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Supporting Information

Nano-Modified Aerogel with Inherent Anisotropy and Its Relative 3D Printing Assisted Applications in Wearable Biomedical Fields

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EXPERIMENTAL SECTION

Chemicals and reagents: Jackfruit and sugarcane, plant oil were purchased from local market. Chloroform was purchased from Fengchuan Chemical Reagent Technologies Co, Ltd. (Tianjin, China). Sodium borohydride and silver nitrate were purchased from HengXing Chemical Co, Ltd. (Tianjin, China). Ethanol was purchased from West Long Chemical Co, Ltd. (Shanghai, China). Oil Red O was purchased from Biotopped Technologies Co, Ltd. (Beijing, China).

Characterization: The morphologies of JFA, SA were characterized by field-emission scanning electron microscopy (FE-SEM) on SIGMA (Zeiss, Germany).

EXPERIMENTAL SECTION

Preparation of the Jackfruit aerogel (JFA) and Sugarcane aerogel (SA): Jackfruit and sugarcane were cut into appropriate shape and volume (around 2 cm^3) and placed into polytetrafluoroethylene stainless steel autoclaves for carbonization, respectively (180 °C for 12 hours). Next, the jackfruit hydrogels and sugarcane hydrogels were immersed in hot alcohol (around 60 °C) for 60 hours to remove soluble impurities. Then, the jackfruit hydrogels and sugarcane hydrogels were immersed in hot deionized water to remove organic solvent. Finally the remaining jackfruit aerogel (JFA) and sugarcane aerogel (SA) were obtained by freeze-drying[39] (FD-A10N-50, Labconco).

In-situ Preparation of Silver-impregnated Aerogels: The Jackfruit aerogel (JFA) was cut into square (1 cm× 1 cm) pieces. 1.86 g silver nitrate was added into 15 ml deionized water. Then, the JFA and silver nitrate mixture was stirred with magnetically in an ice bath. 0.83 g of sodium borohydride was dissolved into 10 ml deionized water. The sodium borohydride solution was added into the above mixture drop by drop extremely slow. Finally, the silver particles were densely impregnated on the surface of the aerogel. The Ag/JFA was taken out and washed with deionized water for twice. These procedures were repeated at least three times.

3D Printing Process of Intelligent Antibacterial Bracelet: The intelligent antibacterial bracelet was printed by Fused Deposition Modeling (FDM)-based 3D printer MakerBot Replicator Z18. Flexible and soft printing material, polylactic acid (PLA), was selected as the 3D filament. The temperature of the printing process was

220 °C, and the layer height was 0.1 mm with high resolution. We made a mouse model of trauma, took a portion of the pus and apply it to the surface of the plastic gloves when the mouse pus appears. Then wore the intelligent antibacterial bracelet, the Ag/JFA contacted with pus, the electrical conductivity of Ag/JFA+E increased significantly, then the circuit was connected and the two LED lamps would light up.

Skin Toxicity Test: We evaluated the toxicity of the JFA, Ag/JFA and Ag/JFA+E by using a mouse skin model. Nine-week healthy male KM mice with body weight ranging from 33 g to 35 g were selected from the Laboratory Animal Science of Nanchang University. The mouse back skin was shaved before the study. The mouse back was moistened with PBS as blank control.Then the samples applied onto the skin for 12 h for a period of 5 days. After five times treatment, the mice were sacrificed and the cross-sections skin were cut with 7 μm in thickness, stained with hematoxylin and eosin (HE) and examined under a light microscope.

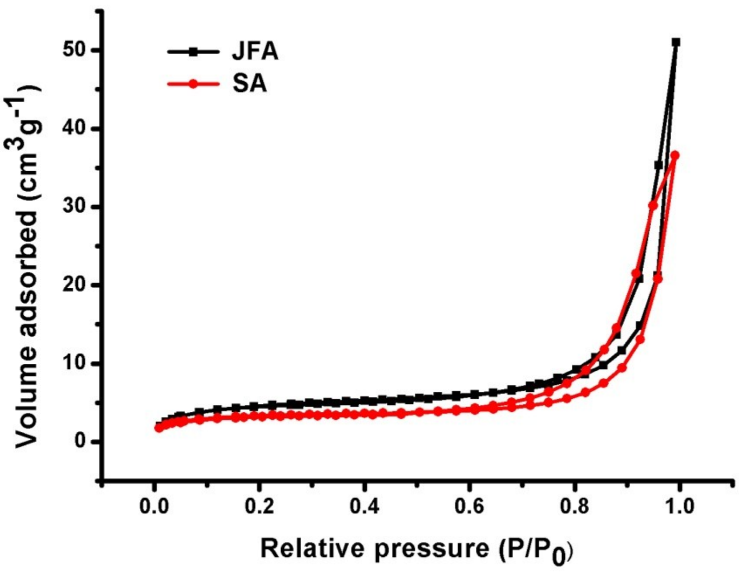

Figure S1. Nitrogen gas adsorption and desorption isotherms of JFA and SA.

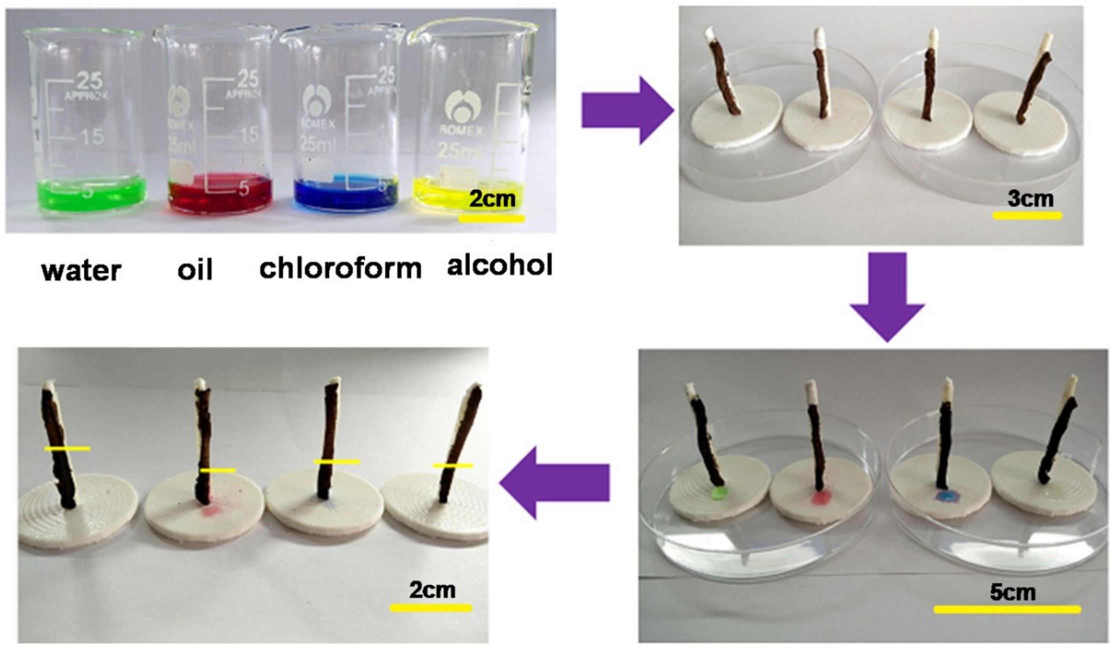

Figure S2. Fabrication process of the anisotropy properties of liquid adsorption experiment. The 3D model of disk which was designed by Rhino software and accomplished by FDA 3D printer.

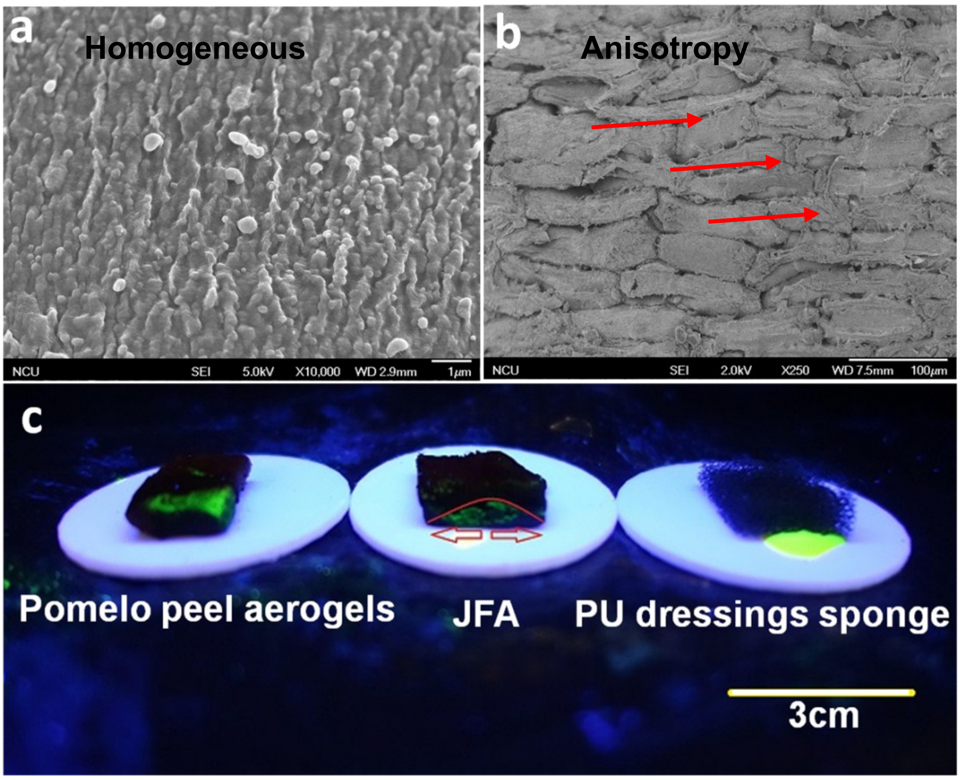

Figure S3. SEM images of (a) pomelo peel aerogels(homogeneous aerogels) and (b) JFA. Adsorption effects test of (a) pomelo peel aerogels(aerogels), (b) JFA, (c) PU sponge. The JFA utilized inherent structural anisotropy to absorb liquid immediately along the direction of the arrow.

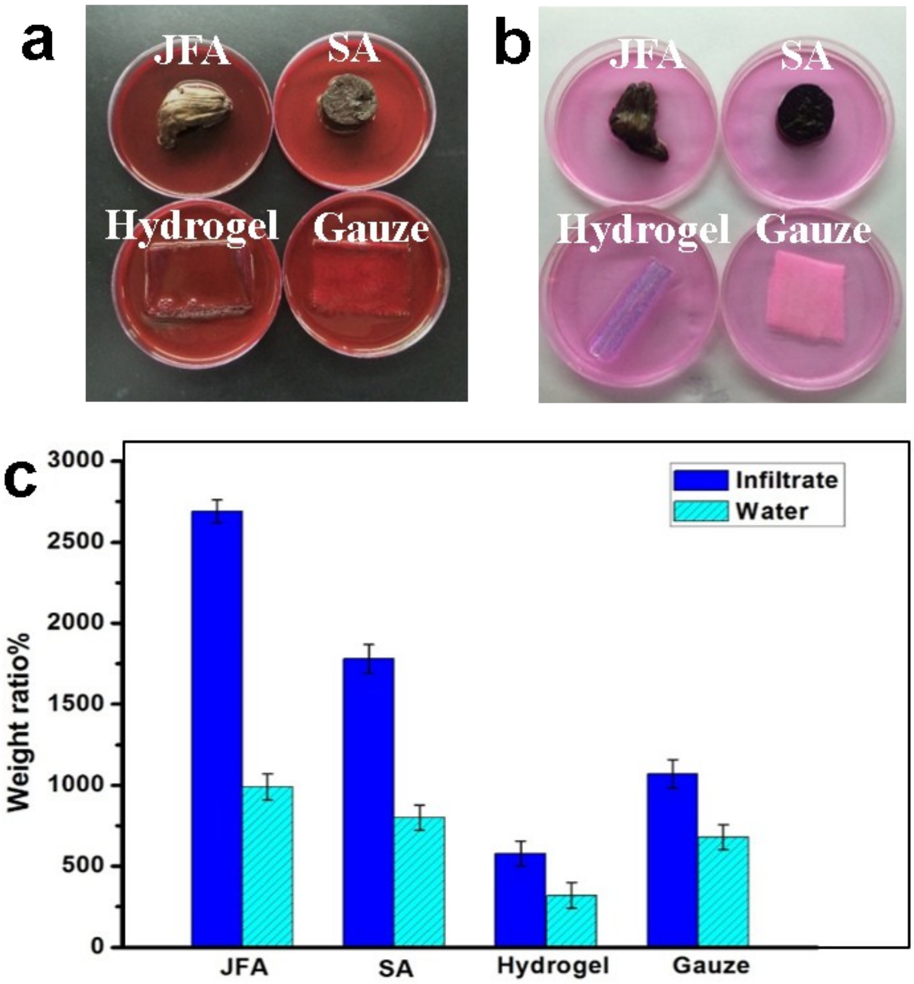

Figure S4. Absorption capacity of four kinds of materials. (a, b) Absorption process of JFA, SA, hydrogel, Gauze for infiltrate and water. (c) The absorption capacity of the JFA, SA, hydrogel, Gauze for infiltrate and water. The weight ratio of JFA was the best. The weight ratio, is defined as the weight of absorbed substance per unit weight of the dried above materials.

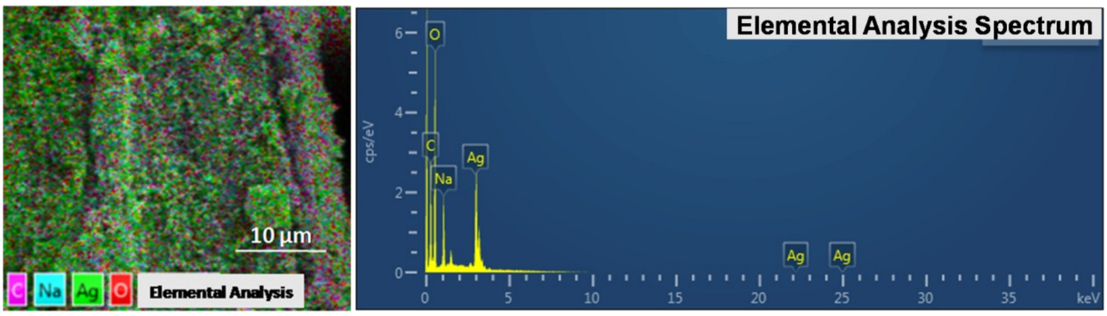

Figure S5. (a) The EDS element map and (b) corresponding spectrum from an as-prepared sample.

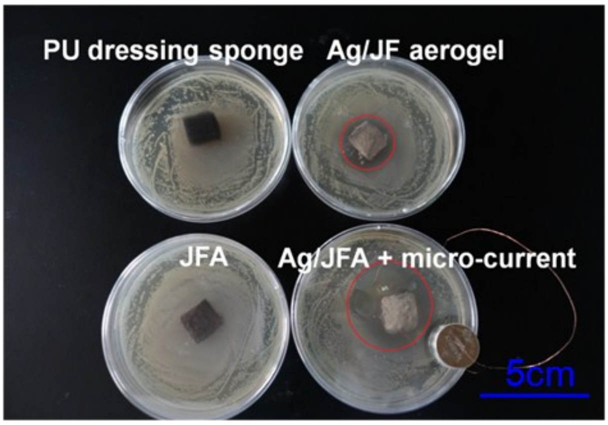

Figure S6. The inhibition zone test for E. coli of (1) PU dressing sponge, (2) Ag/JFA, (3) JFA and (4) Ag/JFA+ E

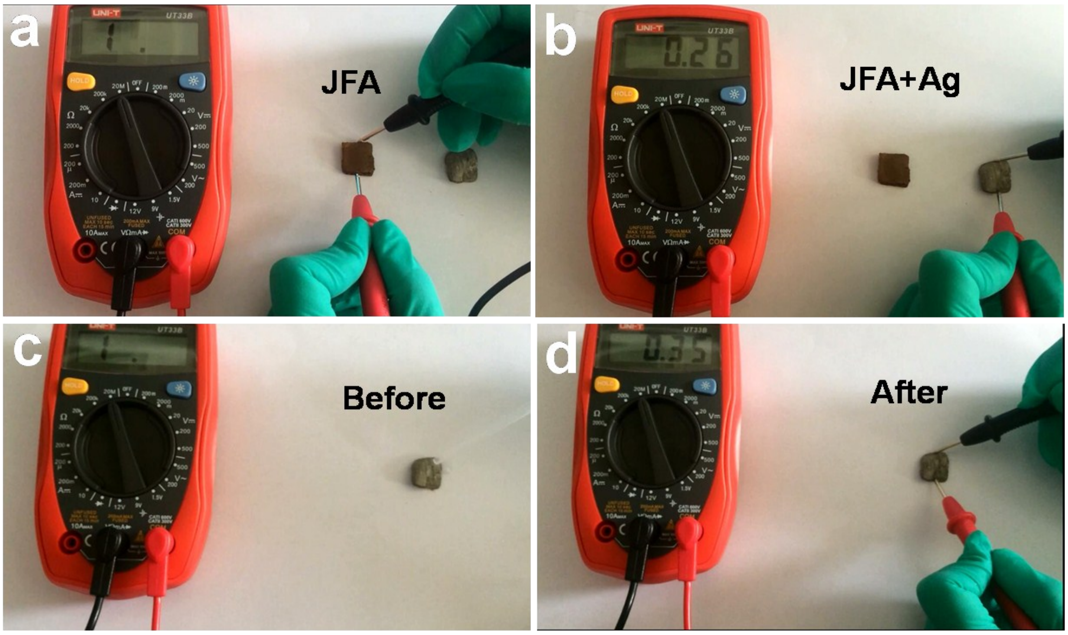

Figure S7. The existence of silver and the increase of liquid can improve electrical conductivity. Comparison of electrical conductivity of (a) JFA and (b) Ag/JFA, (c) Before the adding water. (d) The conductivity increases after adding water.

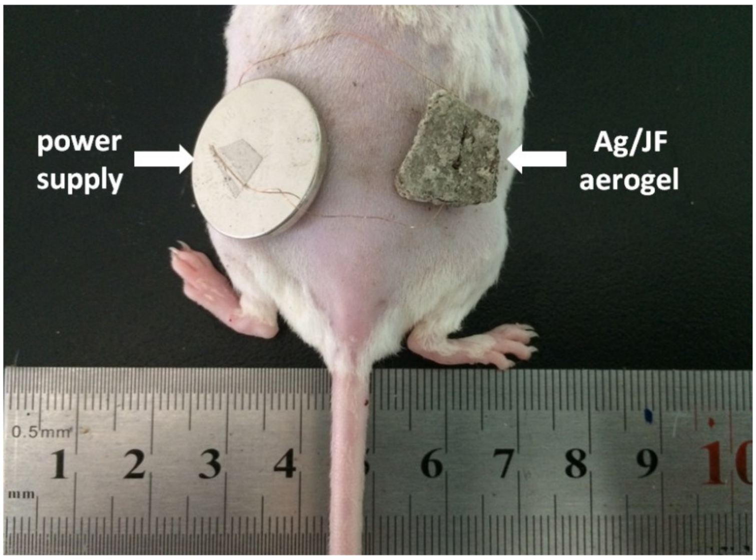

Figure S8. The Ag/JFA+E was applied on the shaved area and wrapped in gauze.