Supporting Information

Regulation of the Viscoelastic Properties of Hyaluronate–Alginate Hybrid Hydrogel as an Injectable for Chondrocyte Delivery

*Hyun Ji Lee[a], Yerang Seo[a], Hyun Seung Kim[a], Jae Won Lee[a], Kuen Yong Lee[a,b,]**

[a] Department of Bioengineering, Hanyang University, Seoul 04763, Republic of Korea

[b] Institute of Nano Science and Technology, Hanyang University, Seoul 04763, Republic of Korea

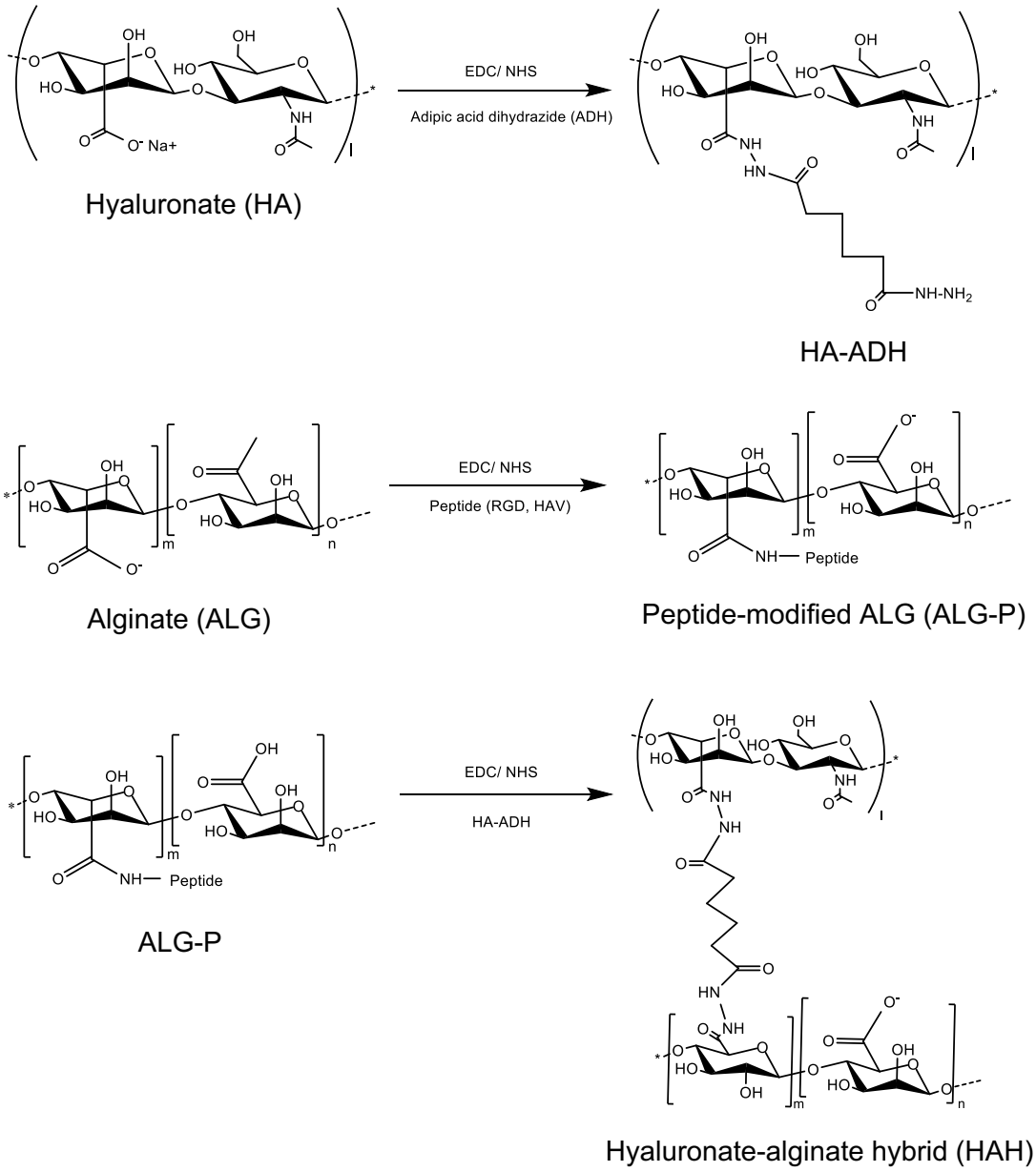

Figure S1. Procedure to synthesize hyaluronate-alginate hybrid (HAH). Hyaluronate (HA) was conjugated with adipic acid dihydrazide (ADH) via carbodiimide chemistry (HA-ADH). Alginate modified with RGD peptide and HAV peptide (ALG-P) was next coupled to the HA-ADH to produce HAH.

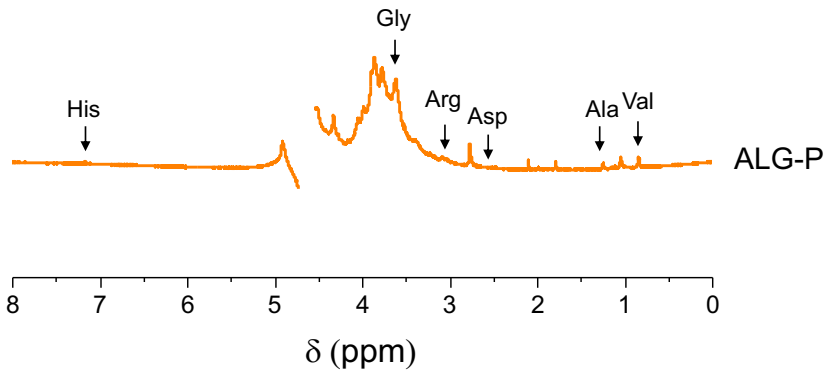

Figure S2. ^{1}H NMR spectra of peptide-modified alginate (ALG-P).

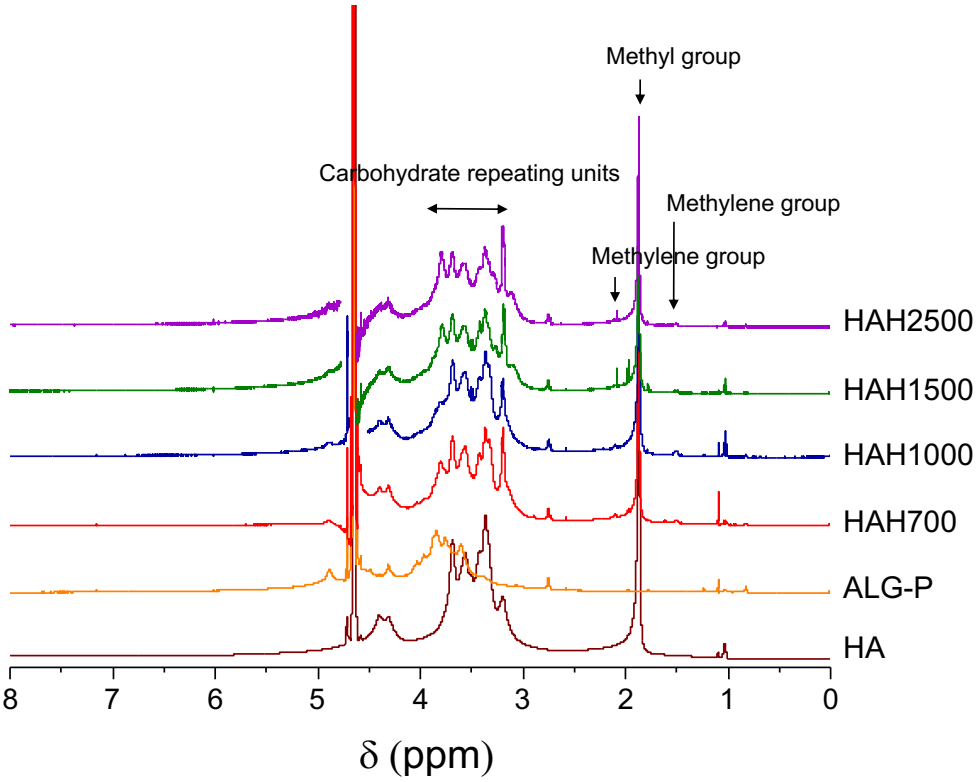

Figure S3. ^{1}H NMR spectra of hyaluronate (HA), peptide-modified alginate (ALG-P), and HAHs prepared with different molecular weights. The number suffixed after HAH denotes the molecular weight of HA before conjugation (kDa).

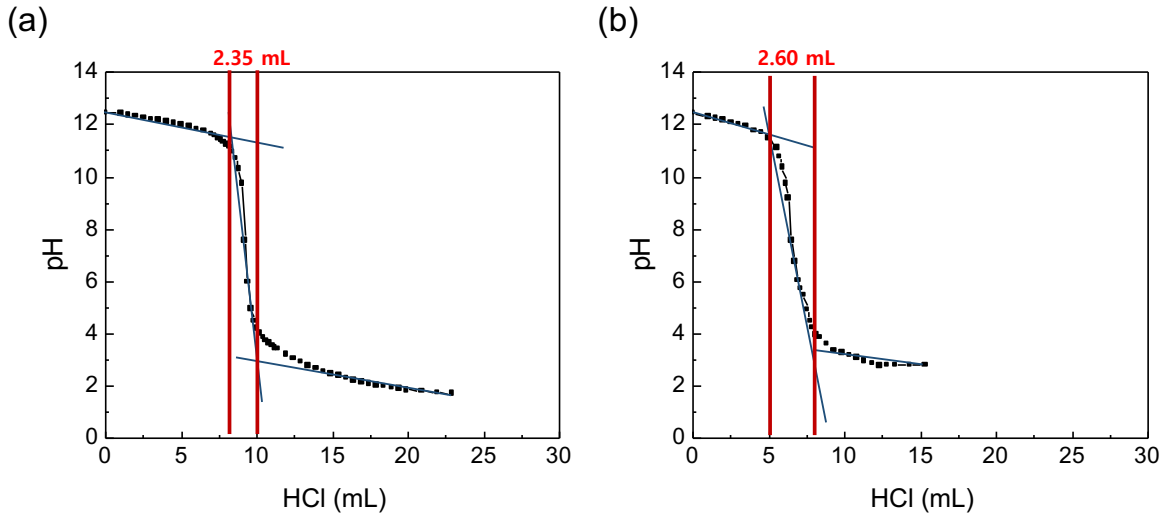

Figure S4. Acid-base titration curves of HA with the molecular weight of 700 kDa and (b) HAH700 (HA/ALG = 2/1, weight ratio).

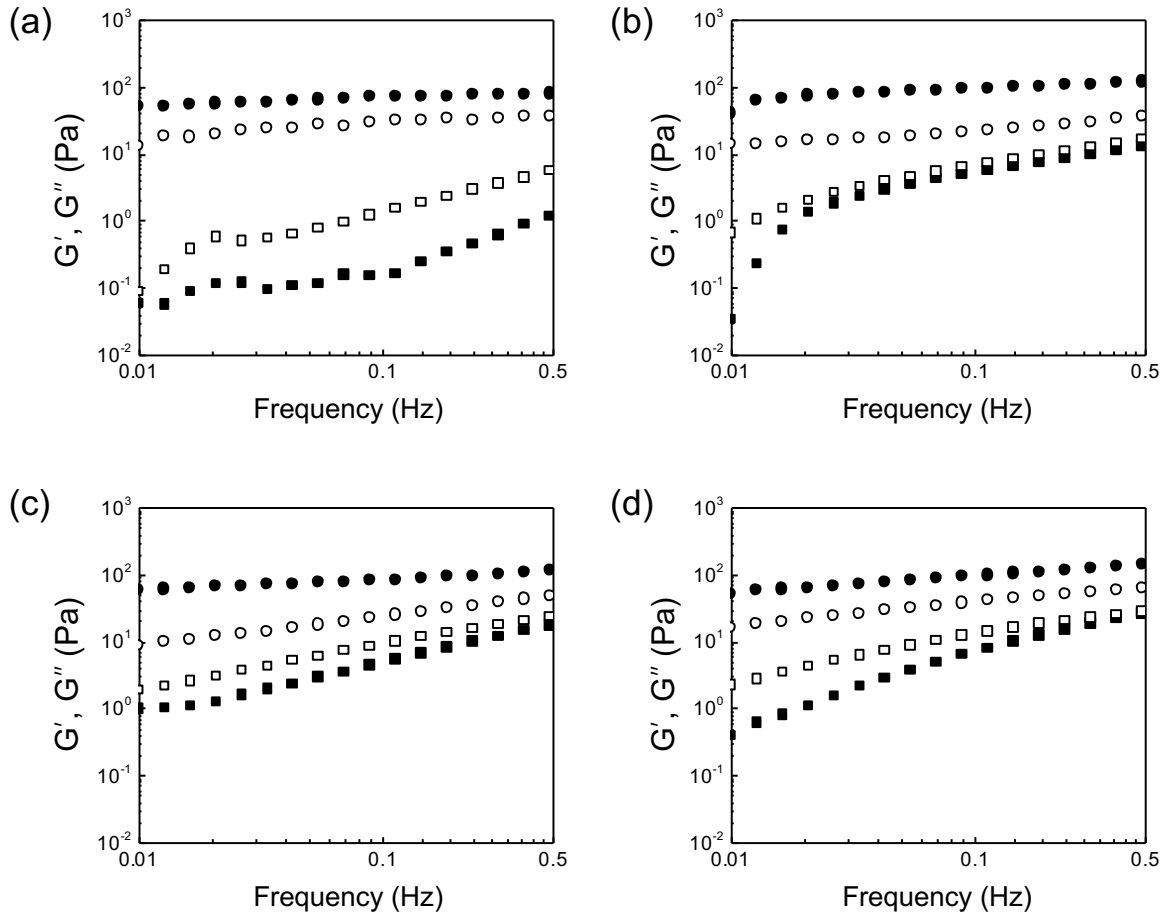

Figure S5. Viscoelastic properties of HAH solution (square) and HAH hydrogel (circle) at 37°C. Values of storage shear modulus (G′, filled symbol) and loss shear modulus (G″, open symbol) of (a) HAH700, (b) HAH1000, (c) HAH1500, and (d) HAH2500 at different frequencies.

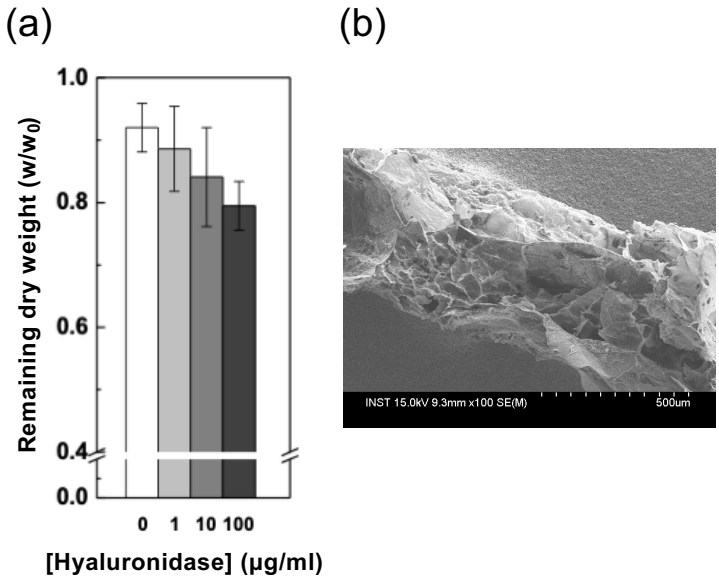

Figure S6. (a) Changes in the dry weight of HAH700 gel disks after treated with hyaluronidase for 2 weeks at 37ºC ([hyaluronidase] = 0-100 μg/ml in PBS; [HAH] = 2 wt%; [HA]:[ALG] = 1:1, weight ratio). (b) Cross-sectional image of HAH700 hydrogel after incubation with hyaluronidase at 37ºC for 2 weeks ([HAH] = 2 wt%; [HA]:[ALG] = 1:1, weight ratio; [hyaluronidase] = 100 μg/ml). The cross-sectional image was taken by scanning electron microscopy (S-4800 UHR FE-SEM; Hitachi, Japan).