

Supporting Information

Behavior of Spherical Poly(2-acrylamido-2-methylpropanesulfonate) Polyelectrolyte Brushes on Silica Nanoparticles up to Extreme Salinity with Weak Divalent Cation Binding at Ambient and High Temperature

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Table S1. Hydrodynamic diameter (d_H) and polydispersity index (PDI) for the core APTES-coated SiO₂ nanoparticles

APTES-coated SiO ₂	Hydrodynamic Diameter (d_H)	PDI
Measurement 1	36.8	0.186
Measurement 2	36.7	0.103
Measurement 3	37.6	0.076
Measurement 4	37.1	0.118

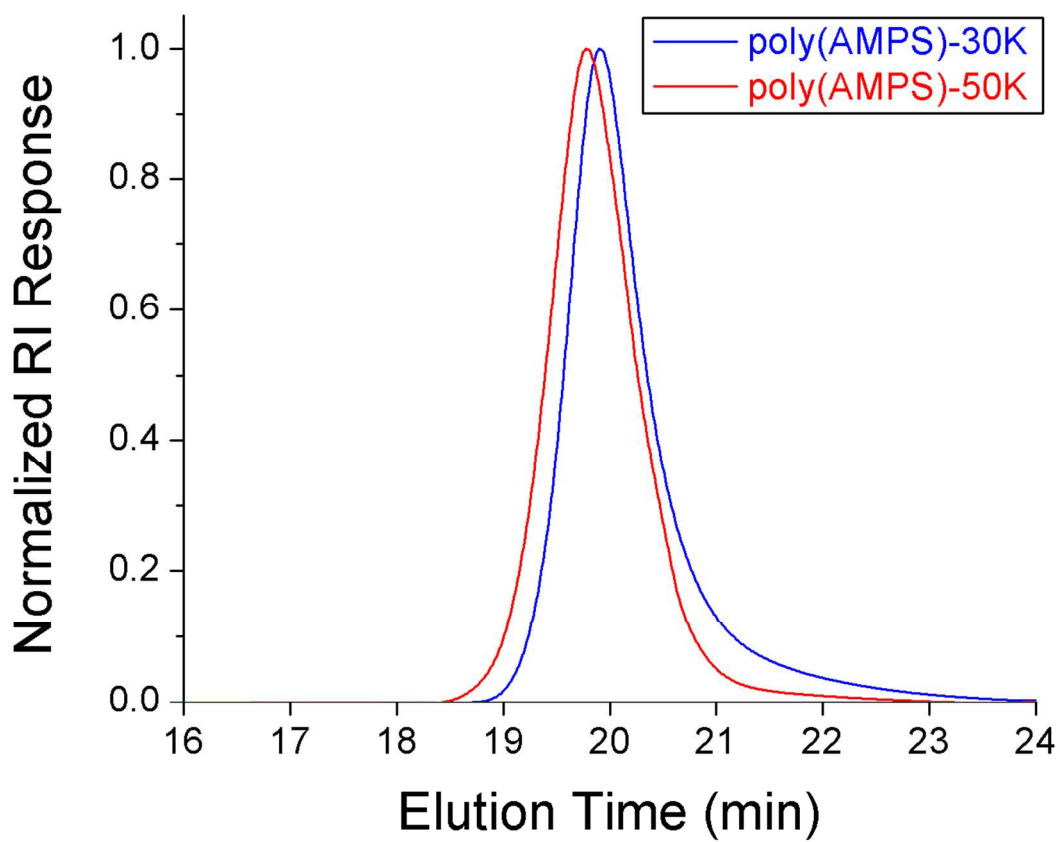


Figure S1. GPC traces for poly(AMPS)-30K (blue) and poly(AMPS)-50K (red) in 3:1 water/acetonitrile with 0.1M NaOAc

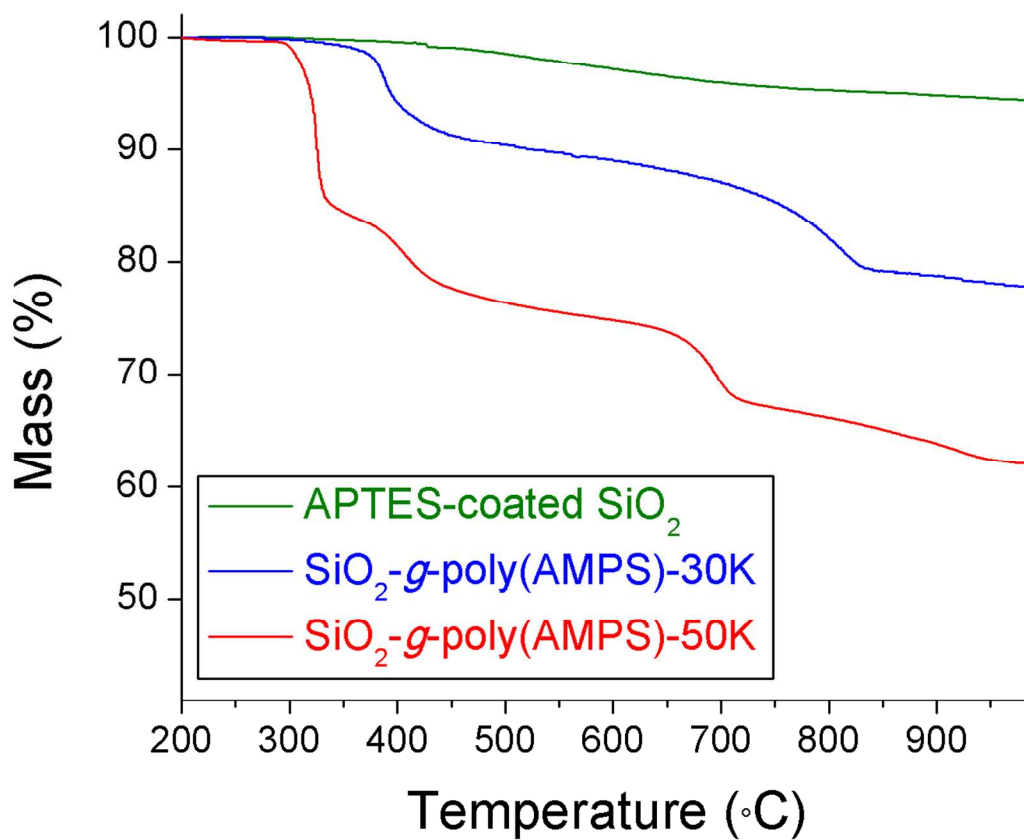


Figure S2. Thermogravimetric analysis for the dried APTES-coated SiO₂ nanoparticles (core, green), and the particles grafted with poly(AMPS)-30K (SiO₂-g-poly(AMPS)-30K, blue) and poly(AMPS)-50K (SiO₂-g-poly(AMPS)-50K, red)

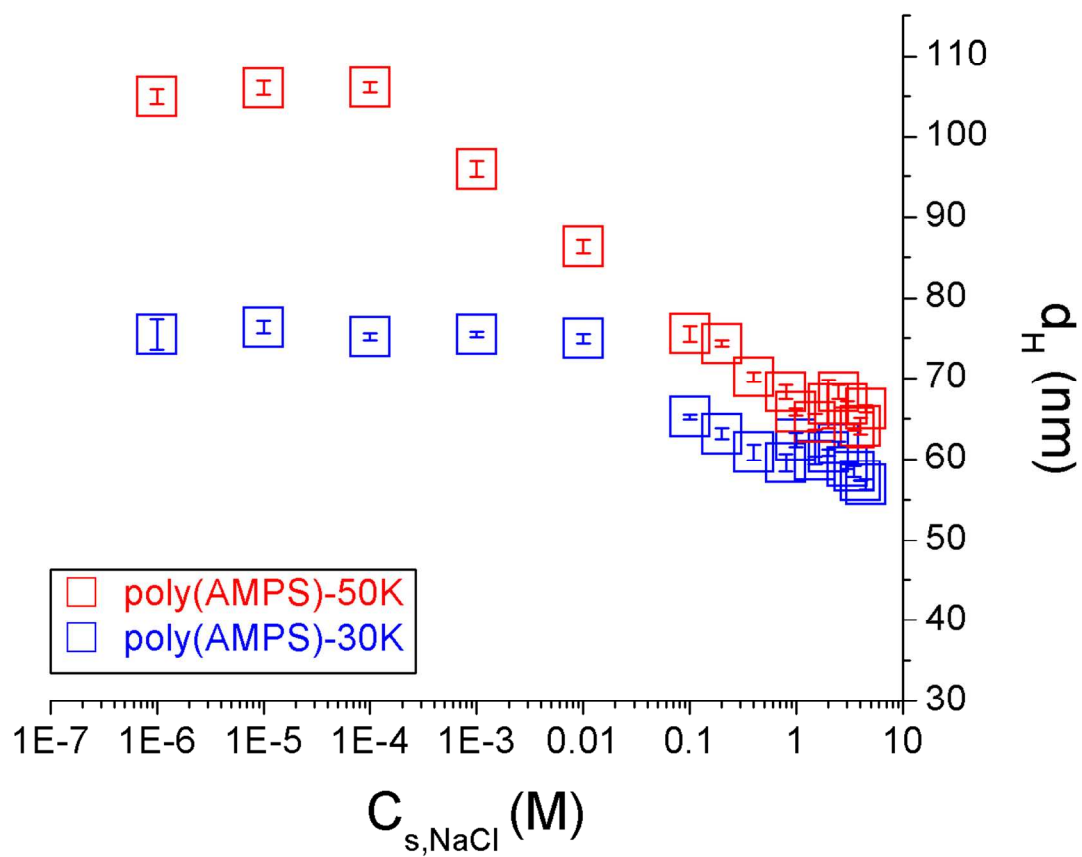


Figure S3. Linear representation of hydrodynamic diameter d_H (in nm) for SiO₂-g-poly(AMPS)-30K (blue) and SiO₂-g-poly(AMPS)-50K (red), represented as a function of the salt concentration C_s (in M) in NaCl solutions. All data were obtained at ambient temperature.

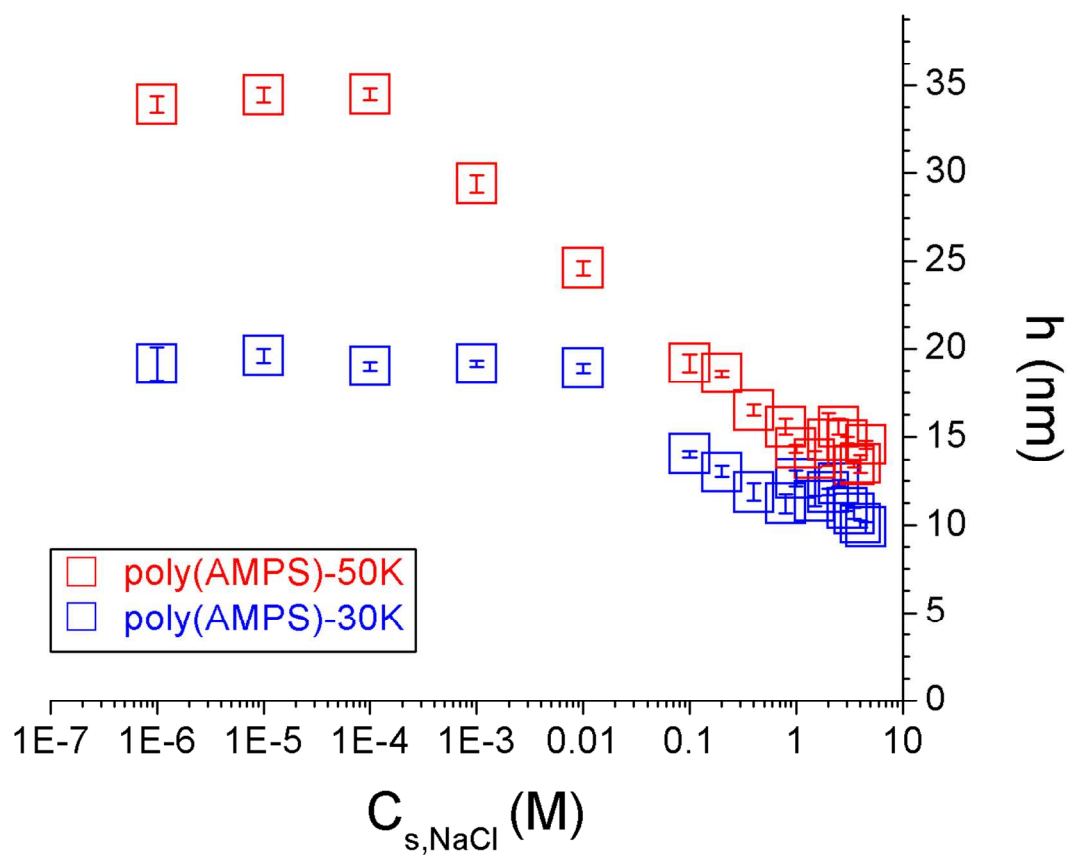


Figure S4. Linear representation of brush thickness h (in nm) for poly(AMPS)-30K (blue) and poly(AMPS)-50K (red) tethered to the silica colloids, represented as a function of the salt concentration C_s (in M) in NaCl solutions (log vs. linear scale). The data were calculated from the hydrodynamic diameter d_H (Figure S3) for SiO₂-g-poly(AMPS) measured by DLS. All data were obtained at ambient temperature.

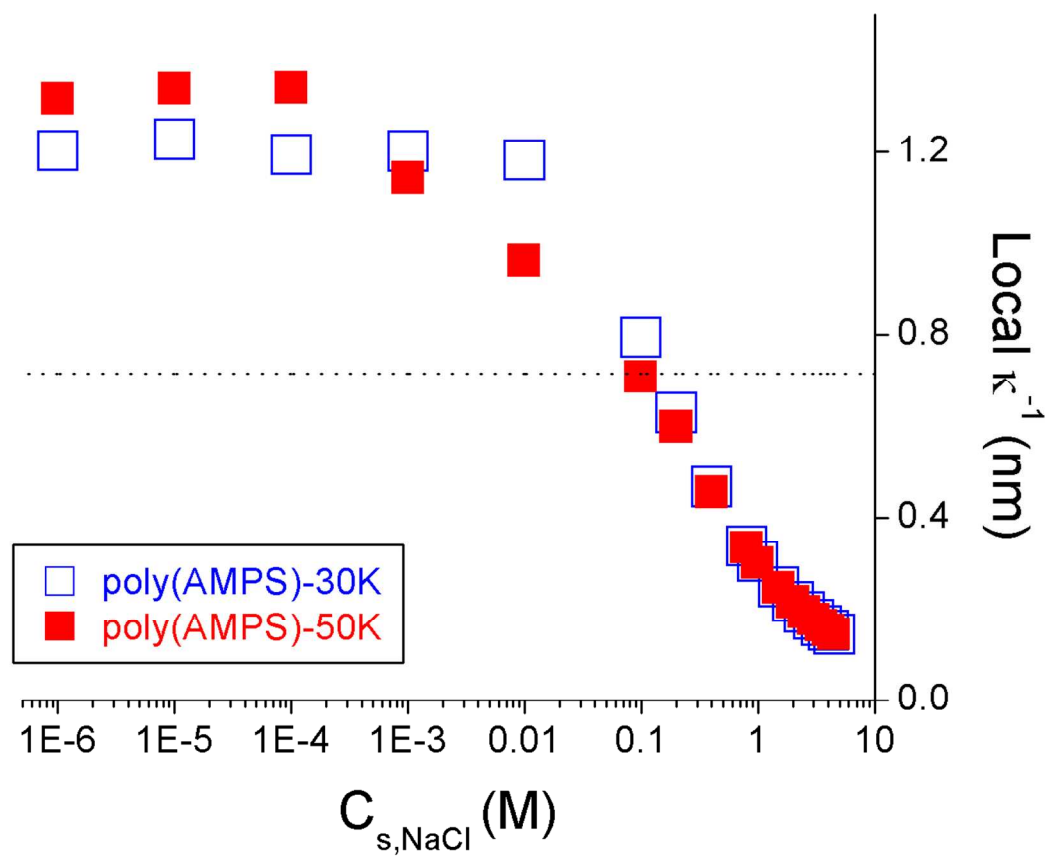


Figure S5. The local Debye screening length κ^{-1} (in nm) represented as a function of solution salt concentration C_s (in M). The dotted line indicates the Bjerrum length $l_B=0.714\text{nm}$ at 25°C

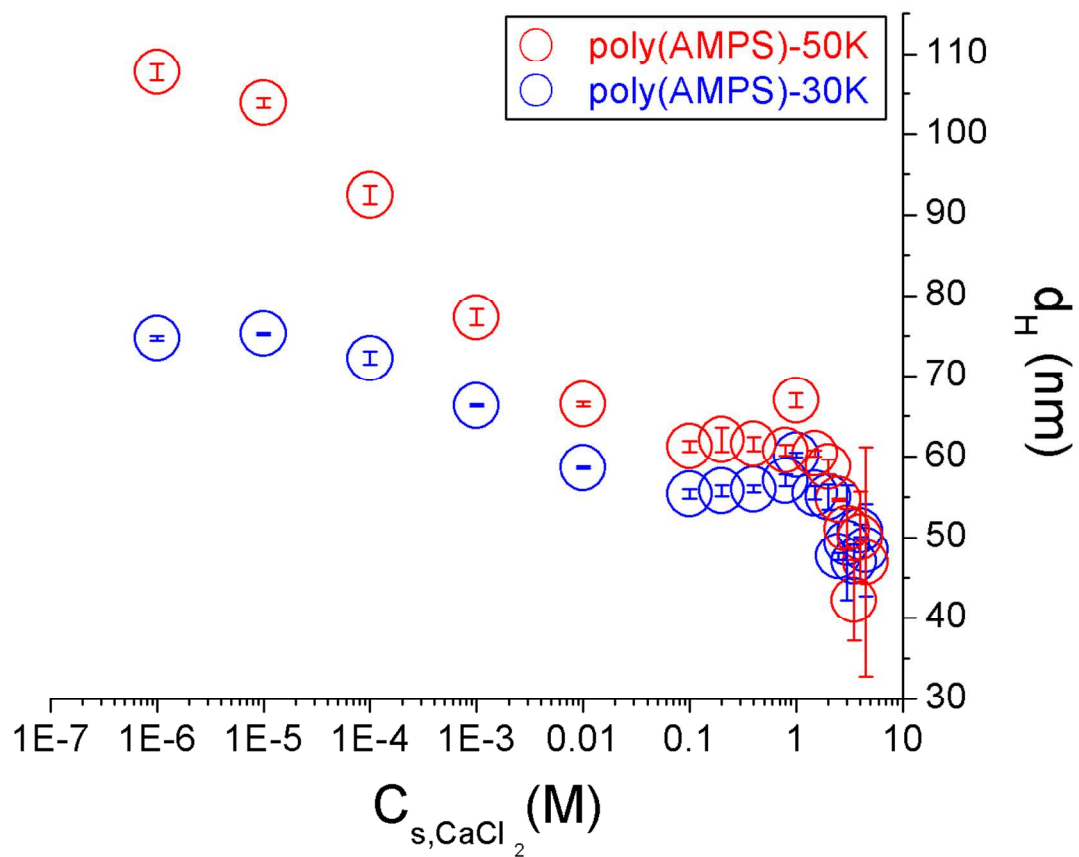


Figure S6. Linear representation of the hydrodynamic diameter d_H (in nm) for SiO_2 -g-poly(AMPS)-30K (blue) and SiO_2 -g-poly(AMPS)-50K (red), represented as a function of the salt concentration C_s (in M) in CaCl_2 solutions. All data were obtained at ambient temperature.

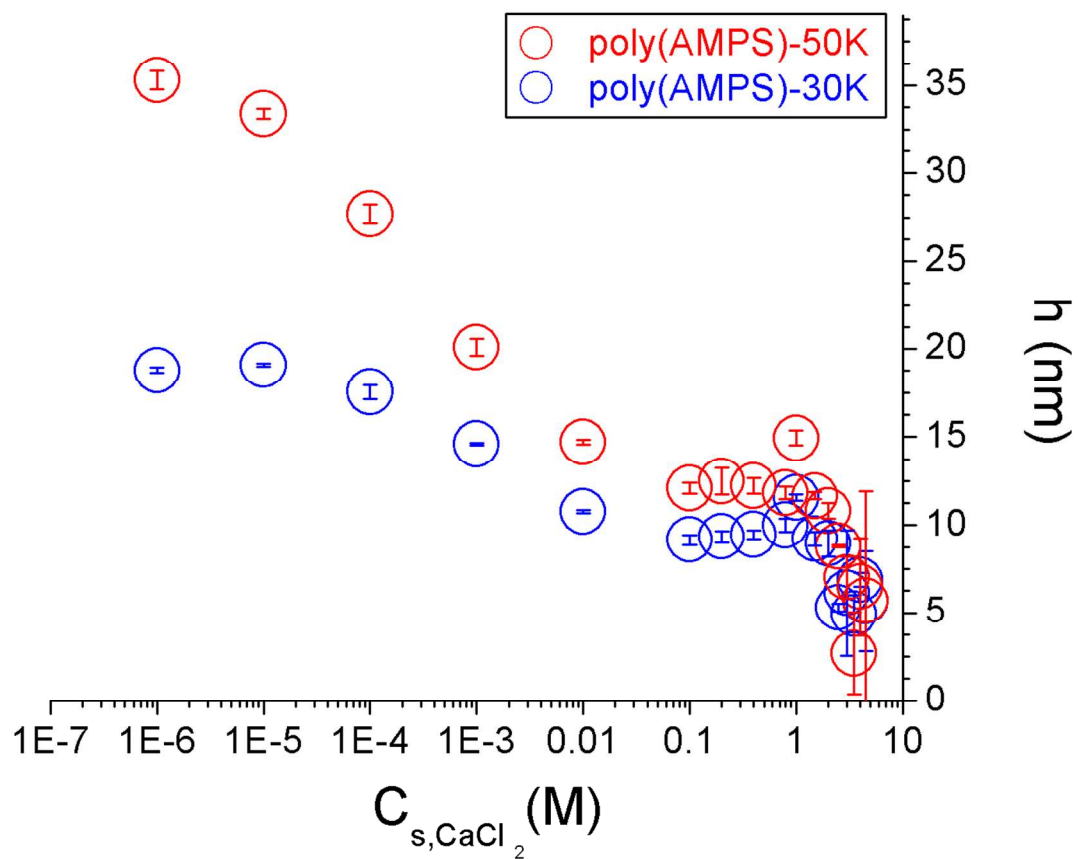


Figure S7. Linear representation of the brush thickness h (in nm) for poly(AMPS)-30K (blue) and poly(AMPS)-50K (red) tethered to the silica colloids, represented as a function of the salt concentration C_s (in M) in CaCl_2 solutions (log vs. linear scale). The data were calculated from the hydrodynamic diameter d_H (Figure S6) for SiO_2 -g-poly(AMPS) measured by DLS. All data were obtained at ambient temperature.

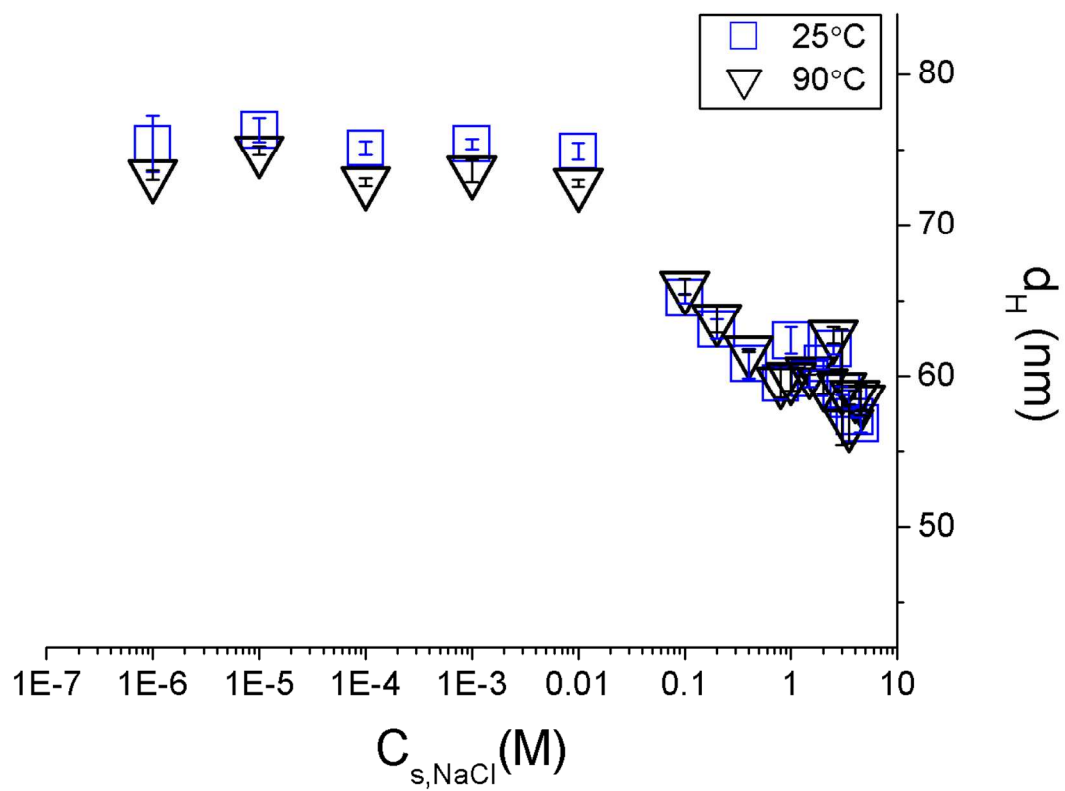


Figure S8. Linear representation of the hydrodynamic diameter d_H (in nm) for SiO_2 -g-poly(AMPS)-30K in NaCl solutions at ambient temperature (square) and 90°C (reverse triangle).

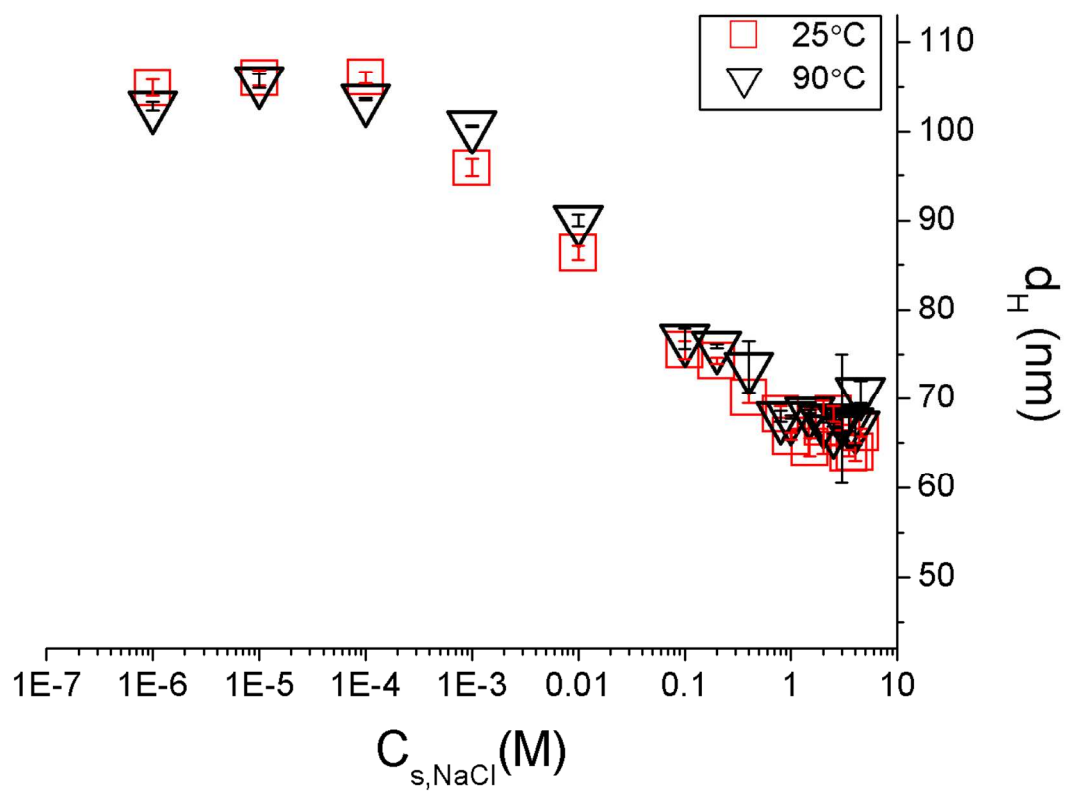


Figure S9. Linear representation of the hydrodynamic diameter d_H (in nm) for SiO₂-g-poly(AMPS)-50K in NaCl solutions at ambient temperature (square) and 90°C (reverse triangle).

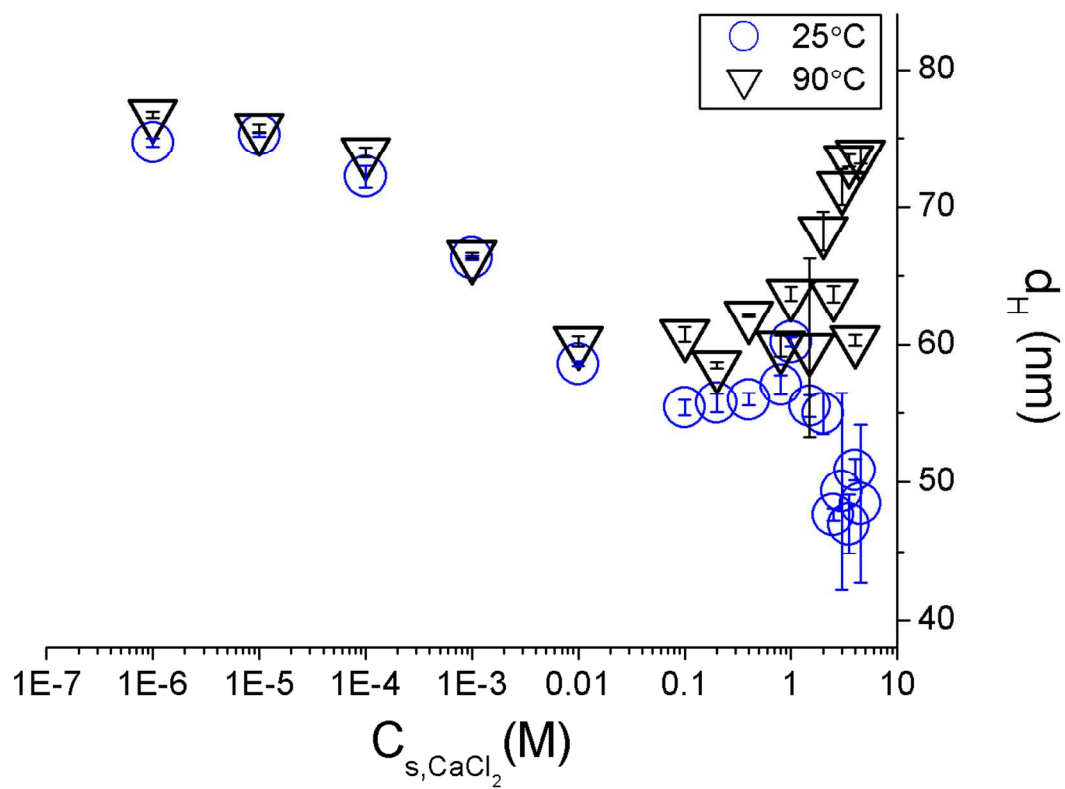


Figure S10. Linear representation of the hydrodynamic diameter d_H (in nm) for SiO_2 -g-poly(AMPS)-30K in CaCl_2 solutions at ambient temperature (circle) and 90°C (reverse triangle).

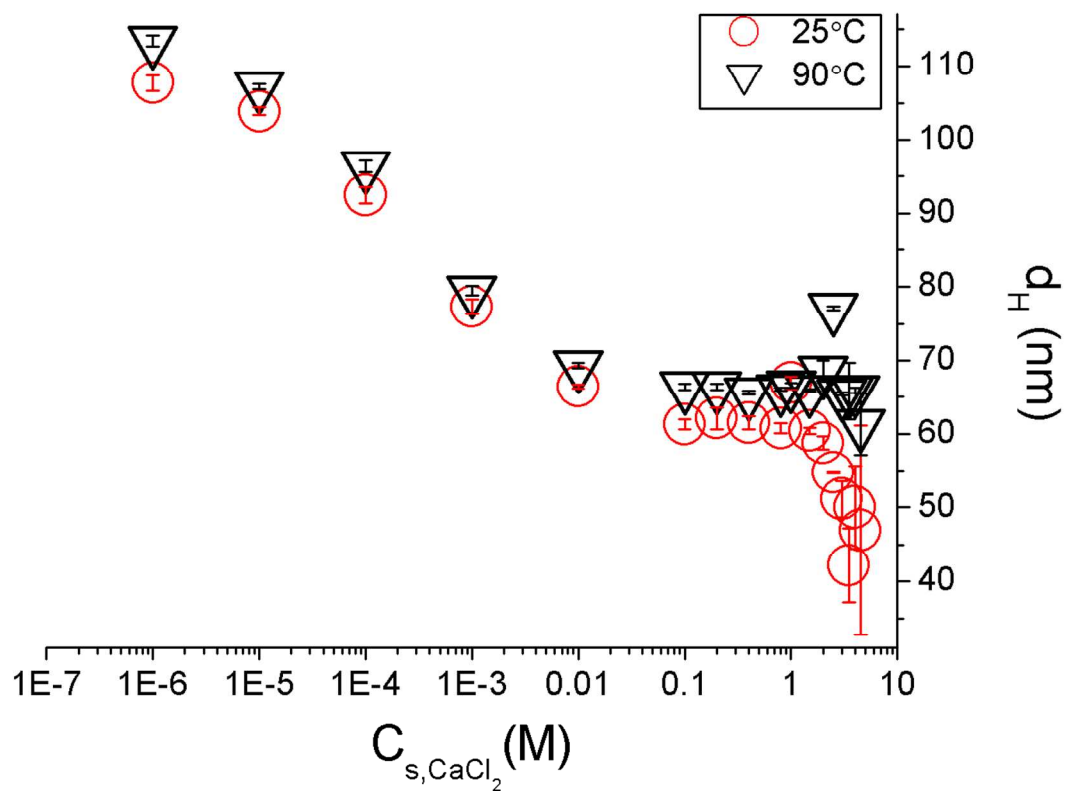


Figure S11. Linear representation of the hydrodynamic diameter d_H (in nm) for SiO_2 -g-poly(AMPS)-50K in CaCl_2 solutions at ambient temperature (circle) and 90°C (reverse triangle).

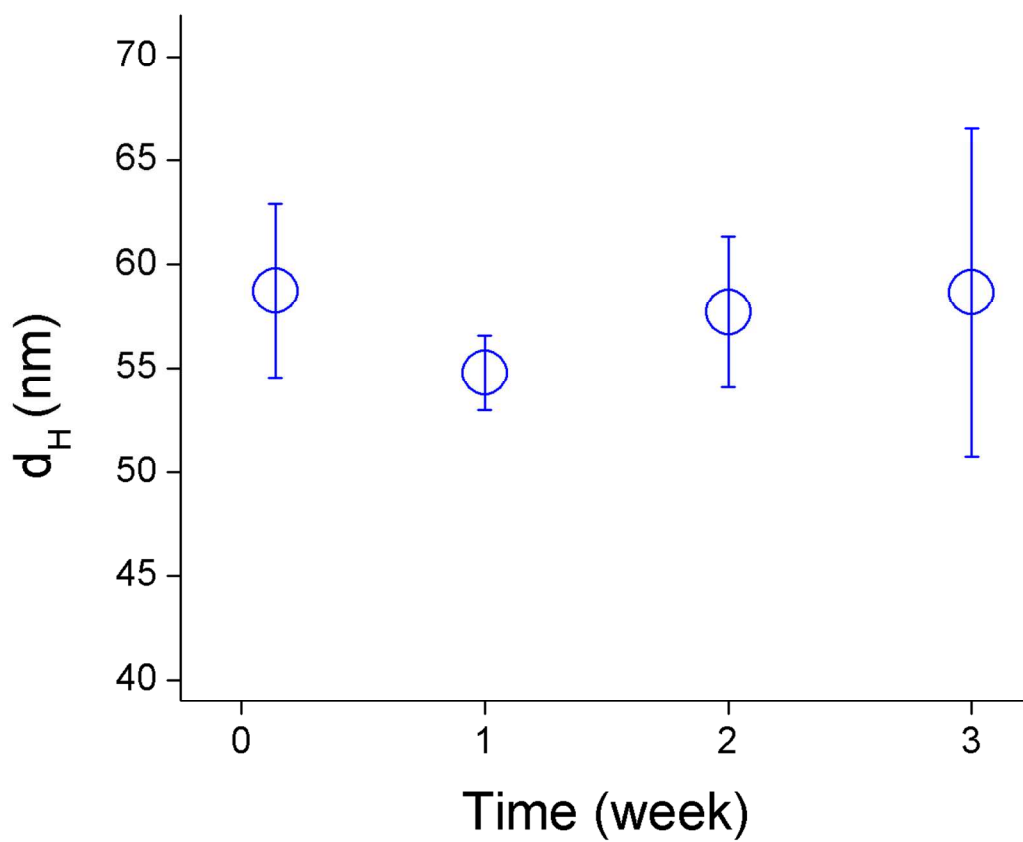


Figure S12. Long term colloidal stability for SiO₂-g-poly(AMPS)-30K in a CaCl₂ solution at C_s=2M at ambient temperature

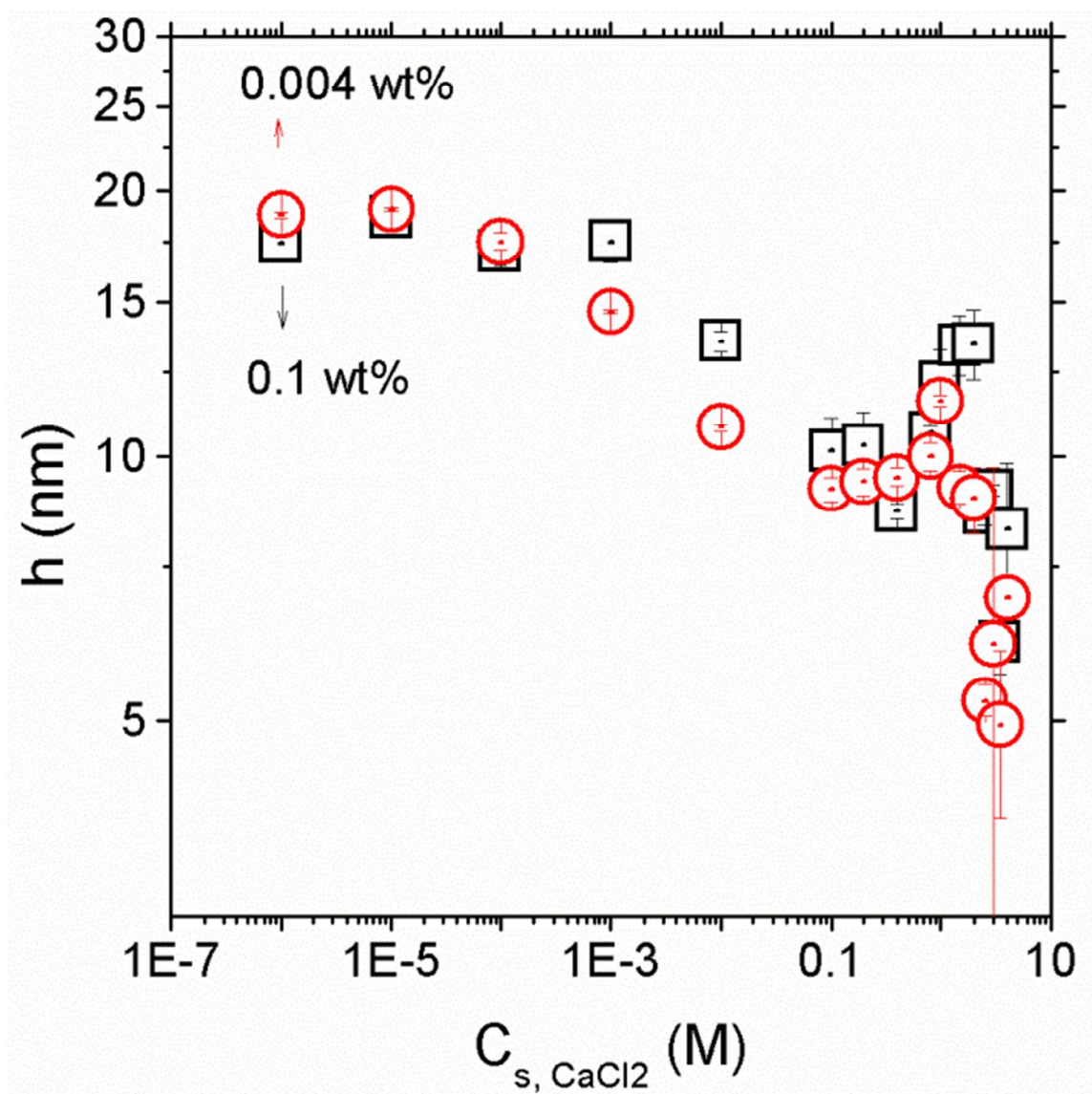


Figure S13. Brush thickness h (in nm) for poly(AMPS)-30K tethered to silica colloids as a function of salt concentration C_s (in M) of CaCl_2 solutions at a concentration of 0.004 wt.% (red circle) and at 0.1 wt.%, 25 times higher (black square) at ambient temperature.

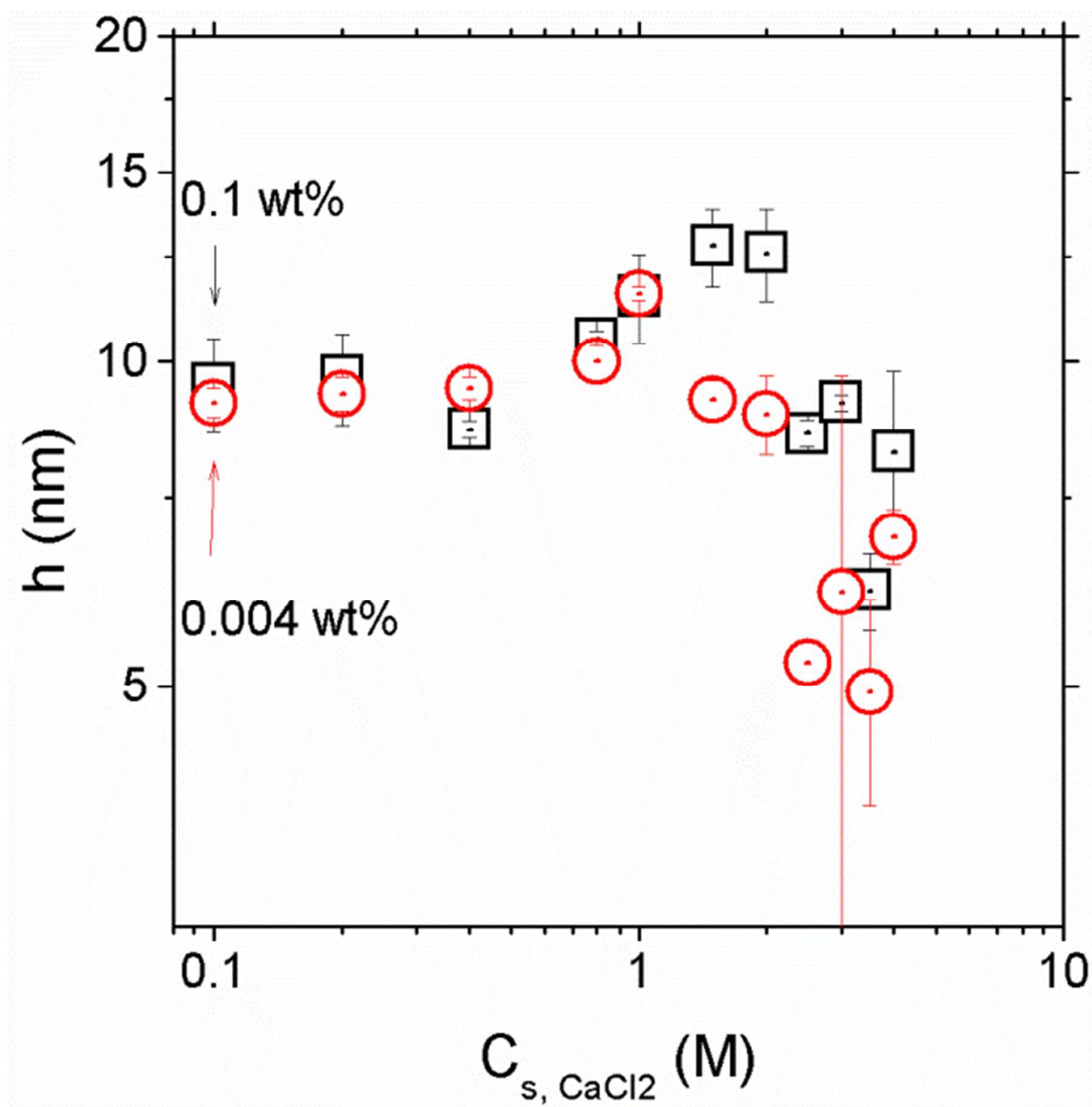


Figure S14. Brush thickness h (in nm) for poly(AMPS)-30K tethered to silica colloids as a function of salt concentration C_s (in M) of CaCl_2 solutions at a concentration of 0.004 wt.% (red circle) and at 0.1 wt.%, 25 times higher (black square) at ambient temperature in the high C_s range ($\geq 0.1\text{M}$).

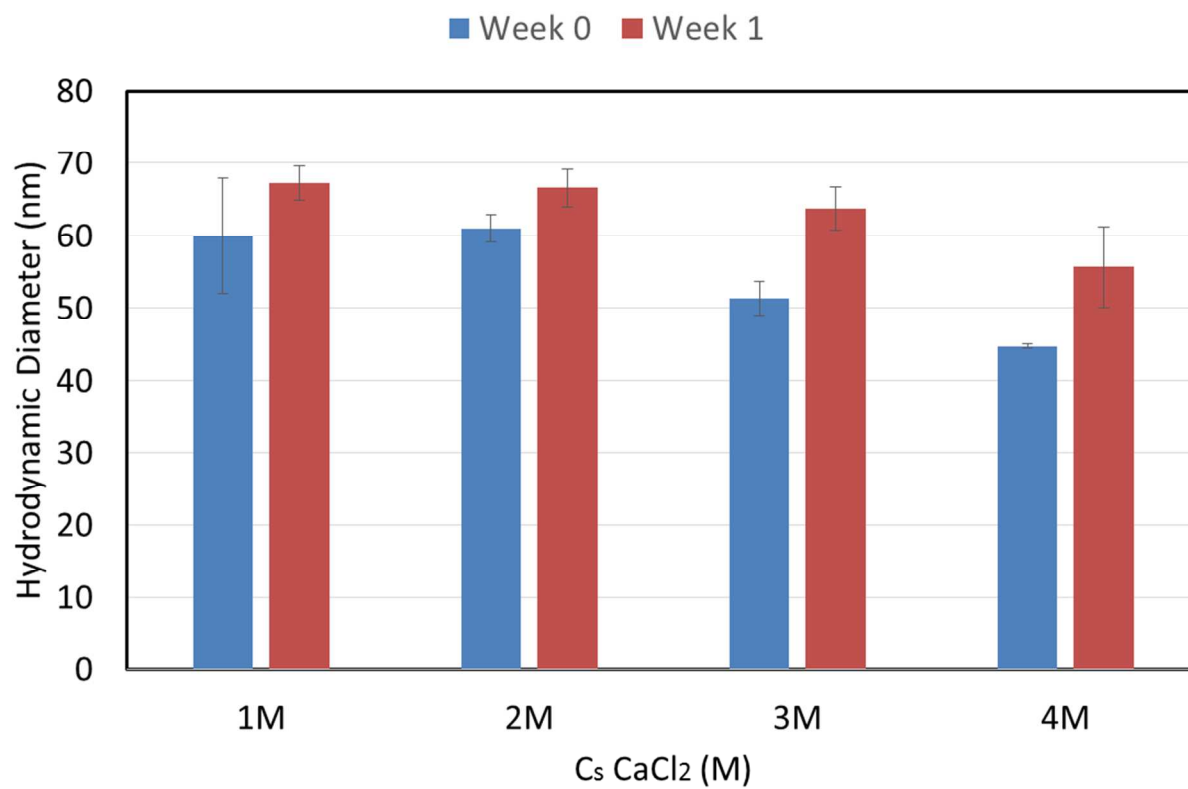


Figure S15. Hydrodynamic diameter of poly(AMPS)-30K tethered silica colloids at CaCl₂ concentrations of 1 to 4M over 1 week of observation at 0.1 wt.% particle concentration.