Supporting Information

Biomimetic, Multi-Responsive and Self-Healing Lactose-modified Chitosan (CTL)-based Gels formed via Competitor-assisted Mechanism

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Analysis of flow curves. The experimental points in the linear part of the curve - *i.e.* at low values of the shear rate - were modeled by a simplified version of the Cross equation (eq. 1S)[1]

$$\eta = \frac{\eta_0}{1+(\gamma k)^n} \qquad \text{(eq. 1S)}$$

where η_0 is the zero-shear viscosity, corresponding to the limiting Newtonian plateau for $\gamma \rightarrow 0$, k is a fitting parameter representing the characteristic relaxation time and n is a fitting parameter known as the Cross rate constant.[2]

Additional figures.

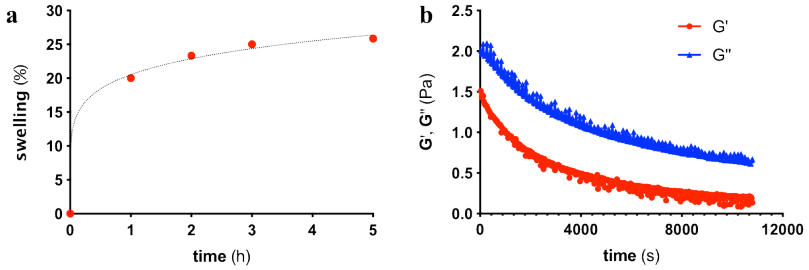

Figure S1. (a) Dependence of swelling, *i.e.* solvent uptake, on time of sample-case CTL-based gel ([CTL] = 40 g/L, [B] = 8 mM, [M] = 16 mM, $R_{M/B}$ = 2). The dotted curve is drawn to guide the eye. (b) Dependence of storage and loss moduli on time of sample-case CTL-based gel ([CTL] = 10 g/L, [B] = 8 mM, [M] = 16 mM, $R_{M/B}$ = 2) in the presence of lysozyme 13 mg/L. Experimental conditions in both cases: T = 37 °C, PBS 1X, pH 7.4.

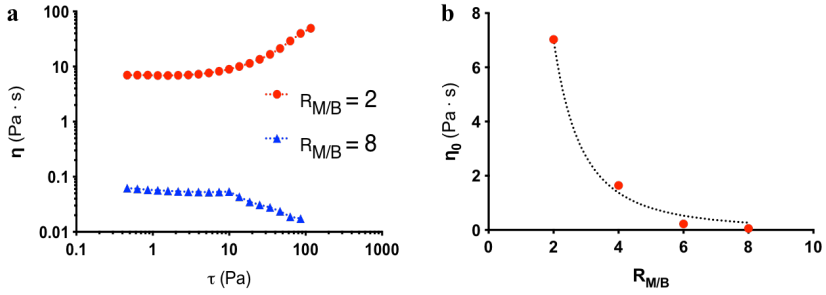

Figure S2. (a) Dependence of the dynamic viscosity, η, on applied stress, τ; dotted lines are drawn to guide the eye. (b) Dependence of the zero-shear viscosity, η_0, on $R_{M/B}$; dotted line is drawn to guide the eye. Experimental conditions: [CTL] = 10 g/L, T = 25 °C, PBS 1X, pH 7.4. $R_{M/B}$ refers to the ratio [M]/[B], where [B] represents the total molar concentration of boric acid while [M] stands for the molar concentration of mannitol.

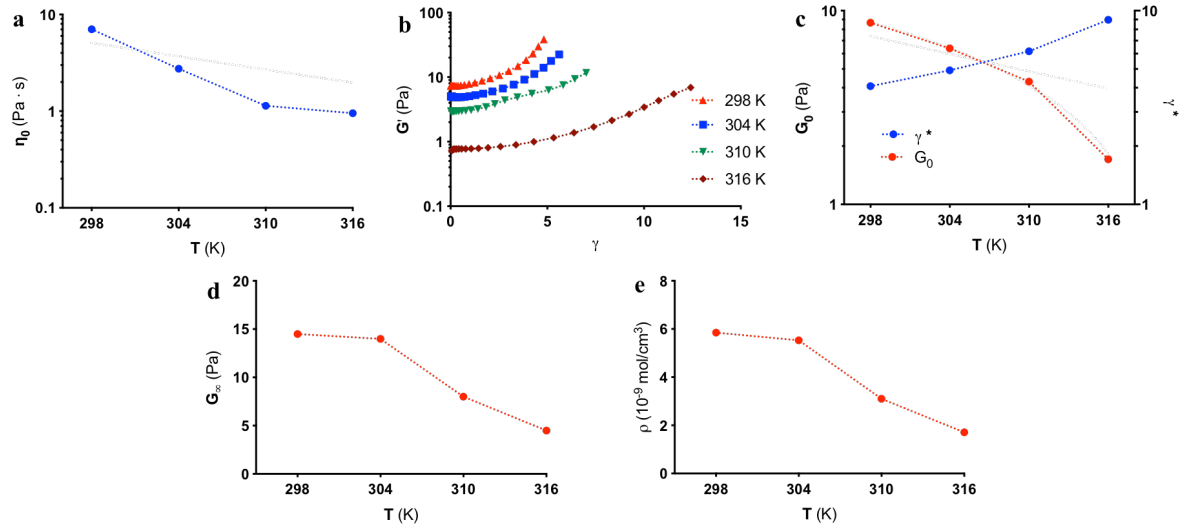

Figure S3. (a) Dependence of the zero-shear viscosity, η_0, on temperature, T. (b) Dependence of the elastic modulus, G', on applied deformation, γ, at different T. (c) Dependence of the shear modulus at zero strain, G_0, and that of critical strain, γ^*, on T. (d) Dependence of the plateau modulus, G_∞, on T. (e) Dependence of the elastically active chains, ρ, on T. All dotted lines are drawn to guide the eye. In all cases the concentration of CTL was 10 g/L, that of boric acid 8 mM and that of mannitol 16 mM ($R_{M/B}$ = 2). All measurements were performed in PBS, pH 7.4.

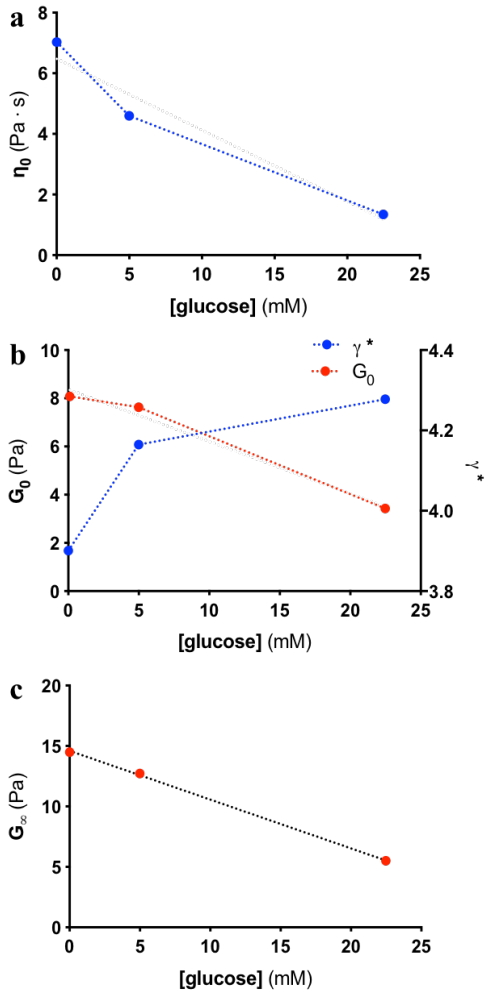

Figure S4. (a) Dependence of the zero-shear viscosity, η_0, on glucose concentration. (b) Dependence of the shear modulus at zero strain, G_0, and that of critical strain, γ^*, on glucose concentration. (c) Linear dependence of the plateau modulus, G_∞, on glucose concentration. All curves have been drawn to guide the eye. Experimental conditions: medium, [CTL] = 10 g/L, [boric acid] = 8 mM, [mannitol] = 16 mM, pH 7.4, T = 25 °C. The medium composition was: PBS 1X for the samples at [glucose] = 0; FBS-supplemented DMEM:PBS 90:10 v/v for samples containing glucose. The concentration of glucose in the media used in experiments with cells was 5.6 mM in the case of Low Glucose DMEM and 25 mM for High Glucose DMEM.

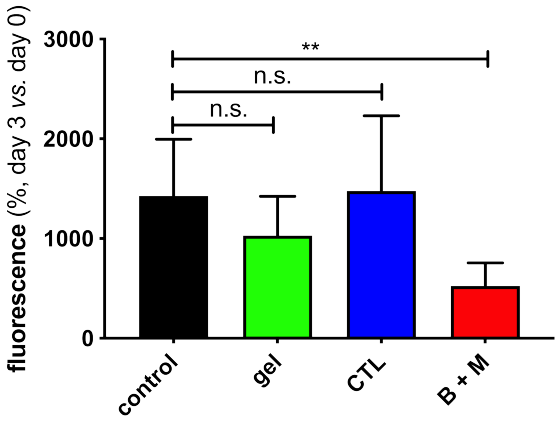

Figure S5. AlamarBlue Assay on NIH-3T3 (mouse fibroblasts) cells. Cells were treated with the sample-case CTL-based gel ([CTL] = 10 g/L, [B] = 8 mM, [M] = 16 mM, $R_{M/B}$ = 2) and its singular components. The composition of medium for all the analyzed samples is Low Glucose DMEM:PBS 45:55 v/v, pH 7.4. Data are means ± standard deviation (SD) of at least six measurements. One-way ANOVA followed by Dunnett *post-hoc* test was performed to compare all groups (n.s.: not significant; **: p value < 0.01).

REFERENCES

(1) Cross, M. M. *J. Colloid Sci.* **1965**, *20* (5), 417–437.

(2) Marsich, E.; Travan, A.; Feresini, M.; Lapasin, R.; Paoletti, S.; Donati, I. *Macromol. Chem. Phys.* **2013**, *214* (12), 1309–1320.