

Supplemental Information

Stress-Independent Delay Time in Yielding of Dilute Colloidal Gels

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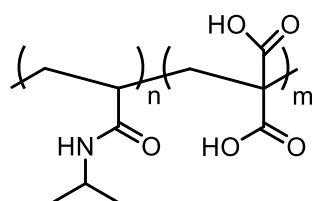


Fig. S1 Chemical structure of the copolymer of *N*-isopropylacrylamide and fumaric acid, poly(*N*-isopropylacrylamide-*co*-fumaric acid). The incorporated fumaric acid into microgels was previously reported to be 0.37 mmol/g.¹

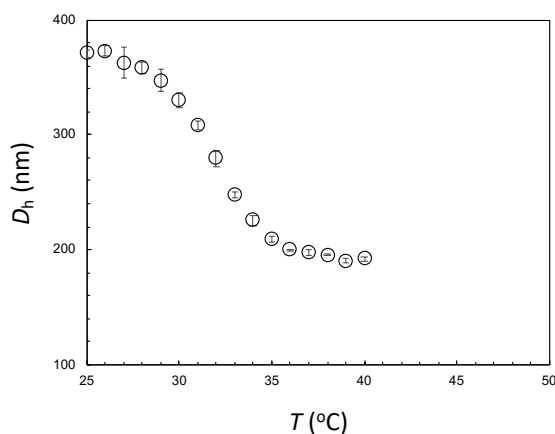


Fig. S2 Temperature (*T*) dependence of hydrodynamic diameter (*D_h*) of the Poly(NIPAM-*co*-FAc) microgel.

The hydrodynamic diameter (D_h) of the isolated PNIPAM-*co*-FAc microgel was measured using a sufficiently dilute suspension of $c = 5 \times 10^{-5}$ g/mL by dynamic light scattering (Malvern Instruments; zetasizer NanoS, Malvern, UK) at pH = 11 and $I = 100$ mM. These conditions of pH and I are identical with those in the rheological tests for the colloidal gels.

The correlation function of the scattering intensity, $g_2(\tau)$, is given by the following eq S1, where β is the extrapolated value at $\tau = 0$ and $g_1(\tau)$ is the correlation function of the scattering electric field.

$$g_2(\tau) - 1 = \beta |g_1(\tau)|^2 \quad (\text{S1})$$

Here, $g_1(\tau)$ is provided by the following eq S2,

$$g_1(\tau) = \exp(-Dq^2t) \quad (\text{S2})$$

where D is the diffusion coefficient and q is the scattering vector, $(4\pi/\lambda)\sin(\theta/2)$ ($\lambda = 633$ nm, $\theta = 173^\circ$).

The hydrodynamic diameter, D_h , was calculated using the Stokes–Einstein equation, eq S3,

$$D_h = kT/3\pi\eta D \quad (\text{S3})$$

where k is the Boltzmann constant, T is the absolute temperature, and η is the viscosity of water. The D_h was calculated from the cumulant analysis of the correlation function, where diffusion coefficients were evaluated using the Stokes–Einstein equation (Zetasizer software v6.12) based on the average of three cycles of measurements.

The T -dependence of D_h was evaluated in the range of 25–40 °C. The measurements at $T > 40$ °C were prevented by the aggregation of the microgels. However, the constancy of D_h (approximately 190 nm) at 35–40 °C ensures that the microgel at $T > 35$ °C is in the fully shrunken state, allowing us to assume safely the constancy of D_h and particle volume fraction at $T > 35$ °C.

Reference

- 1) Nishizawa, Y.; Inui, T.; Namioka, R.; Uchihashi, T.; Watanabe, T.; Suzuki, D. Clarification of surface deswelling of thermo-responsive microgels by electrophoresis. *Langmuir*, **2022**, *38*(51), 16084–16093.