

Supplementary Materials
**3D-Printable Sustainable Bioplastics from Gluten
and Keratin**

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S1. Matrix-assisted laser desorption ionization time-of-flight (MALDI-TOF) mass spectrometry.

The molecular weight of keratin protein was measured by MALDI-TOF analysis using a rapifleX[®] MALDI instrument (Bruker). For sample preparation, about 5.0 mg of keratin powder and 5.0 mg of α -cyano-4-hydroxycinnamic acid (matrix) were first separately dissolved in 1 ml of solution mixture made of acetonitrile and water (1:1 weight ratio) containing 0.1% trifluoroacetic acid (TFA) [1]. About 10 μ L of both sample and matrix solutions were mixed well, and 1 μ L of the mixture was dispensed onto a MALDI plate and dried. The mass spectrum of the sample (with 10000 shots collected) was measured in the range of 500 to 5000 m/z (as shown below).

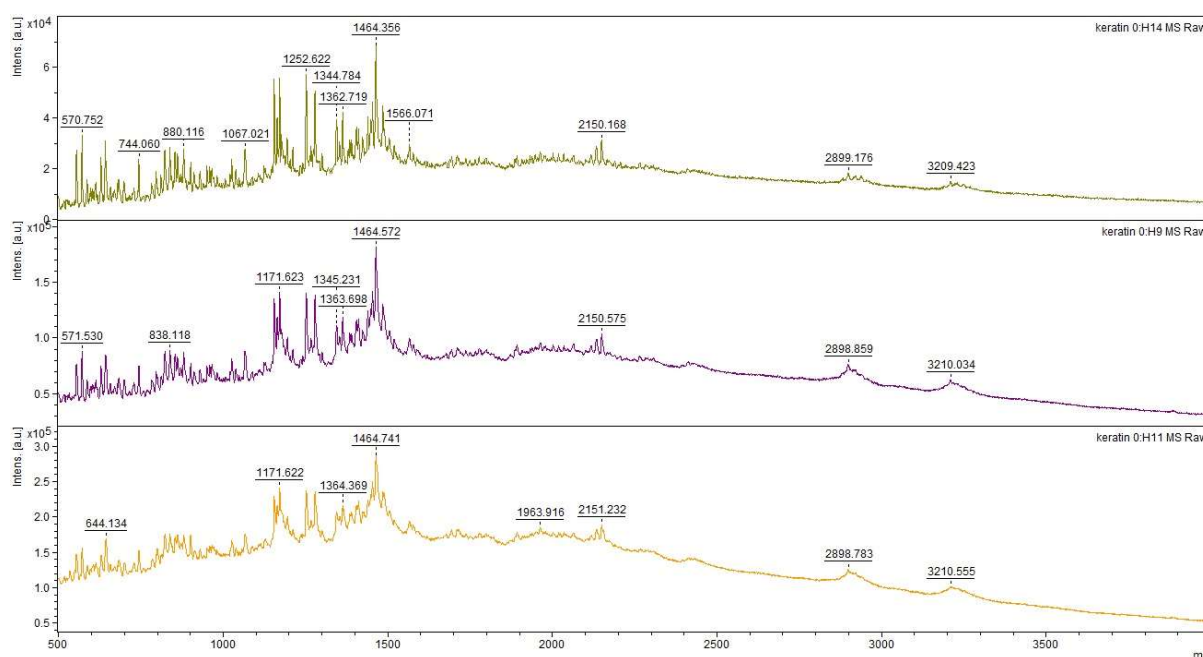


Figure S1: MALDI-TOF MS spectrum of keratin powder.

S2. Deconvolution of Fourier transform infrared (FTIR) spectroscopy data.

The secondary structure of proteins in fabricated hydrogels was estimated by deconvoluting the amide-I region ($1580\text{--}1690\text{ cm}^{-1}$) of the measured FTIR data (as shown below) using the MagicPlot Student software. The data was fit with multiple Gaussian peaks corresponding to β -sheets (1684 cm^{-1}), β -turns (1671 cm^{-1}), random coil and α -helices (1650 cm^{-1}), intramolecular β -sheets (1631 cm^{-1}), intermolecular β -sheets (1615 cm^{-1}), and glutamine side chain. (1596 cm^{-1}) [2]. The percentage of secondary structures were calculated from obtained peak areas.

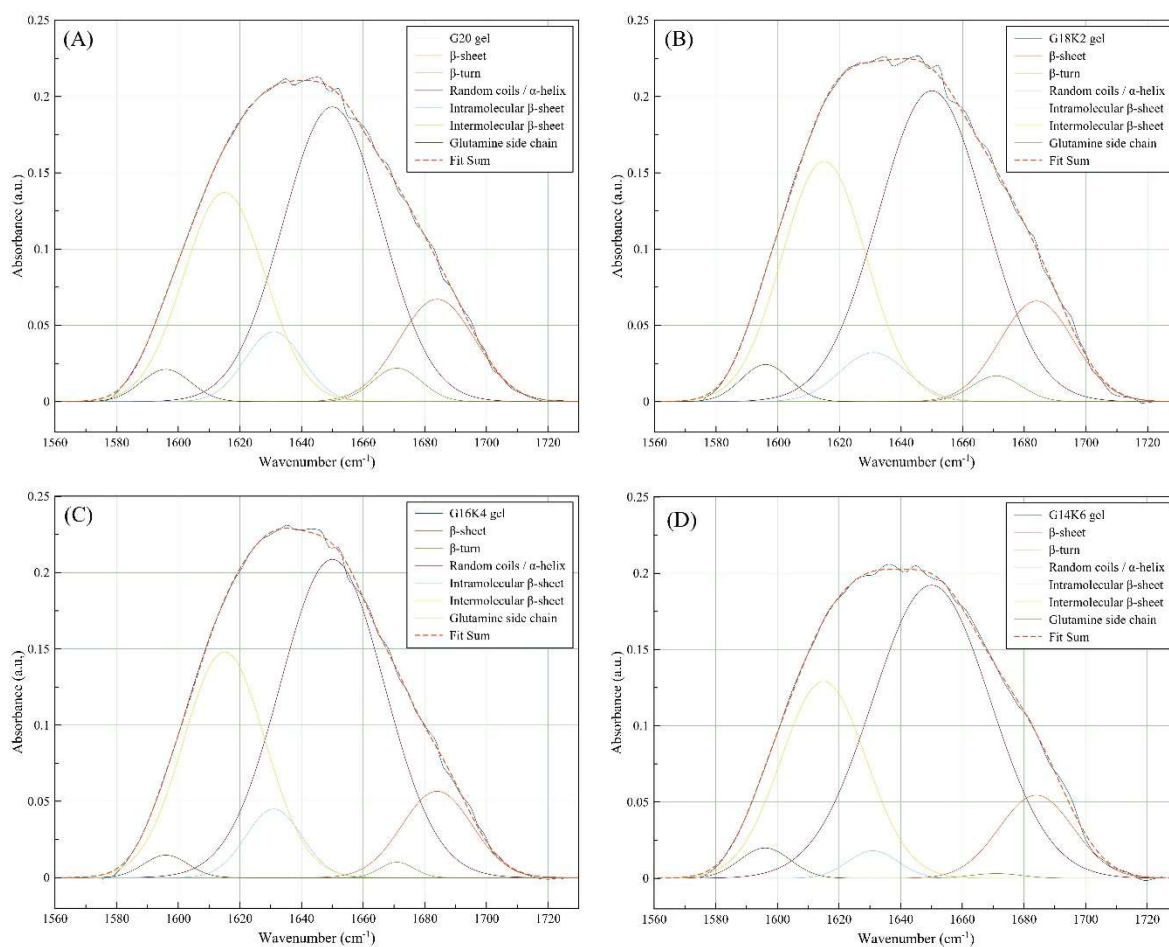


Figure S2: The deconvolution of the amide-I spectral region of the FTIR spectra of fabricated hydrogels.

Reference:

1. Cardamone, J. M. Investigating the microstructure of keratin extracted from wool: Peptide sequence (MALDI-TOF/TOF) and protein conformation (FTIR). *J. Mol. Struct.* **2010**, 969, 97–105. <https://doi.org/10.1016/j.molstruc.2010.01.048>.
2. Georget, D. M. R.; Belton, P. S. Effects of temperature and water content on the secondary structure of wheat gluten studied by FTIR spectroscopy. *Biomacromolecules* **2006**, 7, 469–475. <https://doi.org/10.1021/bm050667j>.