

Supplementary Information

Continuous Oil/Water Separation with Surface Modified Sponge for Oil Spills Cleanup

Daxiong Wu, Ziya Yu, Wenjuan Wu, Linlin Fang, Haitao Zhu*

Qingdao University of Science and Technology, Qingdao 266042, P. R. China.

* To whom correspondence should be addressed:

Professor Haitao Zhu

Tel: +86 532 84022676;

Fax: +86 532 84022814;

E-mail: htzhu1970@163.com

1. FT-IR Analysis

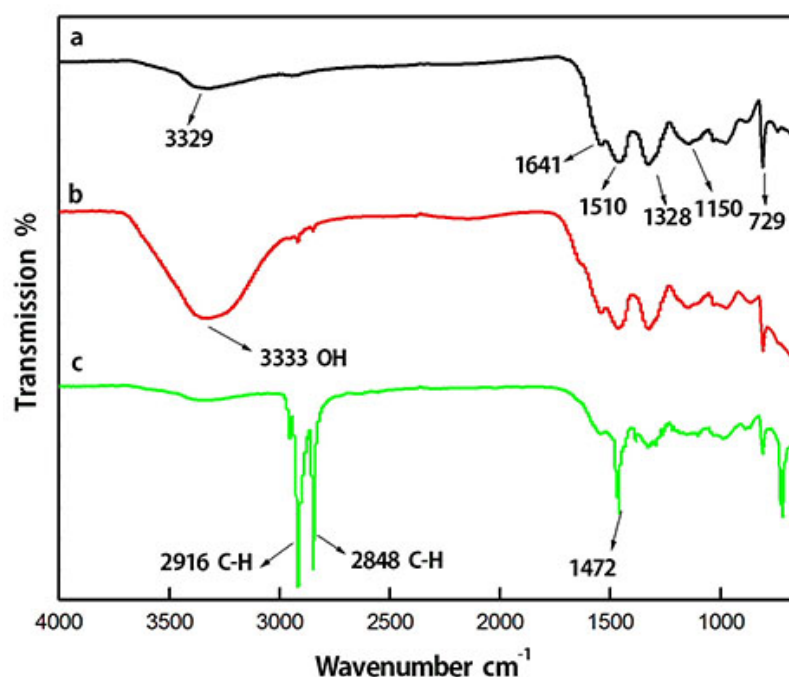


Figure S1. The FT-IR spectra of original PU sponge (a), TiO₂ sol coated sponge (b), TiO₂ and n-octadecyl thiol coated sponge (c).

Typical FT-IR spectra of the original PU sponge, TiO₂ sol coated sponge, TiO₂ and n-octadecyl thiol coated sponge are shown in Figure S1. For the original PU sponge, the stretching vibration of N-H occurs at 3329 cm⁻¹, and the peaks at 1641, 1544, and 1329 cm⁻¹ are attributed to the amide I, II, and III band. In the TiO₂ sol coated sponge spectrum (b), the strong peaks at 3333 cm⁻¹ is attributed to O-H stretching, which is due to the hydrolysis of titanium sol on the surface of sponge. In the TiO₂ and n-octadecyl thiol coated sponge spectrum(c), the peaks at 2916 and 2848 cm⁻¹ are attributed to C-H stretching, and the peak at 1472 cm⁻¹ is attributed to C-H deformation, which indicates the carbon chain from octadecane thiol stay in the sponge after treatment.

2. Energy Dispersive Spectra

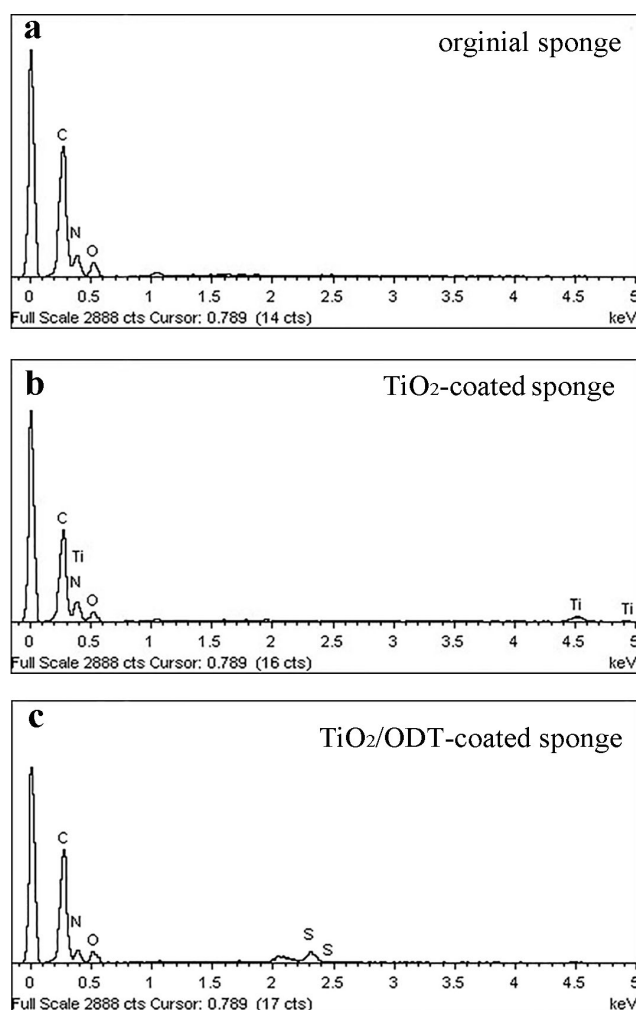


Figure S2. EDS spectra of original PU sponge (a), TiO₂ sol coated sponge (b), TiO₂ and n-octadecyl thiol coated sponge (c).

EDS was applied to detect the constitutional changes of sponge before and after modification. As shown in Figure S2, the EDS spectrum of original PU sponge shows three elements: C, N and O. In addition to C, N and O, the EDS spectrum of the TiO₂-coated PU sponge also shows Ti, verifying that TiO₂ has been coated on PU sponge. Element S and Ti are shown in the EDS spectrum of the TiO₂ and n-octadecyl thiol coated PU sponge, indicating that TiO₂ and n-octadecyl thiol have been coated on PU sponge.

3. Determination of the Water Content.

For the determination of the water content of the oil collected from the continuous separation process, the procedure is as follow. Before the separation process started, NaOH was added to 150 mL water to make a 0.01 mol/L solution and then 50 mL oil was added to make the oil-water mixture. After the separation process ended, the collected liquid was weighted and then titrated with 0.01 mol/L HCl aqueous solution in the presence of phenolphthalein indicator. Water content was determined by following equation:

$$q = V_{\text{HCl}} \times \rho_{\text{water}} \div m_{\text{liquid}}.$$

where V_{HCl} is the volume (mL) of the consumed HCl aqueous solution, ρ_{water} is the density (g/mL) of water at 20 °C, and m_{liquid} is the weight (g) of the collected liquid.

For the determination of the weight of the absorbed water in absorption capacity tests, the absorbed liquids (obtained by squeezing the sponge after absorption process, see section 2.3) from 5 independent experiments were accumulated as a whole and titrated with 0.01 mol/L HCl aqueous solution in the presence of phenolphthalein indicator. The weight of the absorbed water m_w was determined by following equation:

$$m_w = 0.2 \times V_{\text{HCl}} \times \rho_{\text{water}}.$$

where V_{HCl} is the volume (mL) of the consumed HCl aqueous solution, ρ_{water} is the density (g/mL) of water at 20 °C.