SUPPLEMENTAL MATERIALS

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Effect of Soft Viscoelastic Biopolymer on the Undrained Shear Behavior of Loose Sands

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Table S1 Gelatin solution composition

Concentration [%]	Mass of gelatin [g]	Mass of deionized water [g]
8	8.70	100
12	13.64	100
16	19.05	100
20	25.00	100

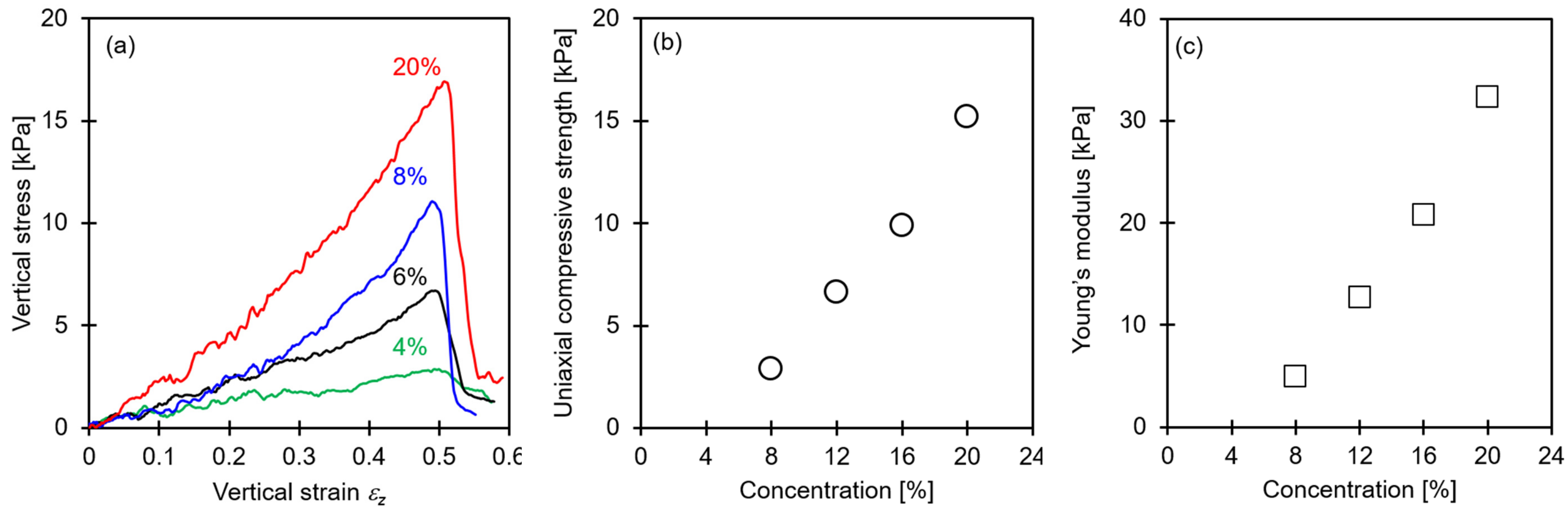

Figure S1. Large-strain mechanical properties of pure gelatin samples at different gelatin concentrations. (a) Stress-strain trends measured in uniaxial compression tests. (b) Uniaxial compressive strength. (c) Young's modulus E determined at half of the peak strain.

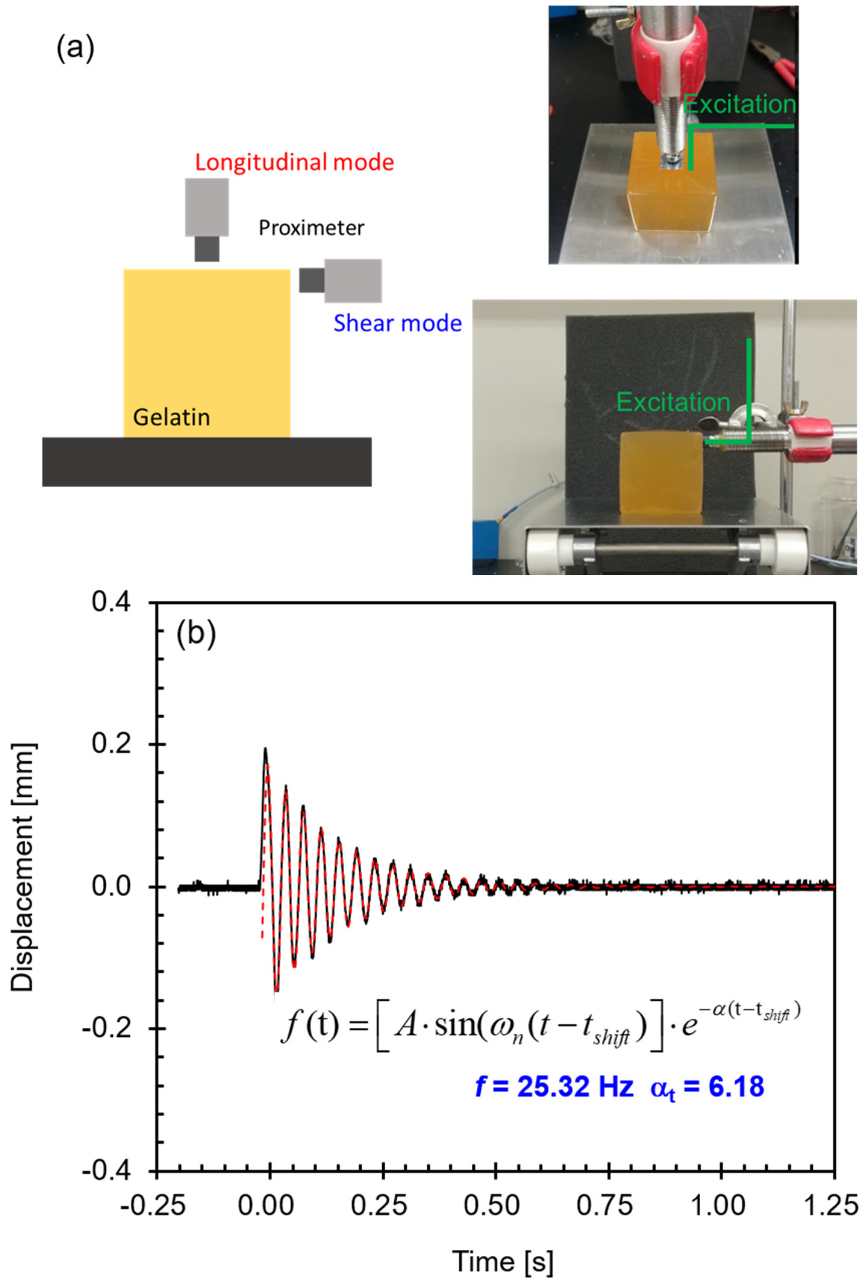

Figure S2. Resonant mode excitation of pure gelatin under a fixed-free condition. (a) Test setup. (b) Representative data acquired from the longitudinal mode (gelatin concentration c= 16%).

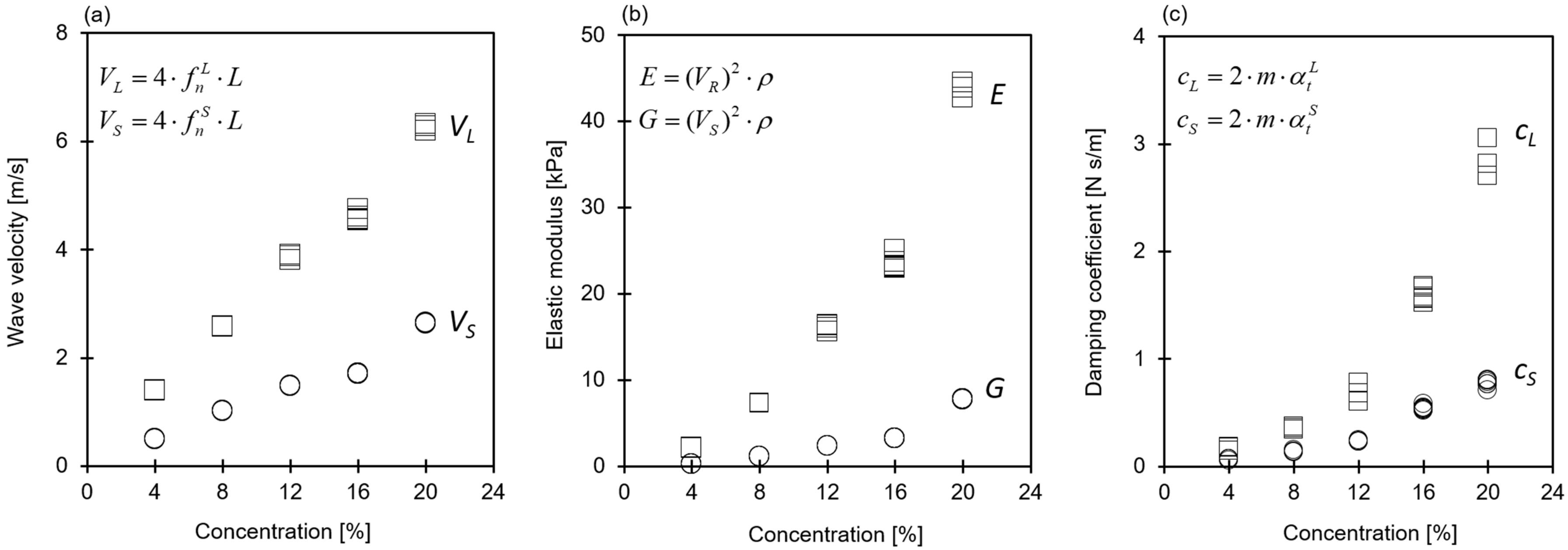

Figure S3. Small-strain mechanical properties of pure gelatin samples obtained from the resonant mode testing. (a) Longitudinal wave velocity V_L and shear wave velocity V_S. (b) Young's modulus E and shear modulus G. (c) Longitudinal damping coefficient c_L and shear damping coefficient c_S.

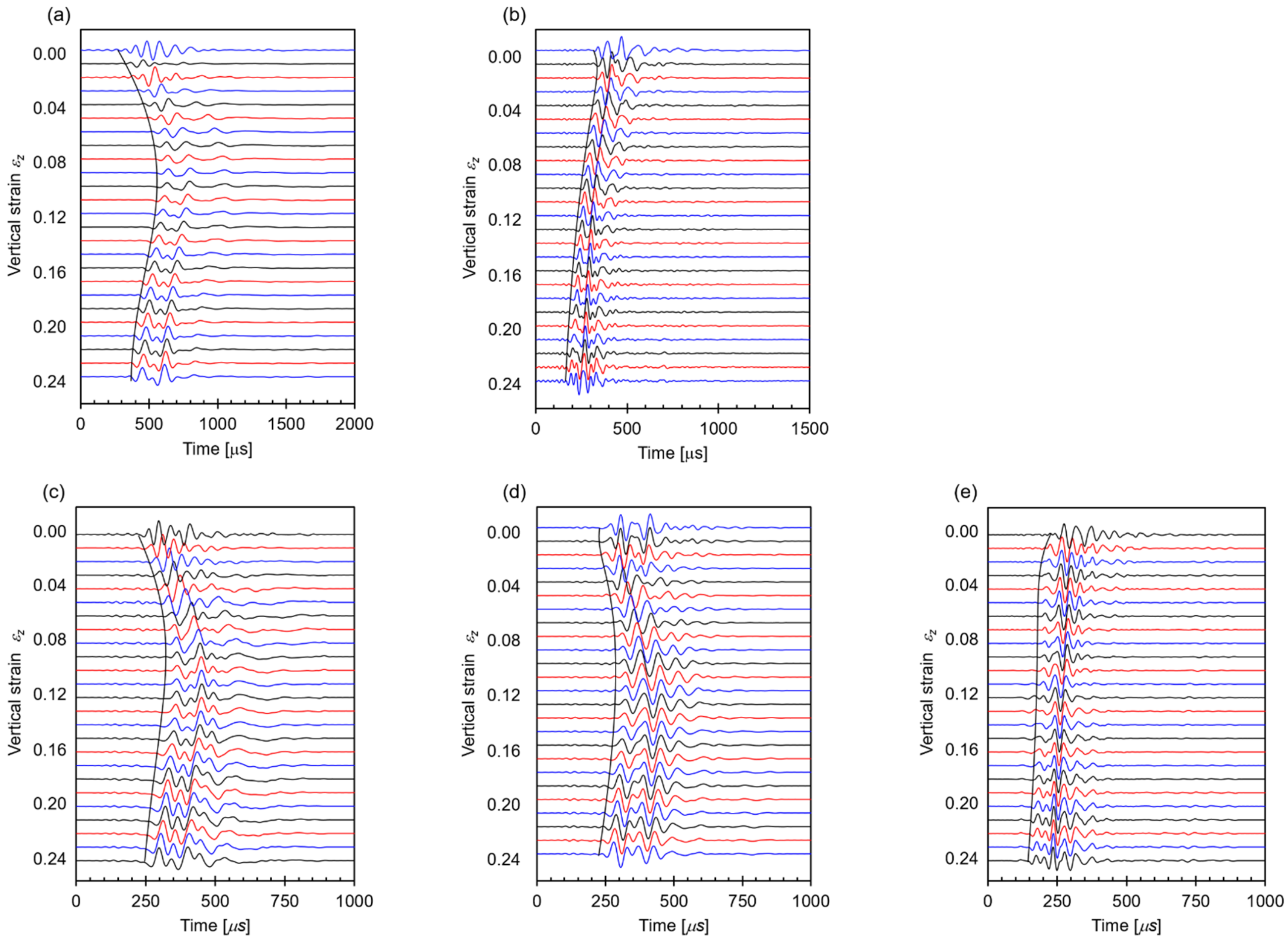

Figure S4. Biopolymer-free sand. Cascade of shear wave signature during undrained deviator loading: (a) D_r = 42 % at σ'_o = 100 kPa, (b) D_r = 53 % at σ'_o = 100 kPa, (c) D_r = 40 % at σ'_o = 400 kPa, (d) D_r = 45 % at σ'_o = 400 kPa, and (e) D_r = 61 % at σ'_o = 400 kPa.

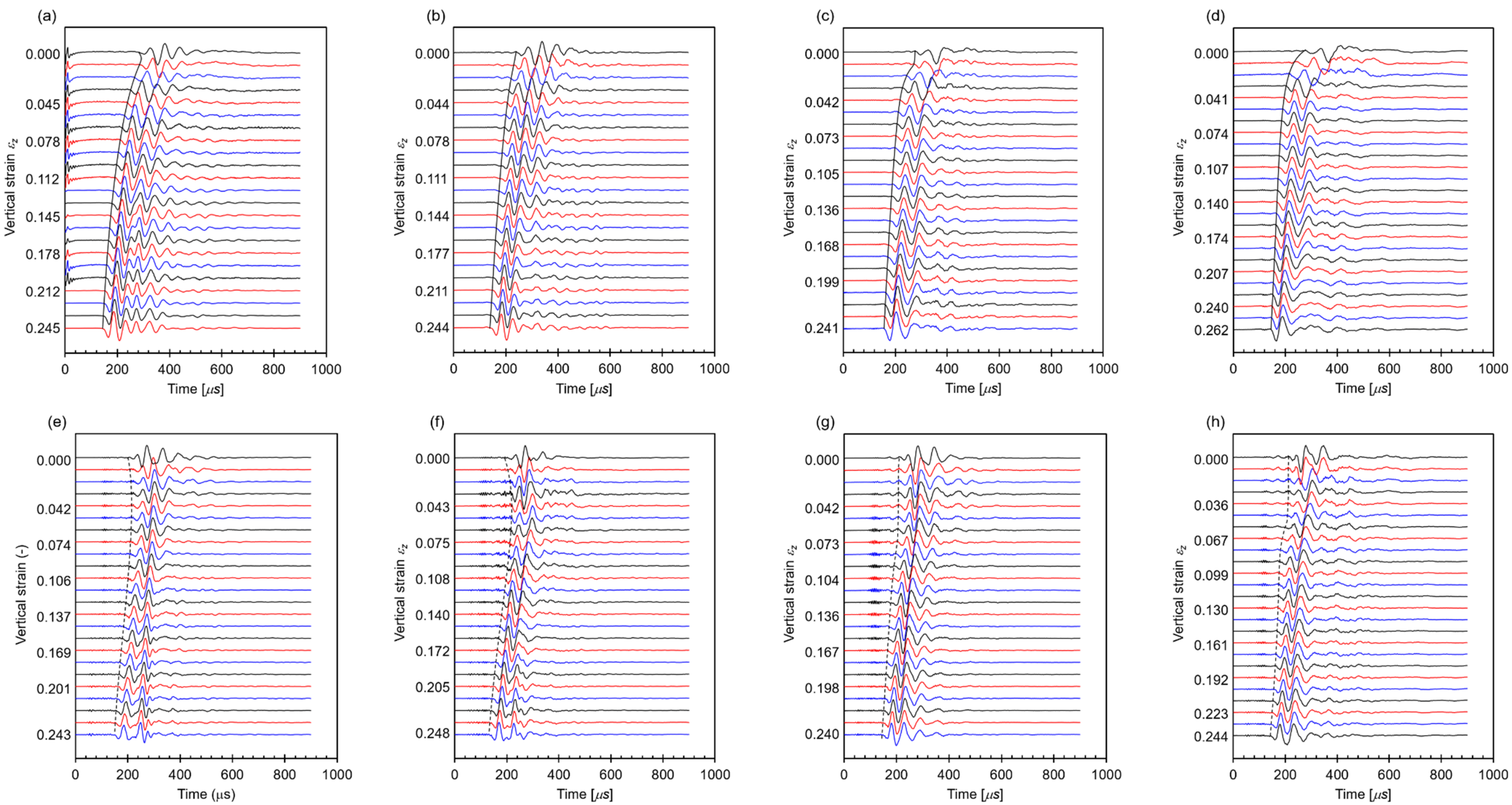

Figure S5. Sand with biopolymer "consolidated-before-gelation" *CbG*. Cascade of shear wave signature during undrained deviator loading: (a) C = 8 % at σ'_o = 100 kPa, (b) C= 12 % at σ'_o = 100 kPa, (c) C = 16 % at σ'_o = 100 kPa, (d) C = 20 % at σ'_o = 100 kPa, (e) C = 8 % at σ'_o = 400 kPa, (f) C = 12 % at σ'_o = 400 kPa, (g) C = 16 % at σ'_o = 400 kPa, (h) C = 20 % at σ'_o = 400 kPa.

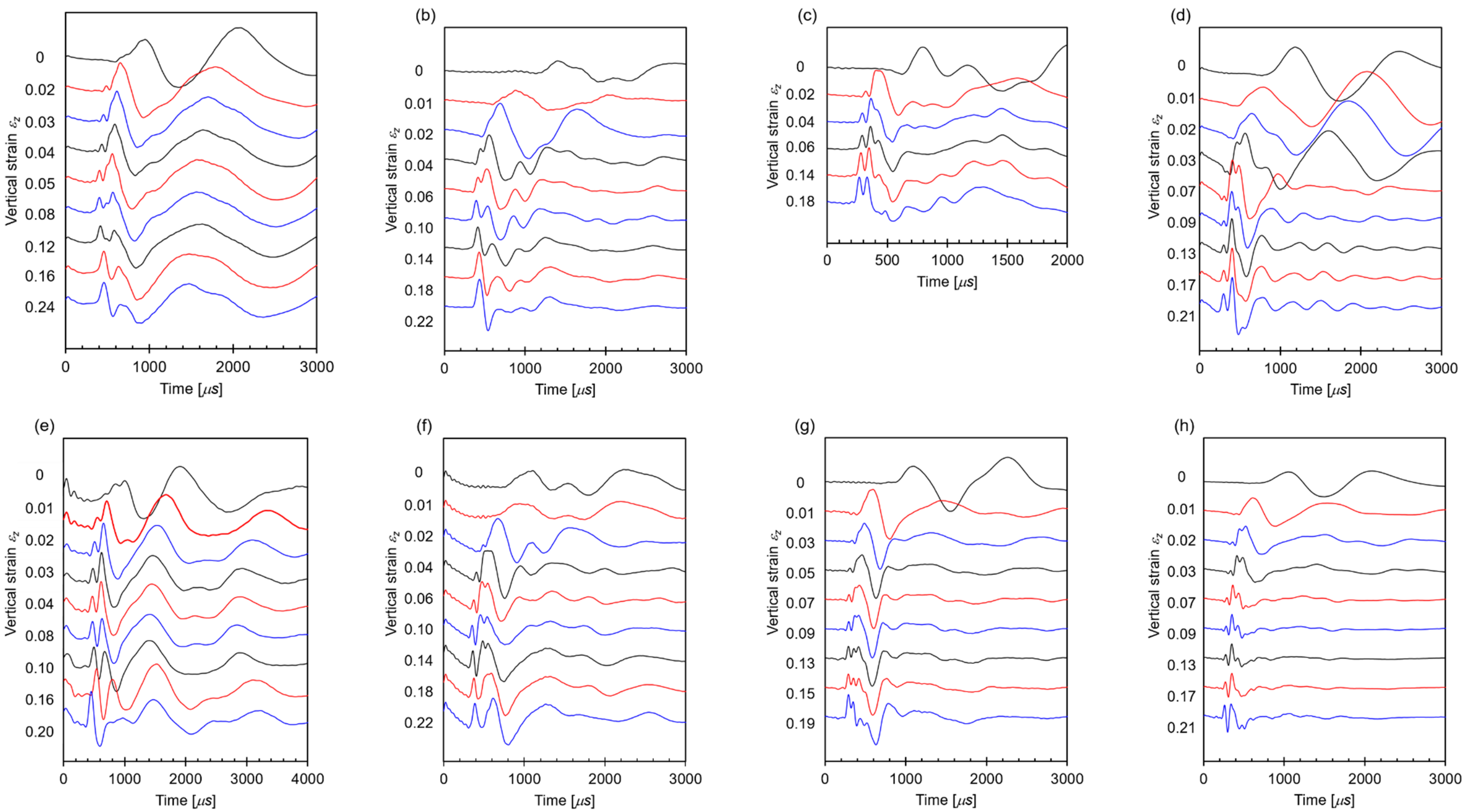

Figure S6. Sand with biopolymer "confined-after-gelation" *CaG*. Cascade of shear wave signature during undrained deviator loading: (a) C = 8 % at σ_o = 50 kPa, (b) C = 12 % at σ_o = 50 kPa, (c) C = 16 % at σ_o = 50 kPa, (d) C = 20 % at σ_o = 50 kPa, (e) C = 8 % at σ_o = 100 kPa, (f) C = 12 % at σ_o = 100 kPa, (g) C = 16 % at σ_o = 100 kPa, (h) C = 20 % at σ_o = 100 kPa.

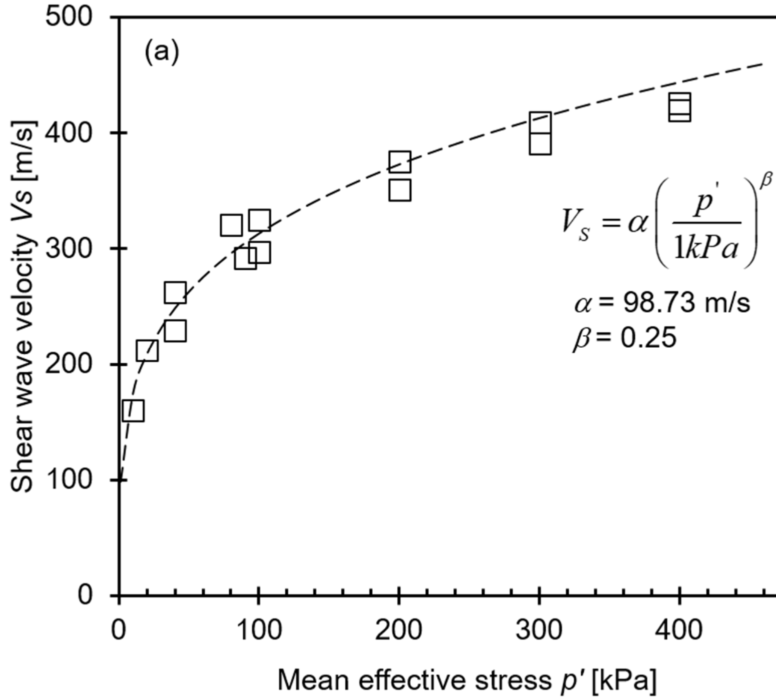

Figure S7. Shear wave velocity-mean effective stress relation of the biopolymer-free sand.