Electronic Supplementary Material (ESI) for Soft Matter.
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Formation and rupture of Ca^{2+} induced pectin biopolymer gels

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PART A:

ANALYSIS AND CALCULATIONS

If K_ξ is the individual elastic constant of a floc of size ξ, then the macroscopic elastic constant G' for a system of size L can be written as [22]

$$G' \sim \left[\frac{L}{\xi}\right]^{d-2} K\xi$$

where d is the dimension of the system.

For a 3-dimensional system, G' can be written as

$$G' \sim \left[\frac{L}{\xi}\right]^{d-2} K\xi \sim \left[\frac{L}{\xi}\right] K\xi \sim \left[\frac{K\xi}{\xi}\right]$$

For a macroscopic deformation of (ΔL), the deformation of an individual floc is

$$(\Delta L)_\xi \sim \left(\frac{\Delta L}{L}\right)\xi$$

The force on a floc is therefore

$$F_\xi = K\xi\,(\Delta L)_\xi = K\xi\left(\frac{\Delta L}{L}\right)\xi$$

When the force on a floc is above a critical constant value, the intra-floc links will break.

The limit of linearity γ_0 can be written as

$$\gamma_0 = \left(\frac{\Delta L}{L}\right) \sim (K\xi\xi)^{-1}$$

PART B:

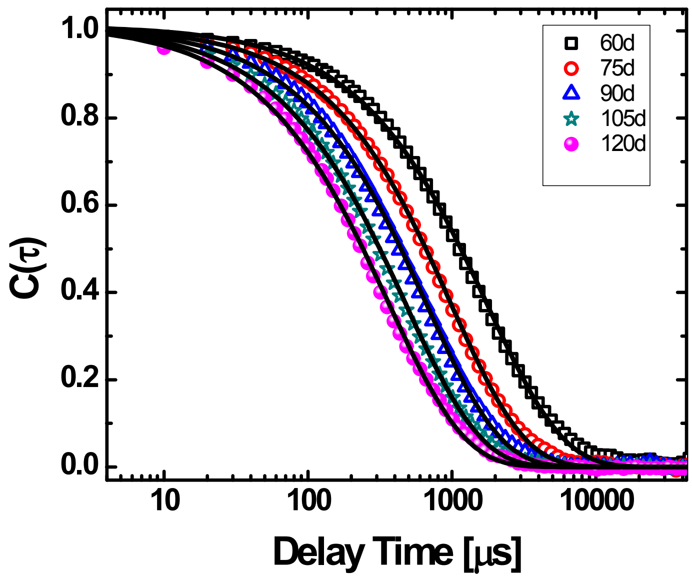

Figure S1: Plots of the normalized autocorrelation functions C(τ) *vs*. delay times τ for 2.5 g/L pectin solutions at 25° C containing 1 mM $CaCl_2$ for different scattering angles: 60°, 75°, 90°, 105° and 120°. The stretched exponential fits to the data are shown by solid black lines.

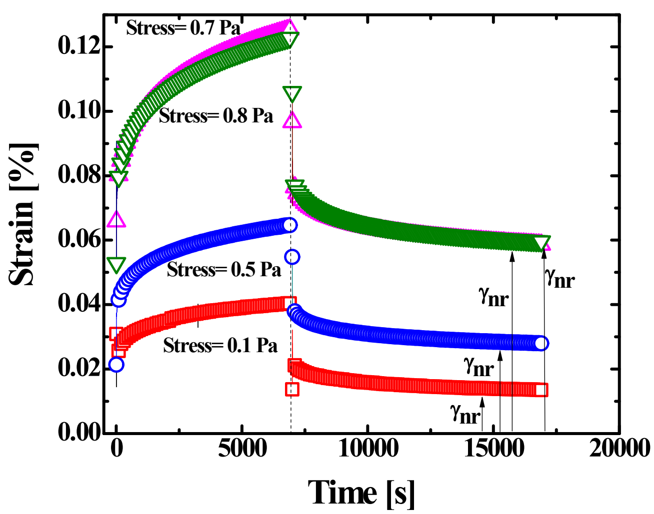

Figure S2: Plots of strain-evolutions during creep and recovery tests for 2.5 g/L pectin gels containing 6 mM $CaCl_2$ at different applied stresses: 0.1 Pa (squares), 0.5 Pa (circles), 0.7 Pa (down-triangles) and 0.8 Pa (up-triangles). The vertical dotted line denotes the time when the stress is set to zero.

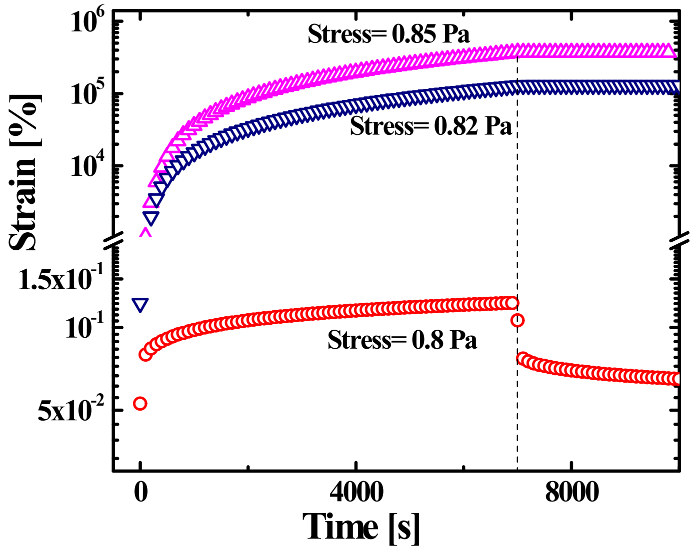

Figure S3: The critical stress $\sigma_{critical}$ is estimated by plotting the strain variation during creep for 2.5 g/L pectin gel samples containing 6 mM $CaCl_2$ due to application of different stresses: a) 0.8 Pa (red circles), b) 0.82 Pa (navy down-triangles) and c) 0.85 Pa (magenta up-triangles). This is followed by a recovery test where the stress is set to zero after 7200 seconds (shown by vertical dotted line). The data indicates that $\sigma_{critical} \approx 0.81$ Pa.

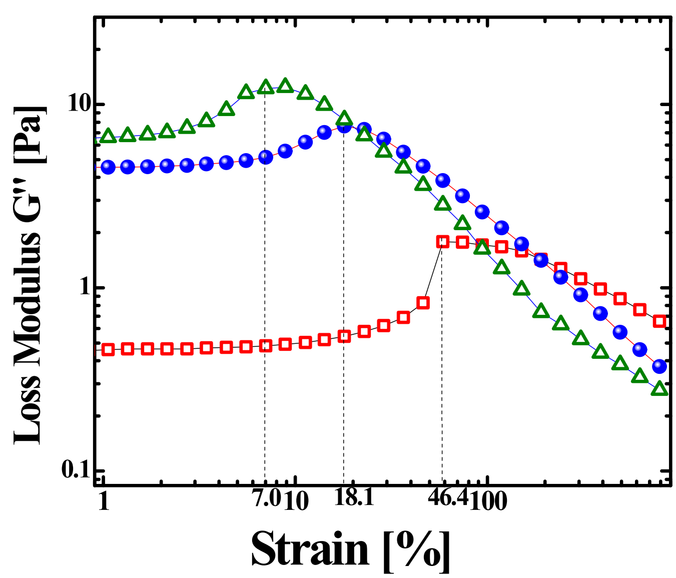

Figure S4: Plots of the loss modulus G" *vs.* strain amplitude for 2.5 g/L pectin solutions with $CaCl_2$ concentrations of 5mM (squares), 8mM (circles) and 10mM (triangles). The yield strains γ_{ys}, which are the strains corresponding to peaks in G", are shown by vertical dotted lines.

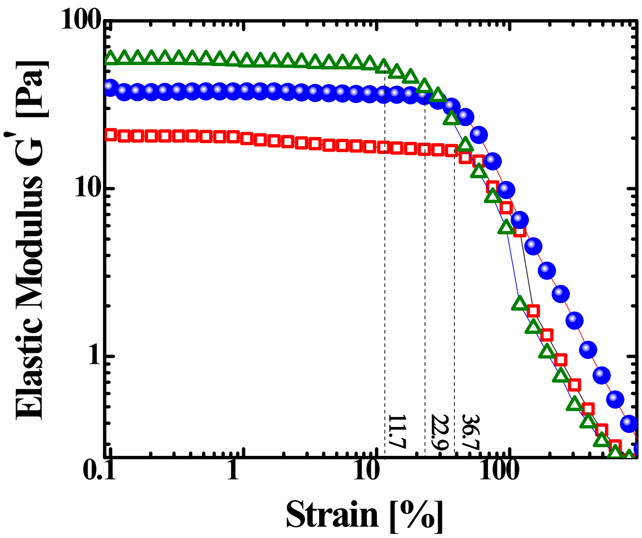

Figure S5: Plots of G' *vs*. strain amplitude for 5 g/L pectin solution with $CaCl_2$ concentrations: 6mM (squares), 8mM (circles) and 10mM (triangles). The start of non-linearity is shown by vertical dotted lines.

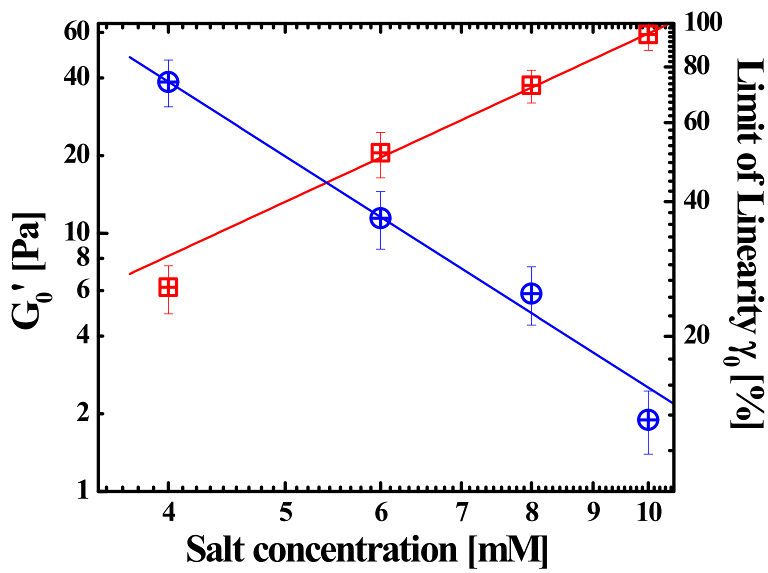

Figure S6: Plots of the elastic modulus G_0' in the linear rheological regime (squares) and the limits of linearity γ_0 (circles) *vs.* salt concentration for 5 g/L pectin solutions. The corresponding power law fits ($G_0' \sim C^K$ and $\gamma_0 \sim C^{-L}$; $K = 1.81$, L = 3.23) to the data are shown by solid lines.