Supplementary Information

Sustainable and Transparent Fish Gelatin Films for Flexible Electroluminescent Devices

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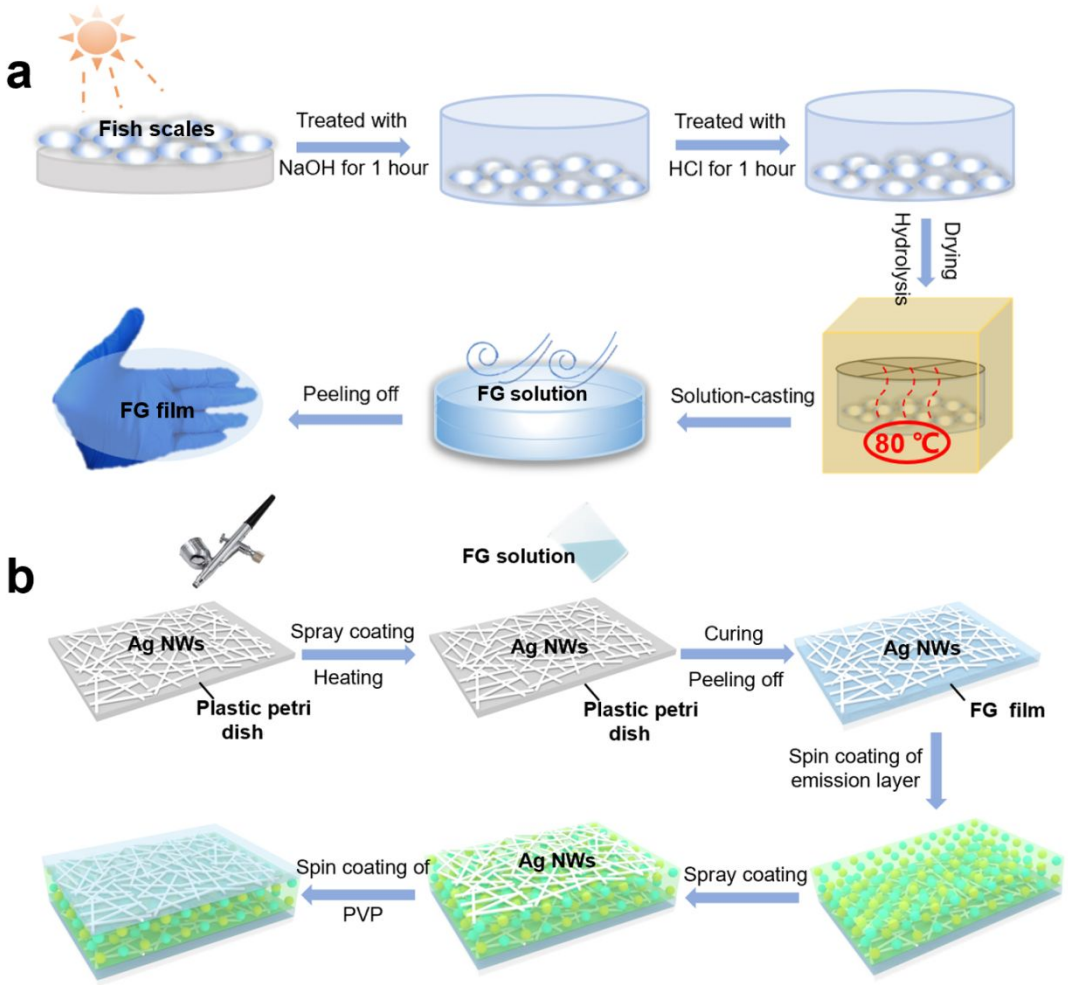

Figure S1. Schematic diagrams showing the preparation procedures of (a) the FG film and (b) the ACEL device.

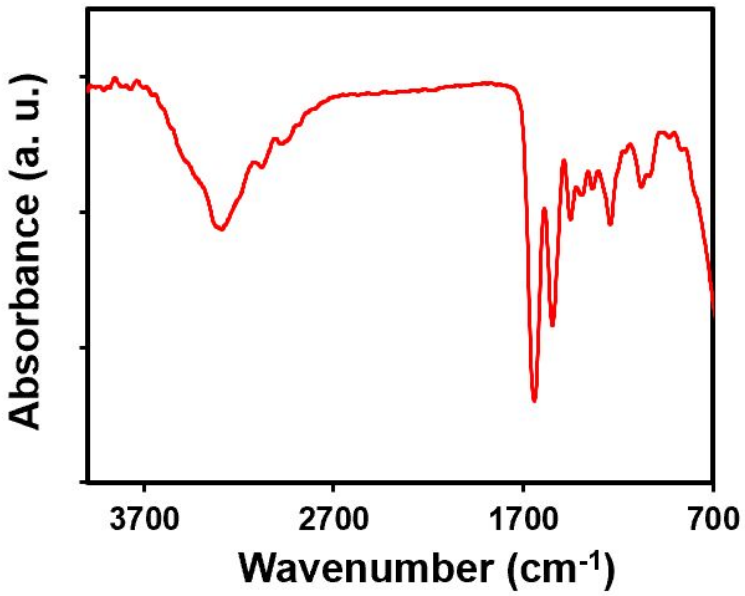

Figure S2. FTIR spectrum of the FG film.

A FTIR measurement was carried out to illustrate the functional groups in FG film. As shown in Figure S2 in the Supporting Information, the absorption bands at 1646, 1550 and 1242 cm^{-1} corresponds to amide-I (C=O stretching), amide-II (N-H bending or C-N stretching) and amide-III (in plane vibrations of C-N and N-H in bound amide or vibrations of CH_2 groups in glycine) respectively, indicating the presence of amides in gelatin. The broad band beyond 3308 cm^{-1} corresponds to the hydroxyl and amino groups, and the absorption band at 1330 cm^{-1} is attributable to CH_2 wagging in proline. These results are consistent with the previous reports.[1,2]

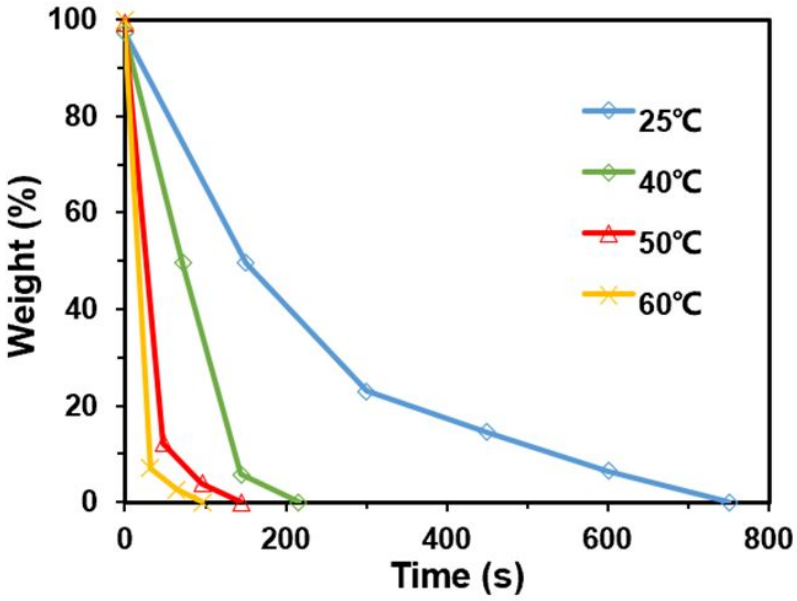

Figure S3. Dissolution curves of the FG films in water at 25, 40, 50 and 60 ℃.

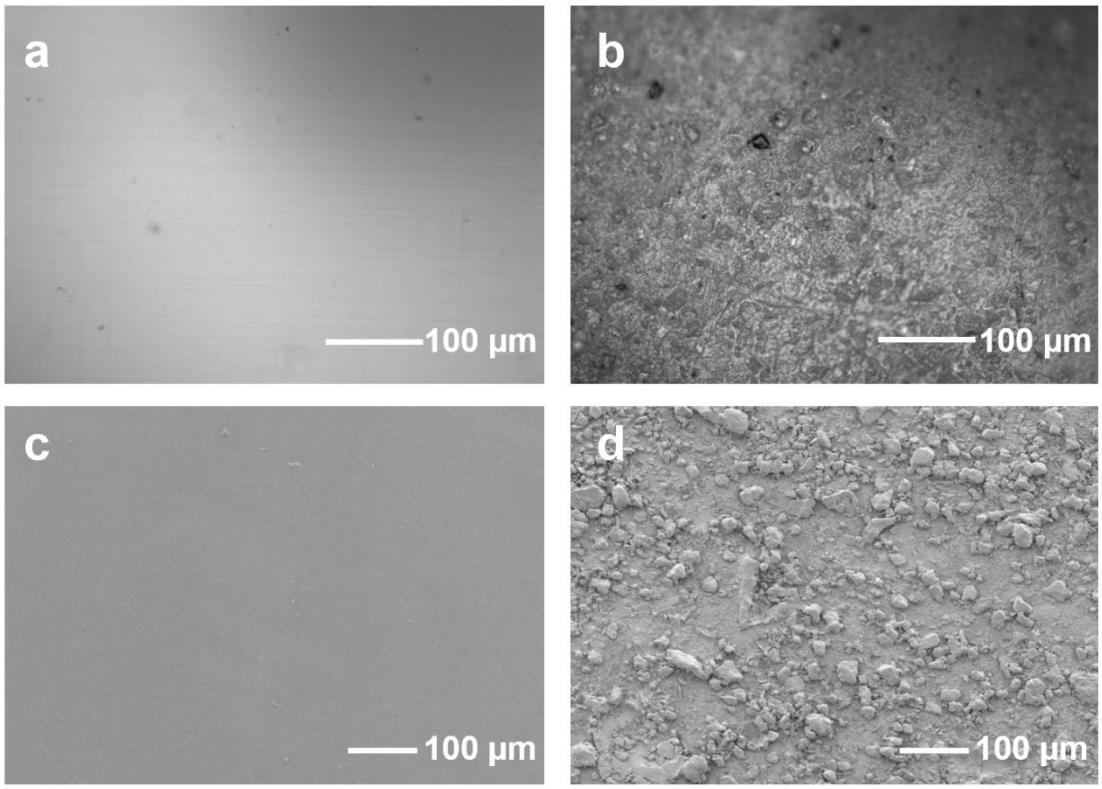

Figure S4. Optical images of (a) the as-prepared FG film and (b) the one buried in soil for 24 hours. SEM images of (c) the as-prepared FG film and (d) the one buried in soil for 24 hours.

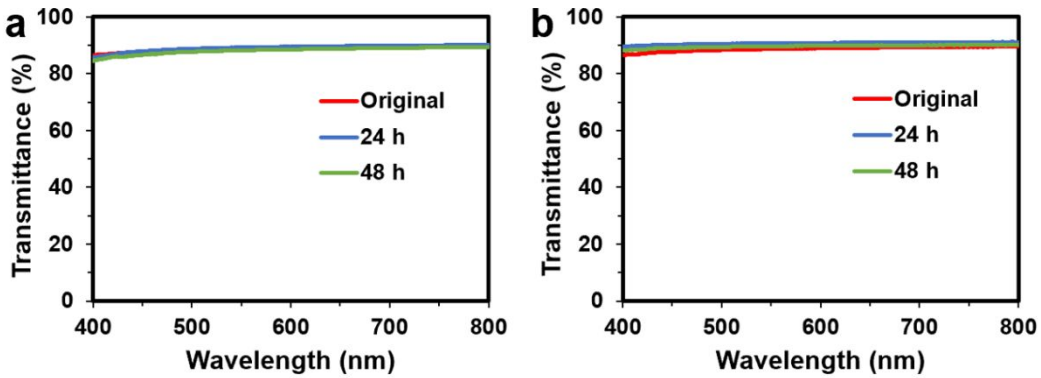

Figure S5. Light transmittances of the FG films after being exposed to (a) air at 100% humidity and (b) sunlight for 0, 24 and 48 hours.

As reported by Etxabide *et al.*, the FG film buried in soil for a certain period could be corroded microbially,[2] which leads to a roughening of the film surface and makes the film opaque. They carried out FTIR measurements and proved that the cleavages of C=O, N−H, and C−N bonds occurred during the biodegradation. Due to the degradation of FG, the surface of FG film became very rough after being buried in soil for 24 hours (the optical and SEM images shown in Supporting Information Figure S4), which explains the opaqueness of the film. To study the effects of moisture and sunlight on the FG films, the as-prepared FG films were exposed to air at 100% humidity (Figure S5a) or sunlight (Figure S5b).[2]

Reference

1. Ben Slimane, E.; Sadok, S., Collagen from Cartilaginous Fish By-Products for a Potential Application in Bioactive Film Composite. *Mar. Drugs.* **2018**, 16, 1-19.
2. Etxabide, A.; Leceta, I.; Cabezudo, S.; Guerrero, P.; de la Caba, K., Sustainable Fish Gelatin Films: From Food Processing Waste to Compost. *ACS Sustain. Chem. Eng.* **2016**, 4, 4626-4634.