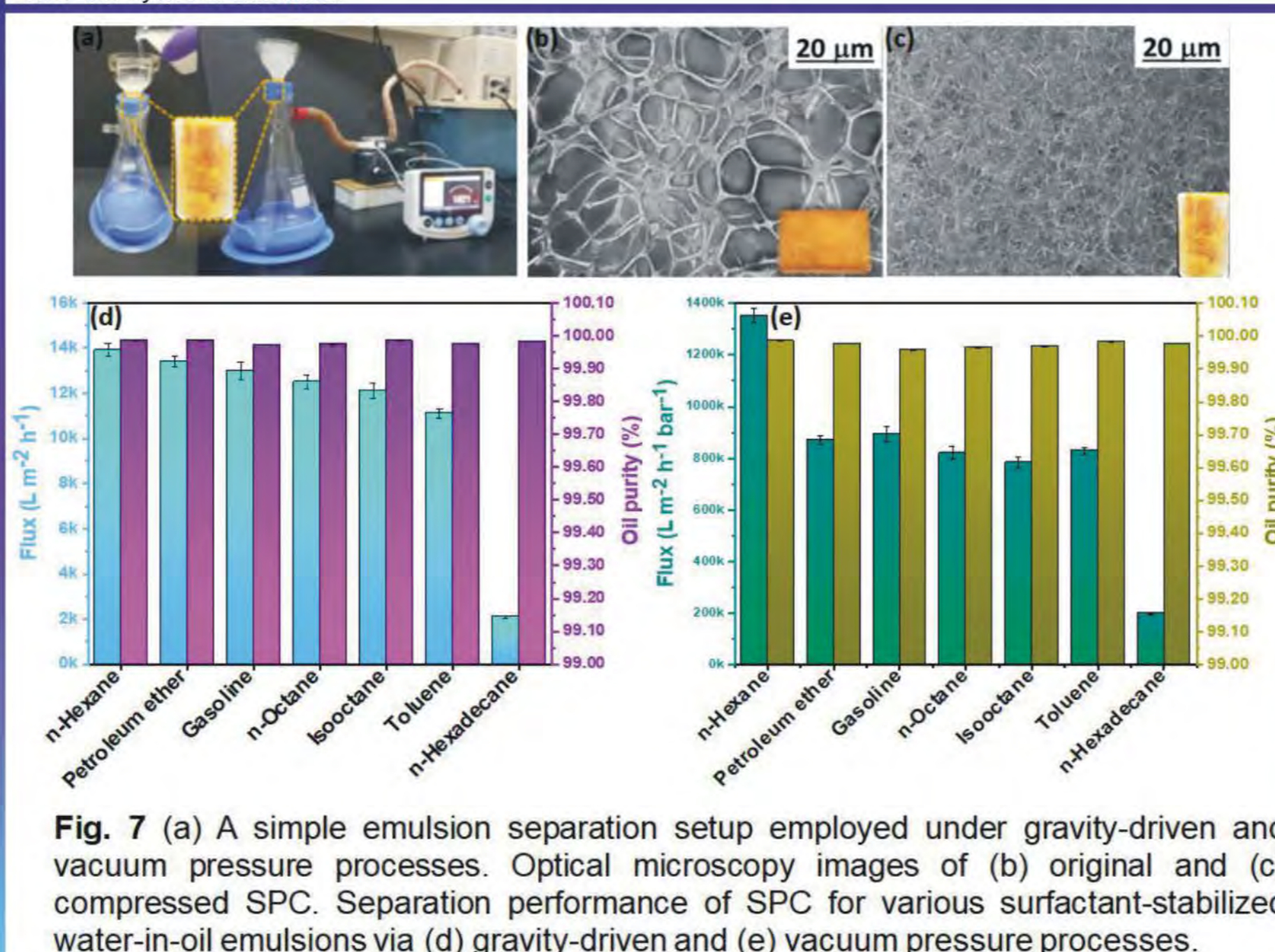
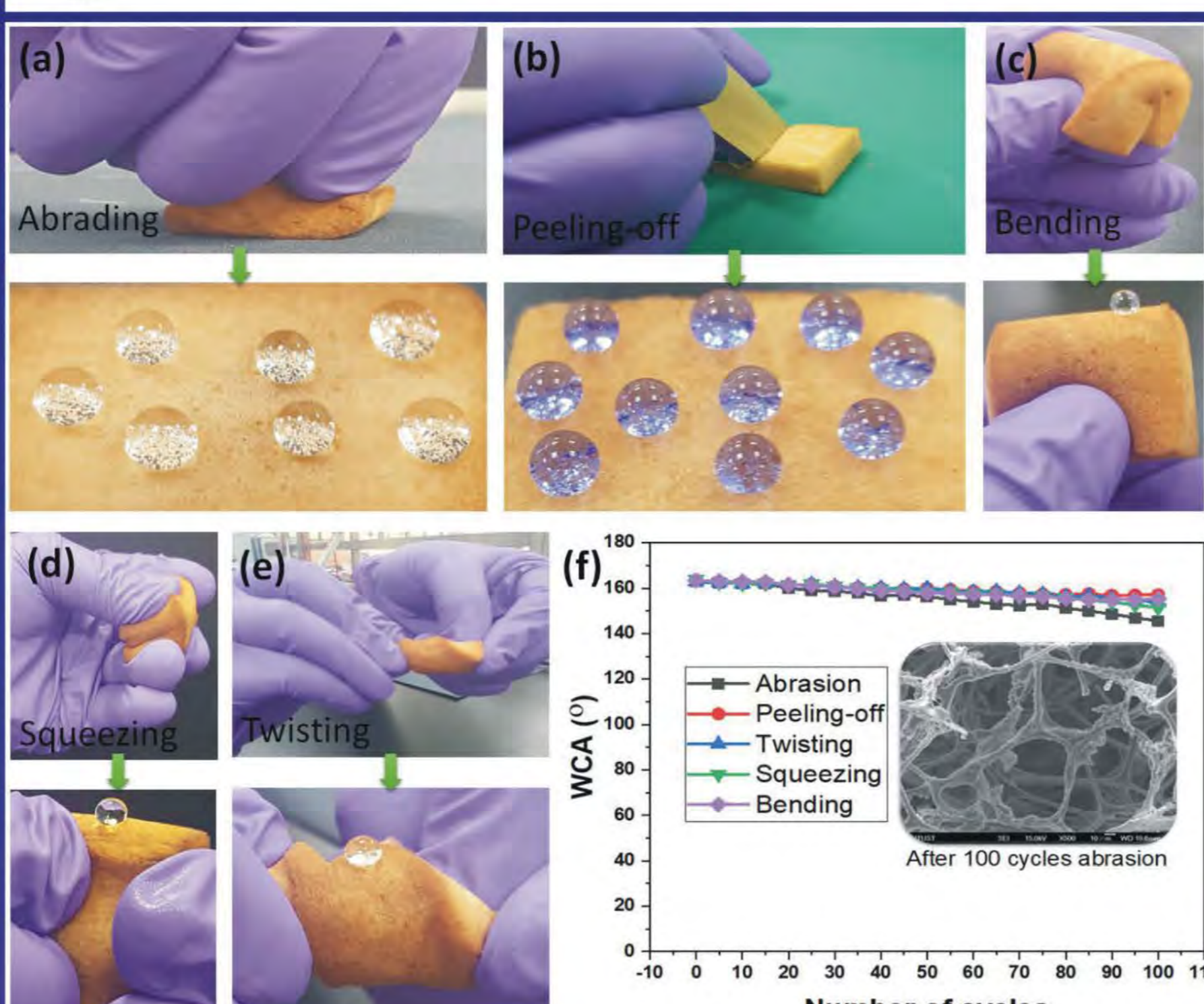
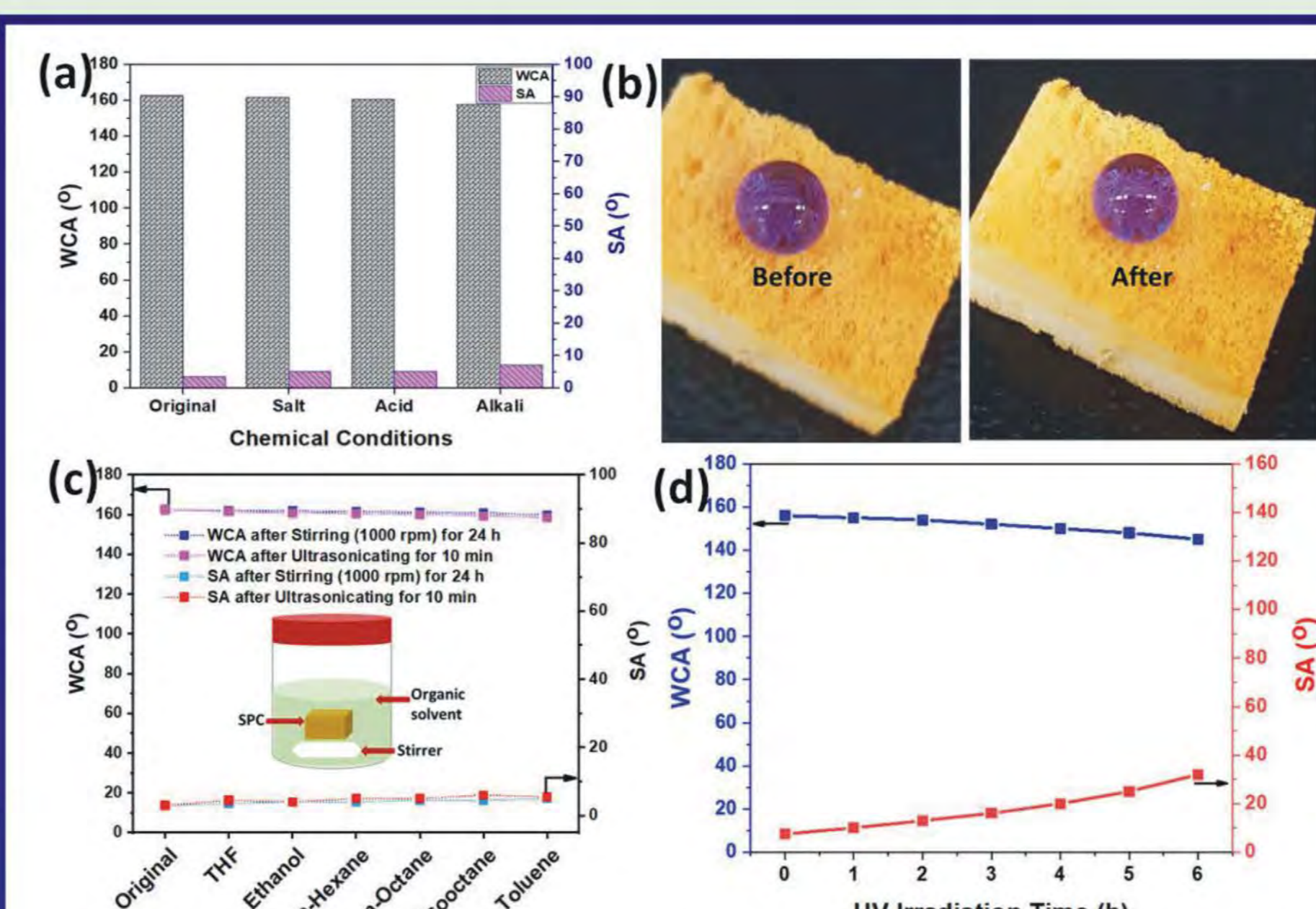
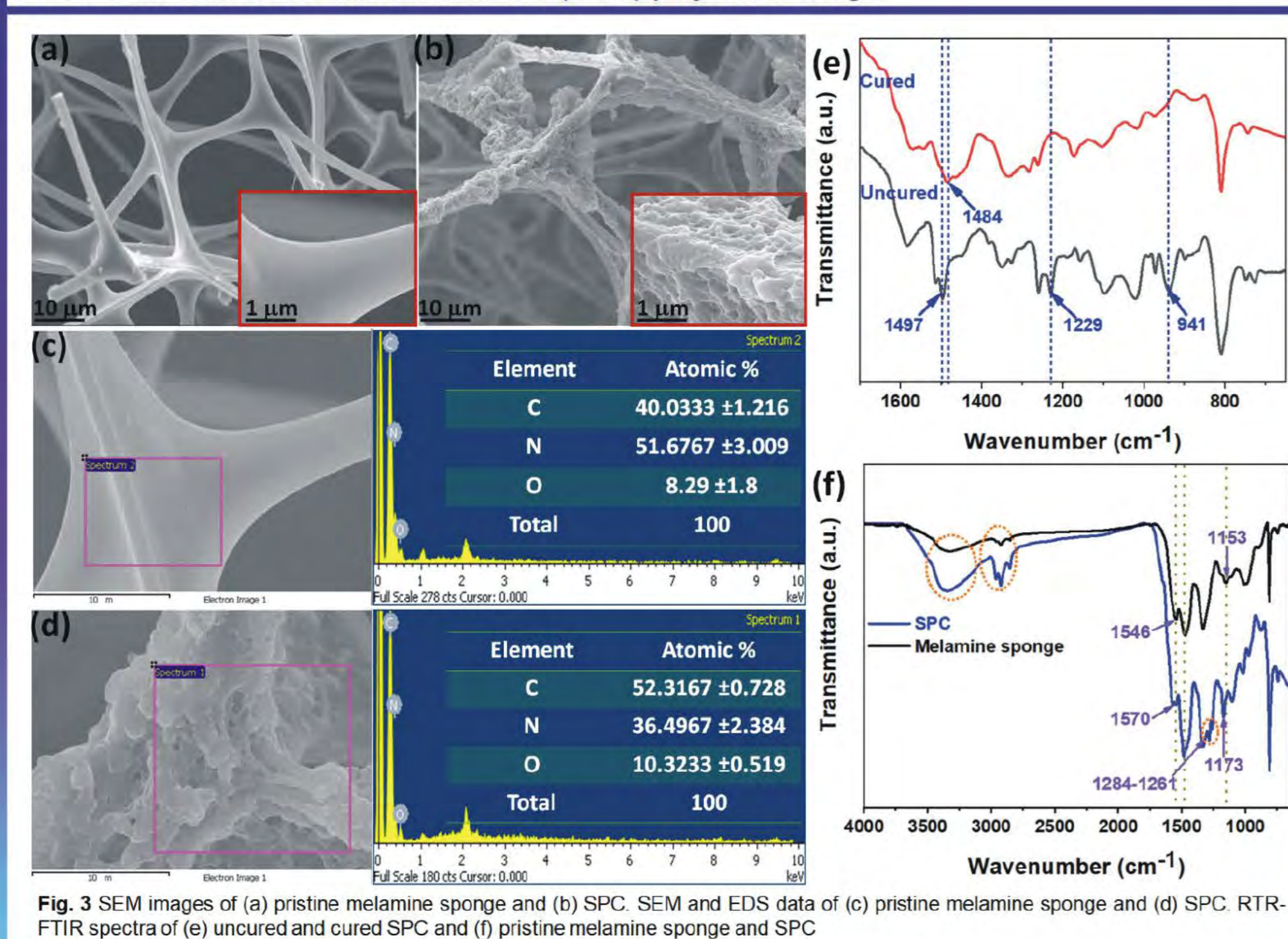
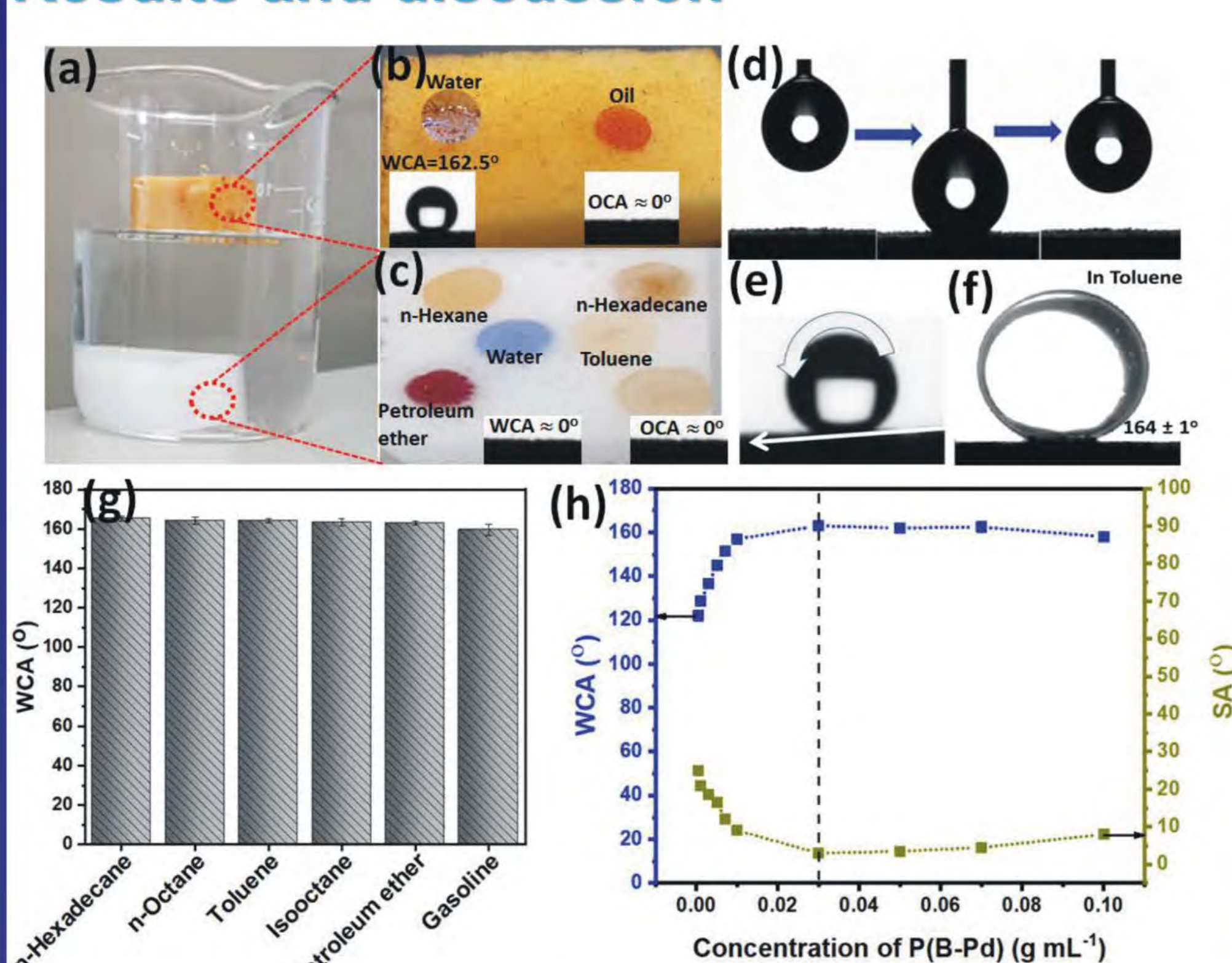
### Abstract

With incessantly increasing oil spillages and their severe challenges worldwide, the methods to separate oil-water mixtures have attracted significant interest in recent years. Herein, we prepared durable superhydrophobic polymer composites (SPC) through simple methods. The as-prepared SPC possesses superhydrophobic and superoleophilic properties and it maintained its superhydrophobicity after long-term immersion in organic solvents, acids, and saline solutions. Moreover, the compressed SPC exhibits excellent surfactant-stabilized water-in-oil emulsions separation ability. High flux values are observed for the separation of emulsions by employing gravity-driven process and external pressure, respectively, with excellent efficiencies. The outstanding separation performance for various water-in-oil emulsions and stability under harsh environmental conditions of SPC make it a candidate for industrial application.

### Preparation Procedure



### Results and discussion



### Summary

In this study, a facile method for the preparation of durable superhydrophobic material was developed. The as-prepared material possesses superhydrophobicity (WCA > 150°) and superoleophilicity (oil contact angle < 5°), exhibiting excellent oil absorption capacity and surfactant-stabilized water-in-oil emulsions separation performance. Very high permeation fluxes of up to 13,900 L m<sup>-2</sup> h<sup>-1</sup> and 1,353,000 L m<sup>-2</sup> h<sup>-1</sup> bar<sup>-1</sup> were obtained for surfactant-stabilized water-in-oil emulsion employing gravity-driven and external pressure filtration, respectively, with excellent efficiencies (oil purity of ≥ 99.96 wt.%). The outstanding separation performance for various oils and organic solvents, stability in harsh chemical and physical environments, robustness, and recyclability of the superhydrophobic composite make it an excellent candidate for large scale application.

### Journal Publications

- Wang, C.F.; Ejeta, D.D.; Wu, J.Y.; Kuo, S.W.; Lin, C.H.; Lai, J.Y. "Tuning the Wettability and Surface Free Energy of Poly(vinylphenol) Thin Films by Modulating Hydrogen-Bonding Interactions." *Polymers* 2020, 12, 523.
- D. Daksa Ejeta, C.-F. Wang, S.-W. Kuo, J.-K. Chen, H.-C. Tsai, W.-S. Hung, C.-C. Hu, J.-Y. Lai. "Preparation of superhydrophobic and superoleophilic cotton-based material for extremely high flux water-in-oil emulsion separation." *Chemical Engineering Journal* 402 (2020), 126289.
- D. Daksa Ejeta, C.-F. Wang, S.-W. Kuo, J.-K. Chen, H.-C. Tsai, W.-S. Hung, C.-C. Hu, J.-Y. Lai. "Preparation of a main-chain-type polybenzoxazine-modified melamine sponge via non-solvent-induced phase inversion for oil absorption and very-high-flux separation of water-in-oil emulsions." *Separation and Purification Technology*, 2021. 263: p. 118387.



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