Supporting information

Preparation of superhydrophobic/superhydrophilic sodium alginate aerogels for efficient oil absorption

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Performance test

1. Corrosion resistance test of α-SSm-M

In this work, to demonstrate the corrosion resistance of α-SSm-M, we prepared different pH solutions using hydrochloric acid (HCl) and sodium hydroxide (NaOH) using simulating the external environment, including strong acids (pH=2) and strong bases (pH=12), and neutral solutions directly using DI. The static experiment was conducted in the water contact angle (WCA) assessment; droplets contacted the surface of α-SSm-M for 10 min, and the droplet adopted 5 μL. Besides, a high concentration of saline, as a great challenge from life wastewater was also accepted for the testing, in which the environment was created with the help of sodium chloride (NaCl, 0, 1, 2, 3 mol/L and saturated solution). The measurement results were taken from the average of three tests that were collected.

2. Hydrophobic layer stability test of α-SSm-M

In the actual wastewater treatment process, it is inevitable to encounter the problem of friction and wear[1], so it is difficult to meet the repair requirements to the maximum extent in the static test. The tape peeling experiments were performed on a 2x1 cm α-SSm-M and loaded with a weight of 10 g. The peeling was repeated 10 times, where the WCA will be recorded by a contact angle measuring meter.

3. Adsorption capacity test of α-SSm-M

Contribution to the specific absorption performance, the α-SSm-M can achieve the treatment of oily wastewater. Thus, oils and organic solvents of some kinds were used to absorb so to their absorption capacity, including hexane, cyclohexane,

dichloromethane, olive oil, soya bean oil and heptane. First, we should accurately record the mass of the pure α-SSm-M (q_0). Next, a certain amount of oil was collected in different graduated beakers. To the oil and organic solvent, the pure α-SSm-M can slowly adsorb them until they reach saturation. Surely, this is the second mass value to record (q_m). The total amount of oils adsorbed (q_{total}, g) and adsorption capacity (Q, g/g) of α-SSm-M were calculated by Eq. (1) – (2):

$$q_{total} = q_{m-}q_0 \quad (1)$$

$$Q\ (g/g) = \frac{q_{total}}{q_0} \quad (2)$$

4. Average Porosity of the α-SSm-M

The average porosity (AP) of the aerogels was determined using the ethanol replacement method[2]. First, the α-SSm-M aerogel was immersed in an anhydrous ethanol solution and vacuumed at 25℃ until the pores in the aerogel were filled with ethanol. Then, the excess ethanol on the outside of the aerogel was removed and the weight of the aerogel was measured immediately. AP can be calculated by Eq. (3).

$$AP(\%) = \frac{m_1 - m_0}{\rho_1 V} \times 100 \quad (3)$$

Where m_1 denotes the mass of the aerogel filled with filled ethanol, $m_0$denotes the mass of the dried aerogel, $\rho_1$denotes the density of the ethanol, and V is the volume of the aerogel.

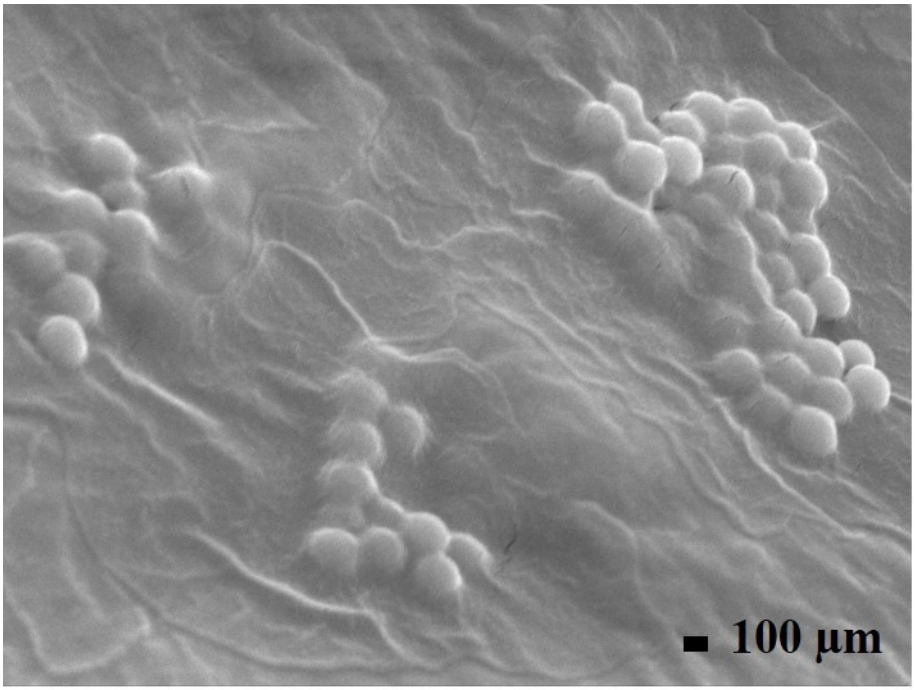

Fig. S1 SEM images of α-SSm-M aerogel sponges with high magnifications.

References

1. I. M. Bhat and S. Lone, *ACS Applied Materials & Interfaces*, 2024, **16**, 13225-13233.

2. C. Wang, G. He, J. Cao, L. Fan, W. Cai and Y. J. A. A. P. M. Yin, 2020, **2**, 1124-1133.