Supporting Information

Preventing diatoms adhesion using a hydrogel with orthosilicic acid analog

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Experimental Section

Materials and chemicals

Polyvinyl alcohol (degree of hydrolysis 99%, degrees of polymerization are 2800) is purchased from Sinopec Sichuan Vinylon Works. Hydroxyethyl methylacrylate (HEMA), N, N'- methylenebis(acrylamide) (MBAA) are received from Sigma-Aldrich. 3-methacyloxypropyl trimethoxylsilane (TMSPMA) and 2, 2-Diethoxyacetophenone (DEOP) are purchased from J&K Chemicals. Polyethylene glycol (PEG) is purchased form Sinopharm Chemical Reagent Co., Ltd., China.

Preparation of PVA/PHEMA-SOSA hydrogel

Firstly, PVA is dissolved in hot water (water bath at 90 degrees for 2 hours) to form the solution of 10 wt% in concentration. PVA solution is poured into a mode (5 cm*5 cm*0.2 cm), and it is placed in the freezing environment (-20℃) for 2 hours, then thawing under room temperature. Making two freeze-thawing cycles, and the PVA hydrogel is prepared. Secondly, PVA hydrogel is immersed in the solution containing HEMA (40 wt%), TMSPMA (0.2 wt%), MBAA (0.4 wt%) and DEOP (0.2 wt%). The precursors solution turn into hydrogels through a photopolymerization under UV irradiation (UPP3-734).

Preparation of PEG/PAAm-SOSA hydrogel

Firstly, PEG is dissolved in water to form the solution of 5 wt% in concentration. Then, the precursors solution is prepared by 80 g PEG solution, 20 g PAAm, 2 mL TMSPMA, 0.4 g MBAA and 200 μL DEOP. The precursors solution turn into hydrogels through a photopolymerization under UV irradiation (UPP3-734).

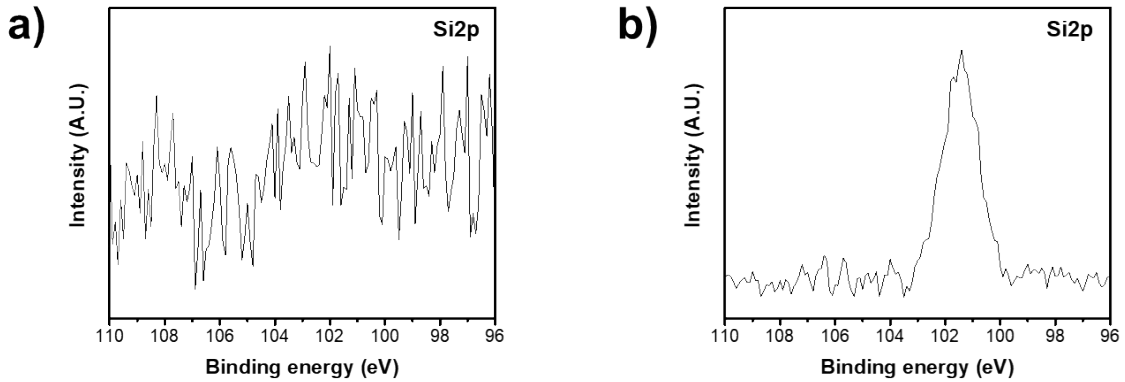

Figure S1. XPS spectra showing the SOSA combines with hydrogel network. Si 2p XPS spectra of a) control hydrogel and b) SOSA hydrogel.

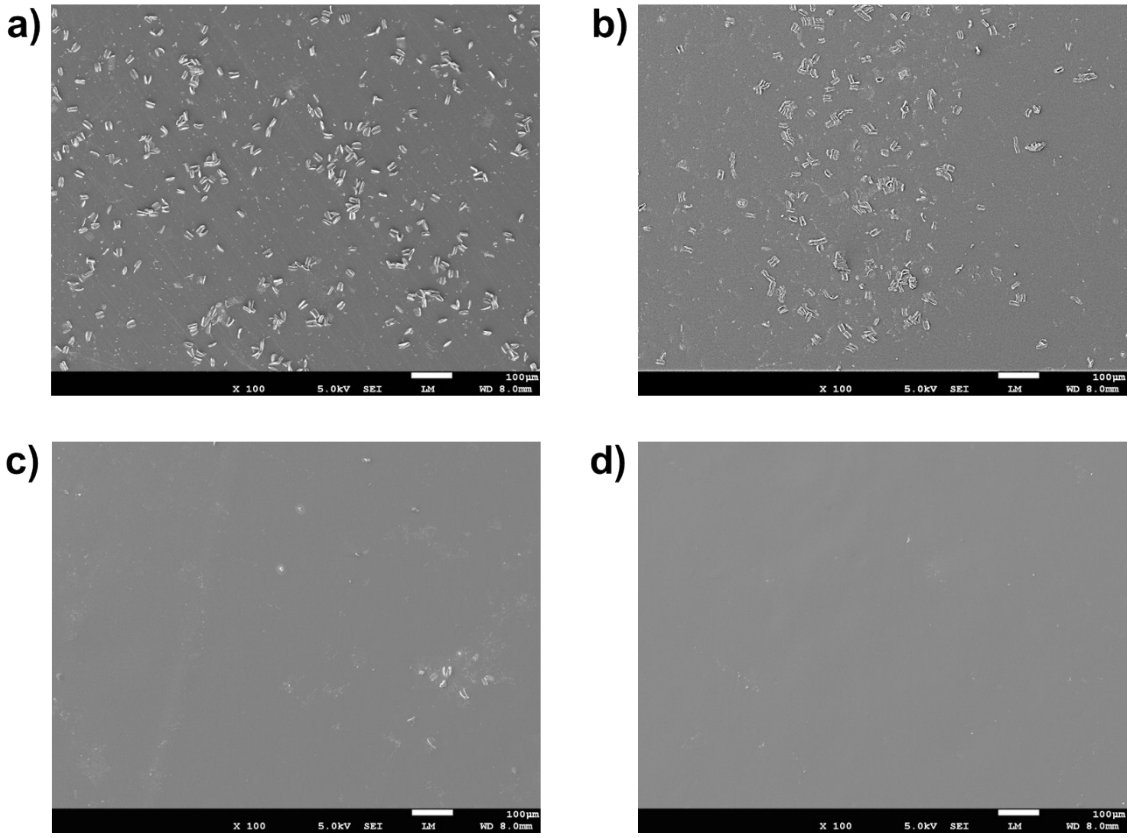

Figure S2. SEM image of diatoms adhesion experiment (Navicula). a) PS. b) Control hydrogel. c) SOSA-5 hydrogel. d) SOSA-10 hydrogel.

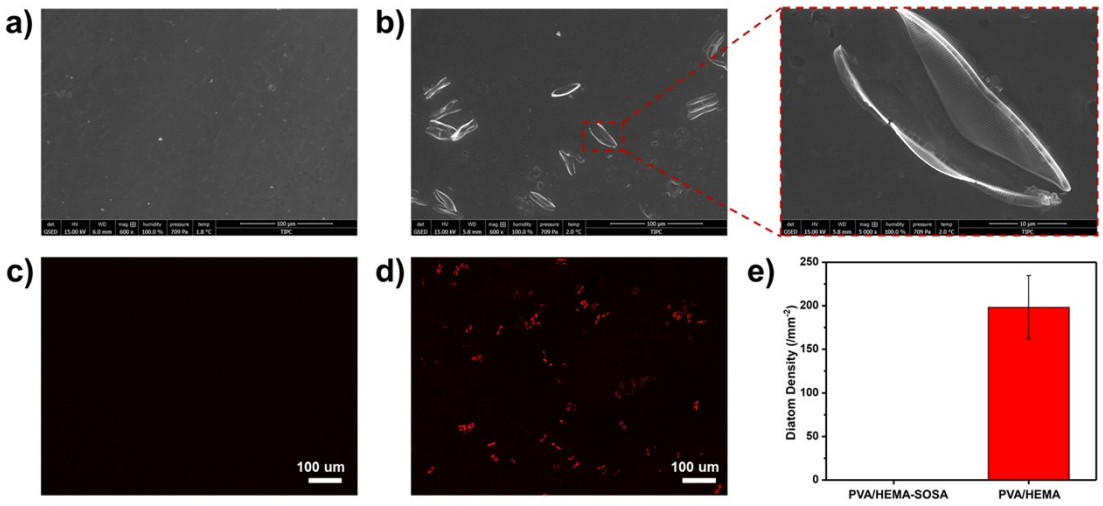

Figure S3. Resistant properties of PVA/HEMA hydrogel and PVA/HEMA-SOSA hydrogel to diatoms (Navicula) biofouling. ESEM images of a) PVA/HEMA-SOSA hydrogel and b) PVA/HEMA hydrogel. Fluorescence images of c) PVA/HEMA-SOSA hydrogel and d) PVA/HEMA hydrogel. e) Statistical chart of Navicula adhesion.

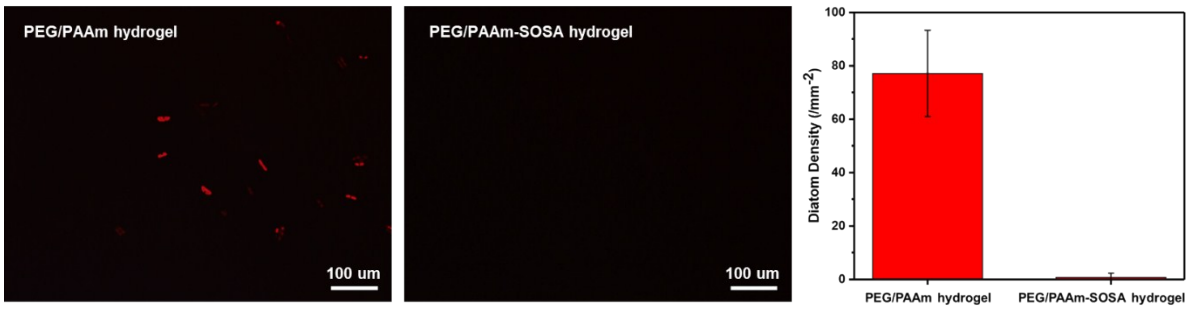

Figure S4. Resistant properties of PEG/PAAm hydrogel and PEG/PAAm-SOSA hydrogel to diatoms (Navicula) biofouling.

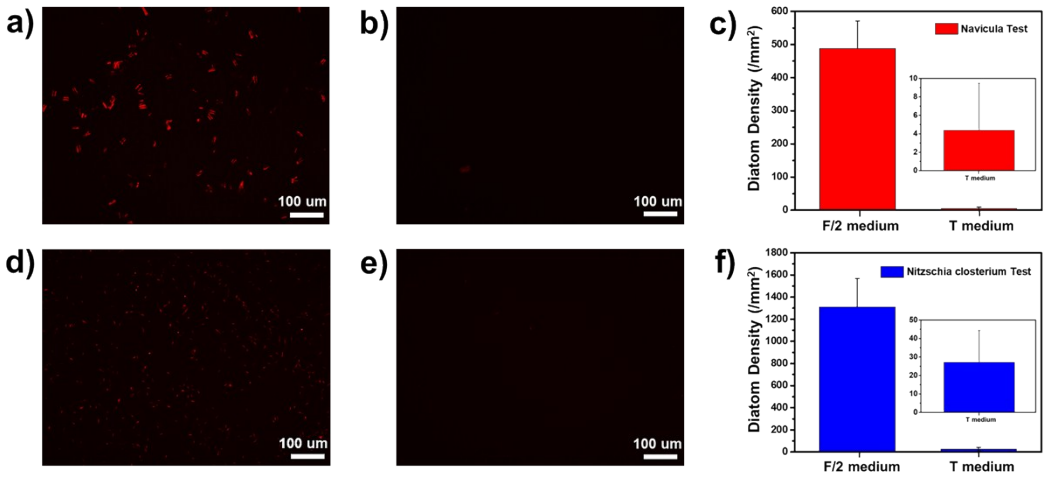

Figure S5. Life activities of cultured diatoms measure by adhesion experiment (on PS). Fluorescence microscopy pictures of Navicula cultured by a) f/2 medium and b) TMSPMA medium. c) Statistical chart of Navicula adhesion. Fluorescence microscopy pictures of Nitzschia closteriums by d) f/2 medium (Nitzschia closteriums) and e) TMSPMA medium. f) Statistical chart of Nitzschia closteriums adhesion.

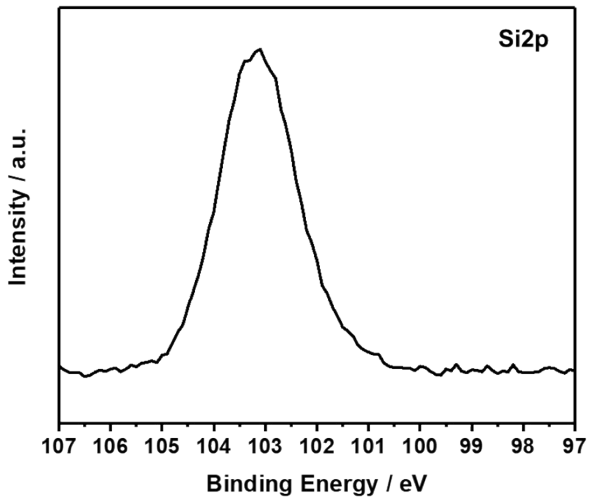

Figure S6. XPS spectra of diatom cultivated in medium with SOSA for 1 hour.

The virgin diatom suspension is mixed with TMSPMA medium (Na_2SiO_3 in f/2 medium is substitute by TMSPMA) and stood for 1 hour. Then, the diatoms are first collected by suction filtration. Then the collected diatoms are dispersed in 40 mL deionized water and supernatant is removed by centrifugation. After centrifugation for 5 times, the precipitates are freeze-drying and the diatoms samples are prepared. The compositions of diatoms are measured by X-ray photoelectron spectroscopy (XPS) (ESCALAB 250Xi).

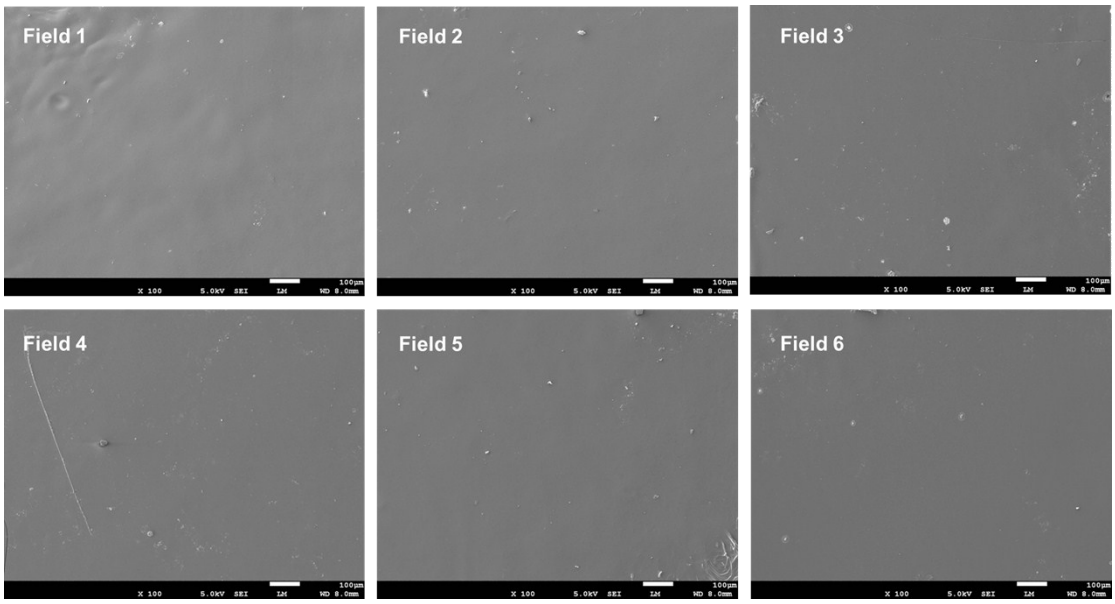

Figure S7. Resistant property of SOSA-10 hydrogel to diatoms biofouling (1 week).