Supporting Information

A magnetic-responsive conical microcolumn for removing oil pollution in pipelines and emulsion filtering with ultra-high separation flux

Lei Kang[a], Yang Zhang[a], Yun-yun Song[a]*, Yan Liu[b], Zhong-qiang Zhang[a]

[a]. Institute of Intelligent Flexible Mechatronics, School of Mechanical Engineering, Jiangsu University, Zhenjiang 212013, China

[b]. Key Laboratory of Bionic Engineering (Ministry of Education), Jilin University, Changchun 130022, China

*E-mail: songyunyun@ujs.edu.cn

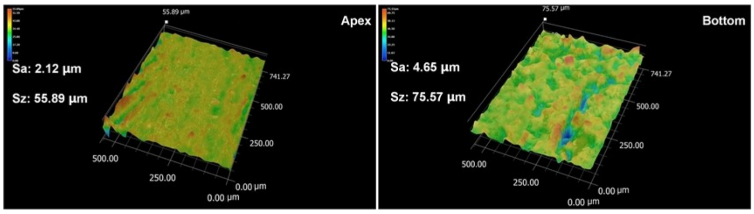

Figure S1. The surface roughness of apex and bottom of the conical microcolumn.

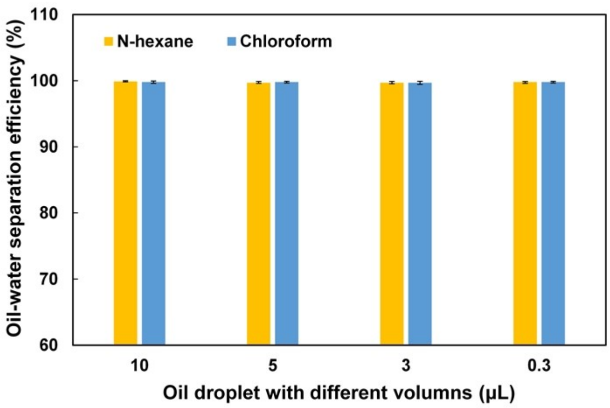

Figure S2. The separation efficiency of large and small oil droplets.

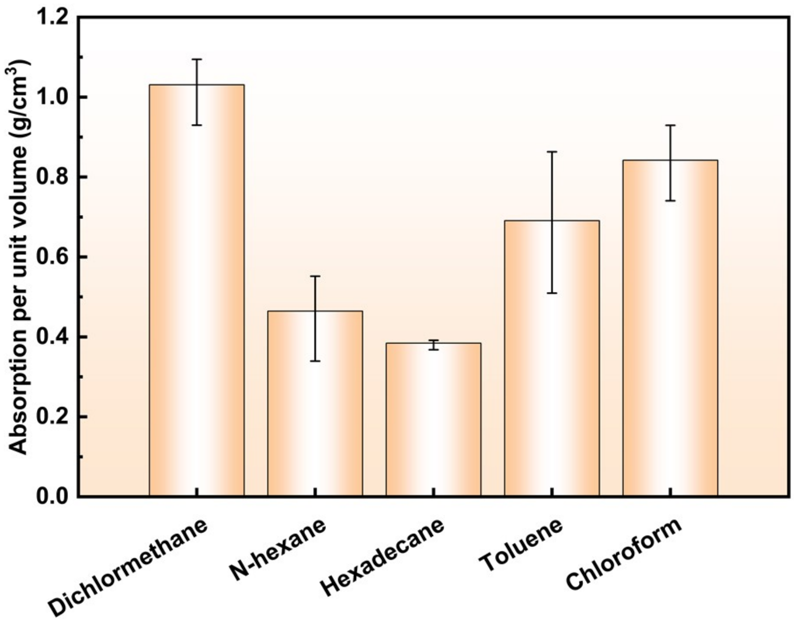

Figure S3. The oil absorption of single conical microcolumn for different oils.

Table S1. The interface oil and emulsions separation efficiency and flux

	Interface oil	Oil-in-water	Water-in-oil
Separation efficiency	99.8±1.6%	93.5±2.2%	95±1.5%
Separation flux	43406±32 L/m²·h	19894±10 L/m²·h	42972±40 L/m²·h

Table S2. Comparison of multi-functional applications and smart effects between our work and other reports

Reference	Multi-functional applications	Smart effects
Ref. 27	Oil droplet transport and collection in different environments	The antigravity transportation capacity of oil droplets
Ref. 40	Collection water	Diode the function of water
Ref. 41	The adsorption capacity toward organic pollutant	Photothermal conversion ability
Ref. 42	Water droplets transport	Self-induced crystallization
Ref. 43	Efficient separation of both oil-in-water and water-in-oil emulsions	Switchable emulsion separation capability
This work	Oil droplet transport and collection in different environments Collection water Collection oil Separation of both oil-in-water and water-in-oil emulsions	Magnetic field control

Video S1. The n-hexane movement on the conical microcolumn with a bottom diamater 1.5 mm and aspect ratio 1:2.

Video S2. The n-hexane movement on the conical microcolumn with a bottom diamater 1.5 mm and aspect ratio 1:5.

Video S3. The n-hexane movement on the conical microcolumn with a bottom diamater 3.5 mm and aspect ratio 1:2.

Video S4. The n-hexane movement on the conical microcolumn with a bottom diamater 3.5 mm and aspect ratio 1:5.

Video S5. The chloroform movement on the conical microcolumn with a bottom diamater 1.5 mm and aspect ratio 1:2.

Video S6. The oil-absorbing process of 10 μL in water.

Video S7. The oil-absorbing process of 0.3 μL in water.

Video S8. The conical microcolumn separates the water droplet and soybean oil droplet.

Video S9. The conical microcolumn separates the water droplet and cetane droplet.

Video S10. The oil droplet in a W-shaped bent tube was absorbed by the conical microcolumn controlled by the external magnetic field.

Video S11. The oil droplet in a spiral bent tube was absorbed by the conical microcolumn controlled by the external magnetic field.

Video S12. The oil pollution absorbing test of a flat PDMS membrane in the W-shaped bent tube.

Video S13. The oil pollution absorbing test of a flat PDMS membrane in the spiral bent tube.

Video S14. The interface oil-water separation process.

Video S15. The oil-water separator capable of filtering oil continuously.

Video S16. The oil-water separator capable of filtering water continuously.

Video S17. The oil-in-water emulsion separation process.

Video S18. The water-in-oil emulsion separation process.

Video S19. The n-hexane detect process.

Video S20. The chloroform detect process.