Starch-based Shape Memory Sponge for Rapid Hemostasis in Penetrating Wound

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Supporting information

Supplementary experiment

RBCs adhesion

RBCs adhesion quantitative test[1, 2]:100 μL of RBCs suspension was dropped onto sample's top surfaces. After incubating the sample at 37 ℃ for 30 min, rinse the sample three times with PBS to remove the unattached red blood cells. Then, 2 ml of 0.1% Triton X-100 was added to destroy red blood cells and release hemoglobin (Fig. S4 (d)), and the microplate reader was used to measure the absorbance of the supernatant at 540 nm. Add 1.9 mL 0.1% Triton X-100 to 100 μ L RBCs suspension as control group. The RBC adhesion was calculated by the following formula:

$$\text{RBC adhesion (\%)} = \frac{OD_{Sample}}{OD_{Control}} \times 100\ (\%)\ (1)$$

Platelet adhesion

The amount of platelet adhesion was measured by LDH reagent[1, 2]. Briefly, Platelet rich plasma (PRP) was obtained by centrifuging rabbit whole blood at 2000 rpm for 10 minutes. 100 μL PRP is dropped onto the material surface and incubated at 37 ℃ for 30 min. Rinse material with PBS to remove nonadherent platelets for there times. After removing PBS solution from the material, soaked it into a 0.1% Triton X-100 solution (600 μL) to lyse platelets to release the lactate dehydrogenase (LDH) enzyme. The LDH was determined with an LDH kit (Shanghai Yu duo Biotechnology Co., Ltd, China) according to its instruction. Add 0.5 mL 0.1% Triton X-100 to 100 μ L PRP as control group. The platelet adhesion was calculated by the following formula:

$$\text{Adhered platelet (\%)} = \frac{OD_{sample}}{OD_{Control}} \times 100\ (\%)\ (2)$$

Degradation in vivo

This study adhered strictly to "Regulations for the administration of affairs concerning experimental animals" issued by the Chinese Ministry of Science and Technology and

was approved by the ethical committee of the National Tissue Engineering R&D Center (Shanghai, China).

All the samples were prepared with the same shape and size (diameter of 10 mm and height of 5 mm). Sterilize the sample under ultraviolet light overnight. SD Rats (male, 200-250 g) was anesthetized by injecting 10% chloral hydrate. Cut a 12 mm long wound on the back of the rat. The prepared samples were placed into the incision, and then the skin was closed. One week later, the rats were killed by anesthetics and the tissues around the materials were taken out. The obtained material-tissue samples were embedded in paraffin, sectioned, and mounted onto slides. The stained slides were observed and analyzed by microscopy. Each group contained 3 rats.

Supporting data

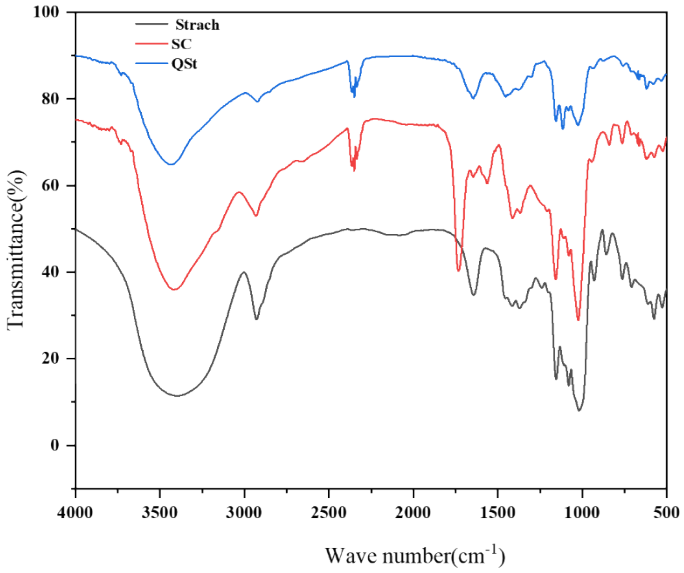


Fig. S1. FT-IR of starch, SC, and QSt

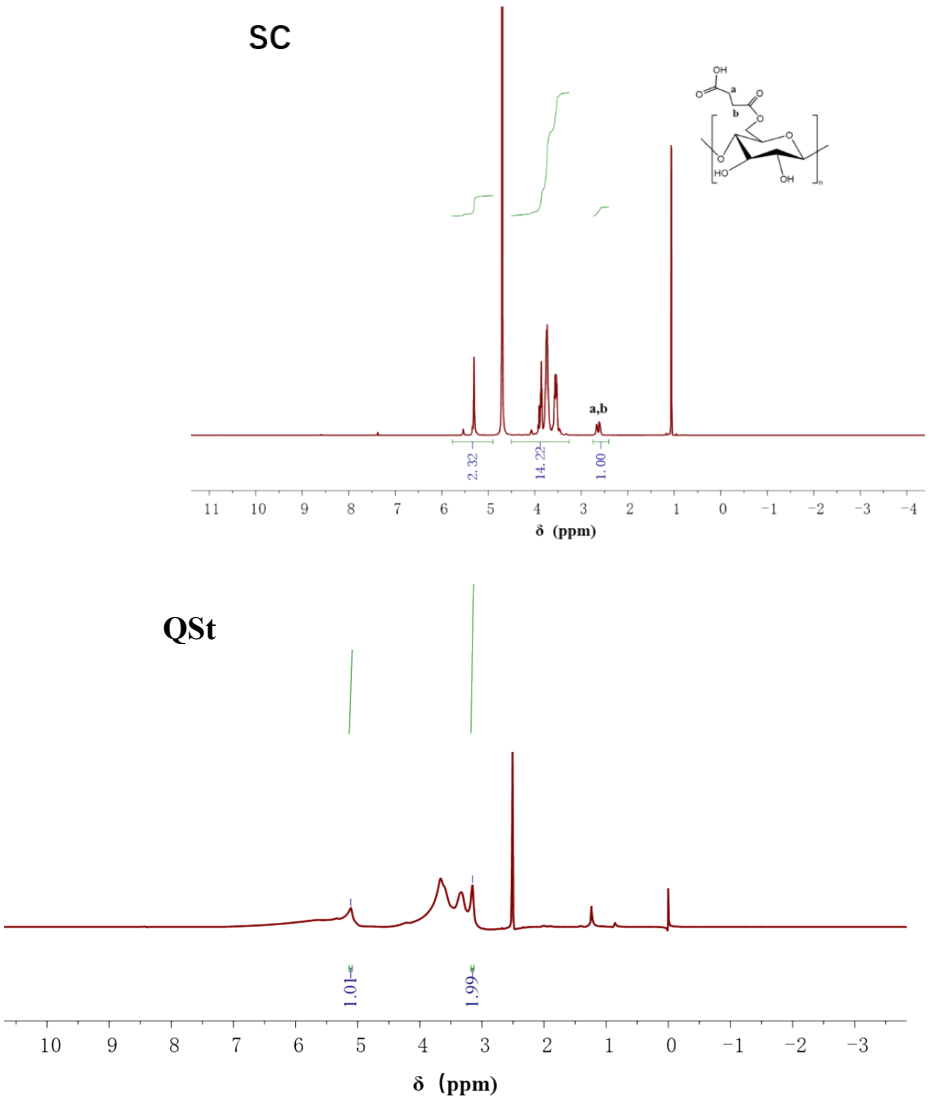
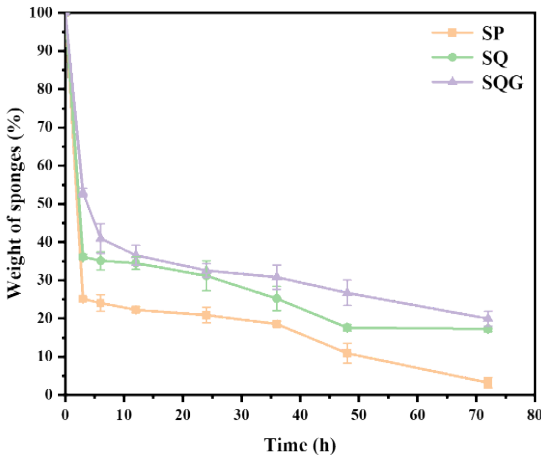


Fig. S2. ^{1}H NRM of SC and QSt



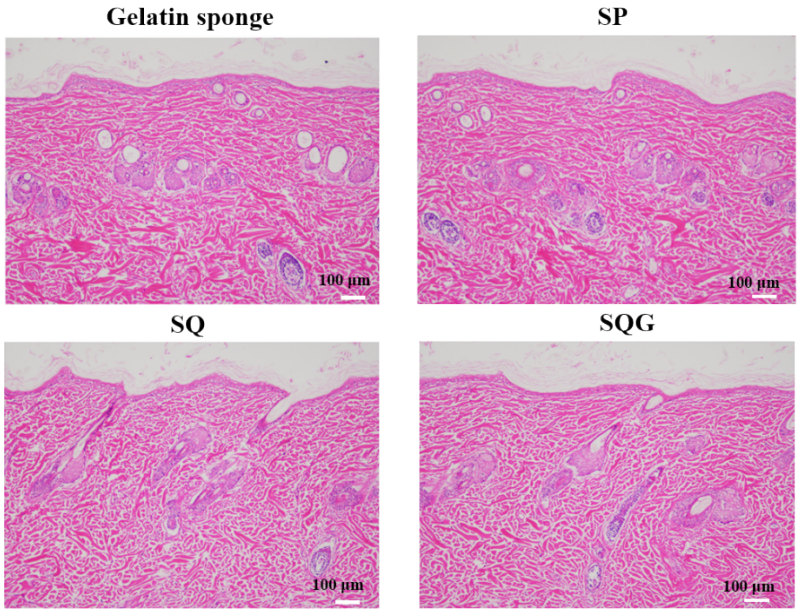


Fig. S3. Degradation of SP, SQ, SQG *in vitro* and *in vivo*

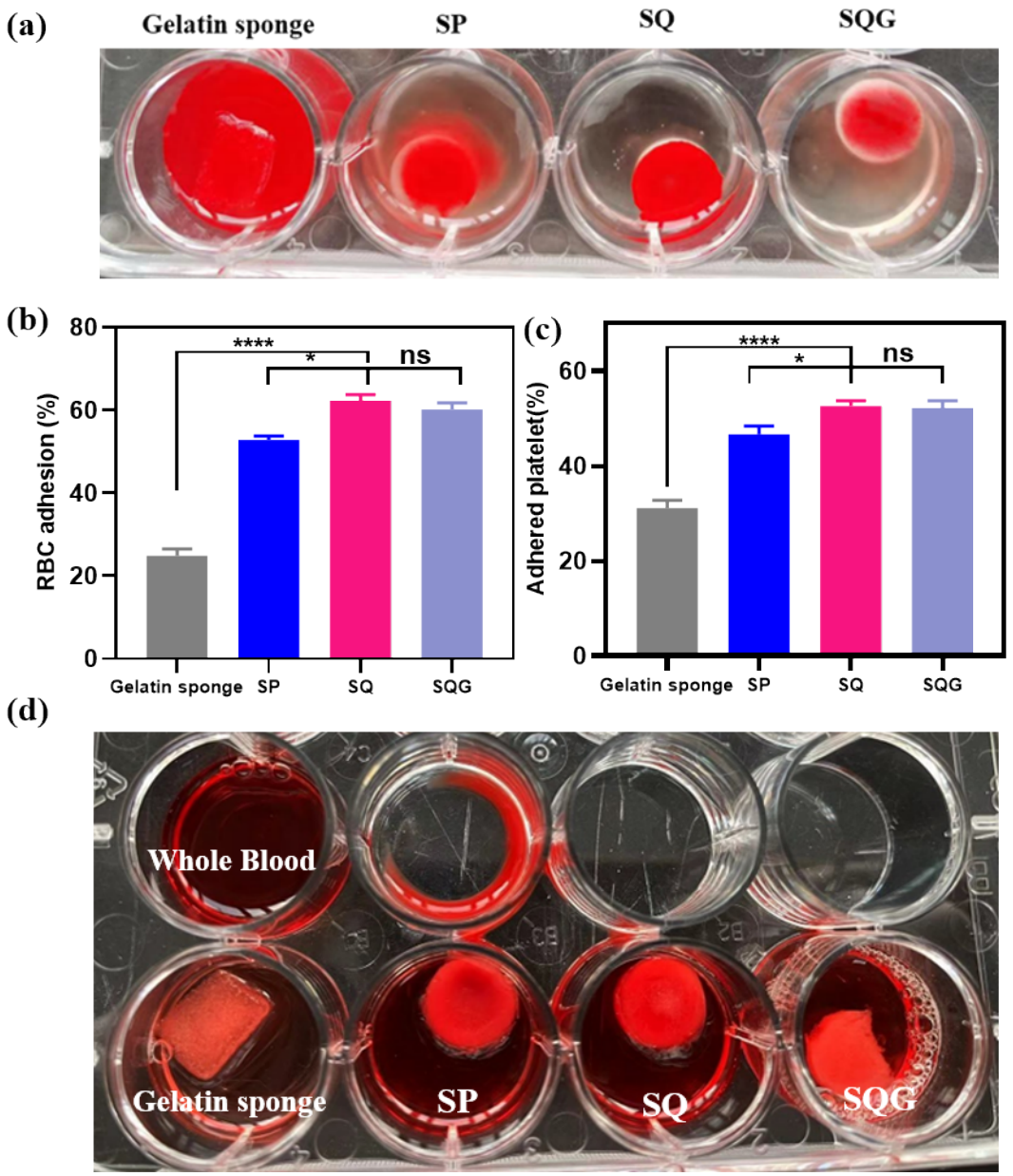


Fig. S4. (a) Photos of materials with blood soaked in PBS. (b)RBC adhesion of materials. (c) Adhered platelet of materials. (d) Photos of materials with blood soaked in Triton X-100

1. X. Du, L. Wu, H. Yan, Z. Jiang, S. Li, W. Li, Y. Bai, H. Wang, Z. Cheng, D. Kong, L. Wang and M. Zhu, *Nat Commun*, 2021, **12**, 4733.
2. X. Du, Y. Liu, H. Yan, M. Rafique, S. Li, X. Shan, L. Wu, M. Qiao, D. Kong and L. Wang, *Biomacromolecules*, 2020, **21**, 1243-1253.