Supporting Information

Chondroitin sulfate deposited on the foxtail millet prolamin/caseinate nanoparticles to improve its physicochemical properties and enhance cancer therapeutic effect

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Abstract: Curcumin (Cur) loaded chondroitin sulfate (CS)−sodium caseinate (NaCas) stabilized foxtail millet prolamin (FP) composite nanoparticles (NPs) was fabricated in one-pot process in this study. FP was capable of self-assembly through liquid antisolvent precipitation under neutral and alkaline conditions (pH 7.0–11.0). On this condition, the microstructure of hydrophobic FP core, amphiphilic NaCas and hydrophilic CS shells were fabricated readily with a one-pot method. With the optimal FP/NaCas/CS weight ratio of 3:2:4, the FP–NaCas–CS NPs shared globular microstructures at about 145 nm, hydrophobic interactions, electrostatic forces, and hydrogen bonds were the main driven forces for the formation and maintenance of the stable FP–NaCas–CS NPs. CS coating enhanced the pH stability but reduced ionic strength stability. The formed NPs were stable over a wide pH value from 2.0 to 8.0

and elevated salt concentrations from 0 to 3 M NaCl. FP–NaCas–CS NPs exhibited higher Cur encapsulation efficiency (93.4%) and re-dispersion. Moreover, CS coating enhanced the selective accumulation in CD44-overexpressing HepG2 cells, resulting in higher inhibition of tumor growth compared to free Cur and FP–NaCas NPs encapsulated Cur. As for comparison, the encapsulated Cur exhibited reduced cytotoxicity on normal liver cells L-O2. This preclinical study suggested that FP–NaCas–CS NPs could be very beneficial in terms of encapsulating hydrophobic drugs, improving the effectiveness of cancer therapies and reducing side effects on normal tissues.

Keywords: Curcumin, chondroitin sulfate, Sodium caseinate, Prolamin, Nanoparticles, CD44 receptor.

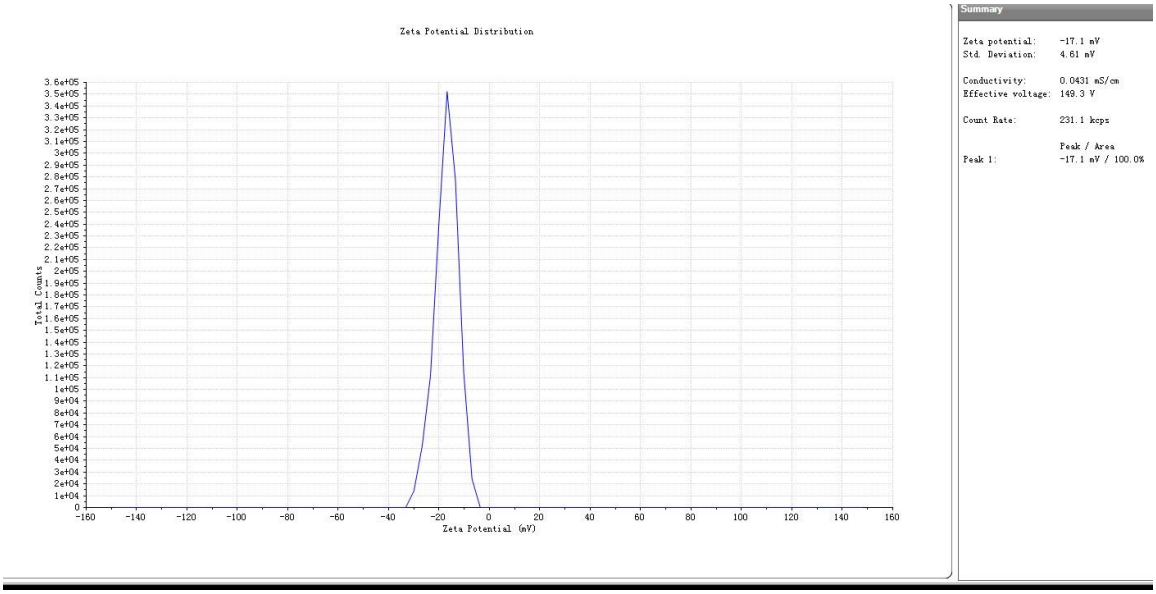

Fig. S1. Representive electrical charge graph of bare FP nanoparticle with water of pH 7 as antisolvent.

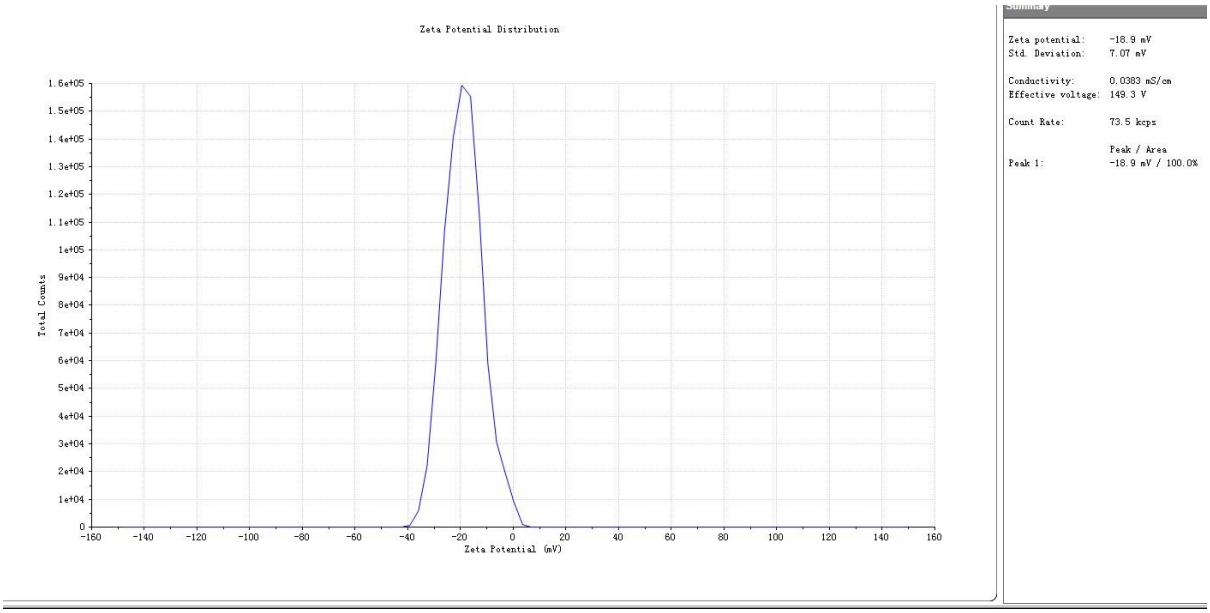

Fig. S2. Representive electrical charge graph of bare FP nanoparticle with water of pH 8 as antisolvent.

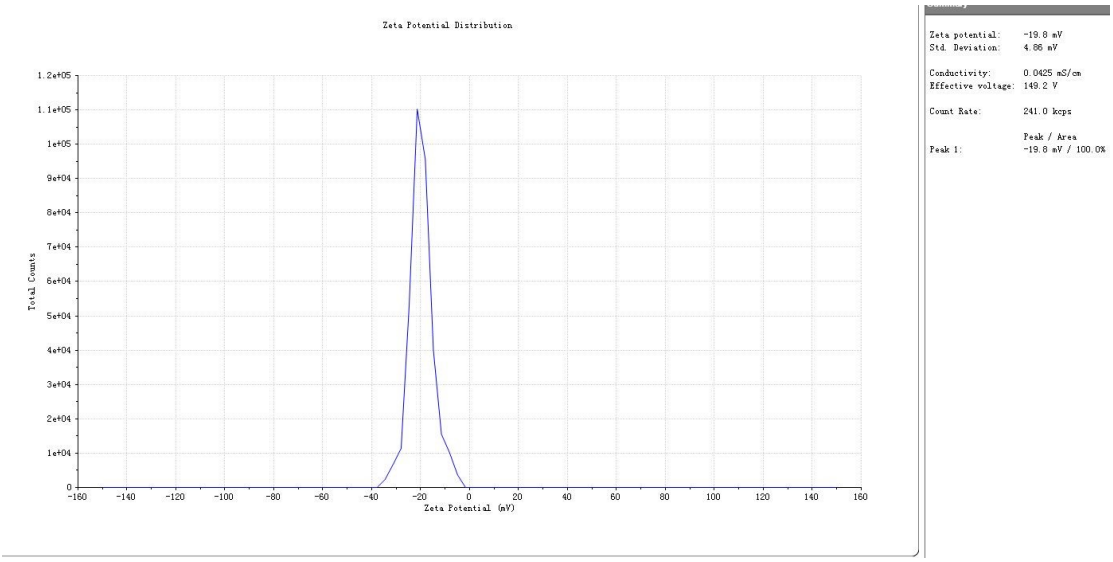

Fig. S3. Representive electrical charge graph of bare FP nanoparticle with water of pH 9 as antisolvent.

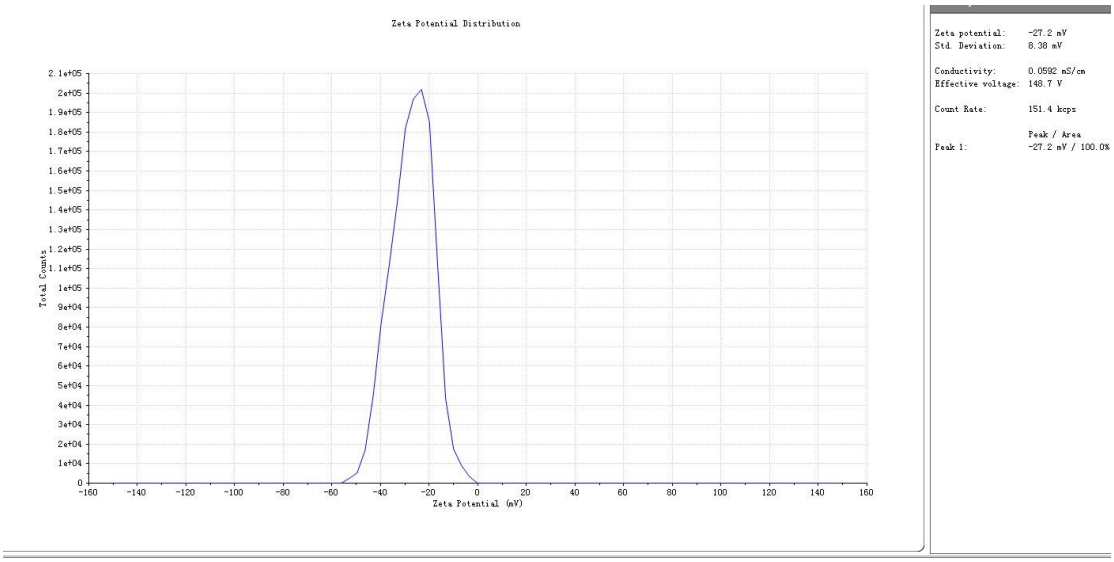

Fig. S4. Representive electrical charge graph of bare FP nanoparticle with water of pH 10 as antisolvent.

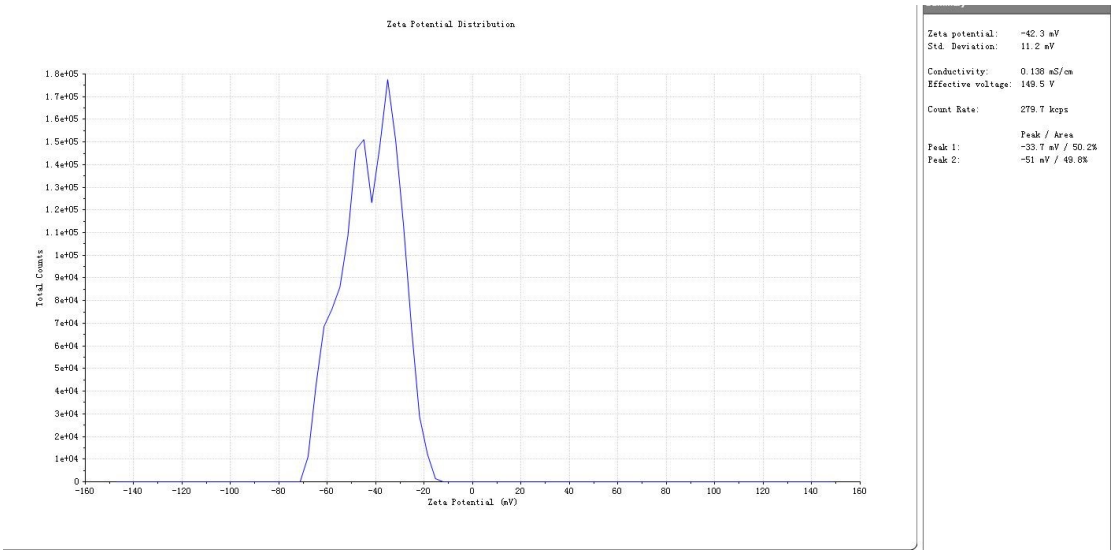

Fig. S5. Representive electrical charge graph of bare FP nanoparticle with water of pH 11 as antisolvent.

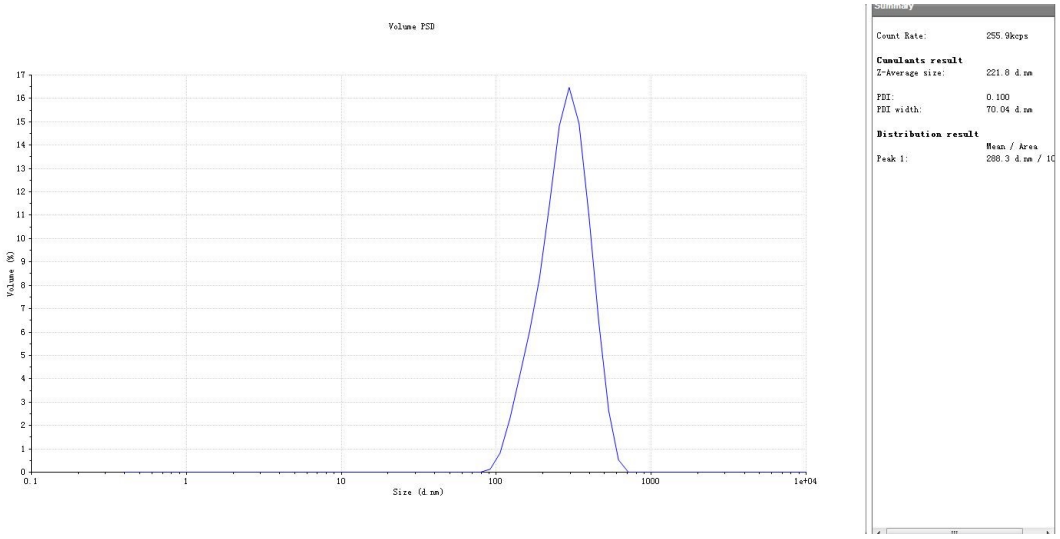

Fig. S6. Representive volume-averaged particle size distribution graph of bare FP nanaoparticles with water of pH 7 as antisolvent.

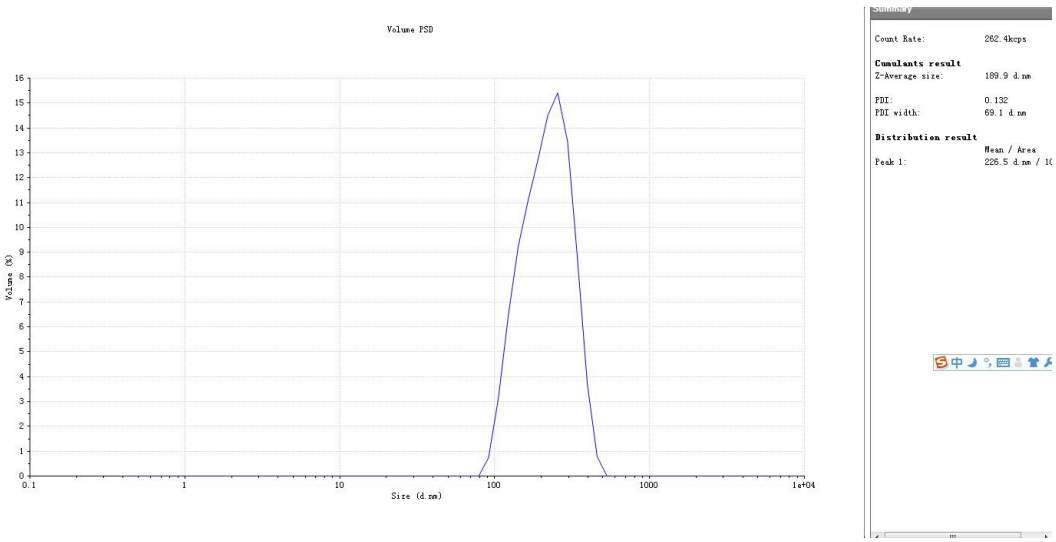

Fig. S7. Representive volume-averaged particle size distribution graph of bare FP nanaoparticles with water of pH 8 as antisolvent.

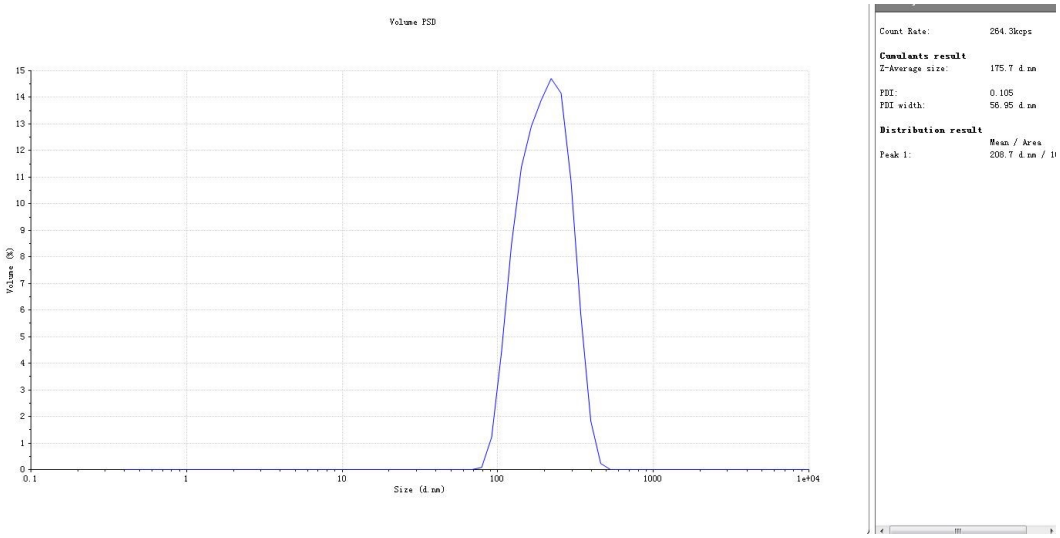

Fig. S8. Representive volume-averaged particle size distribution graph of bare FP nanaoparticles with water of pH 9 as antisolvent.

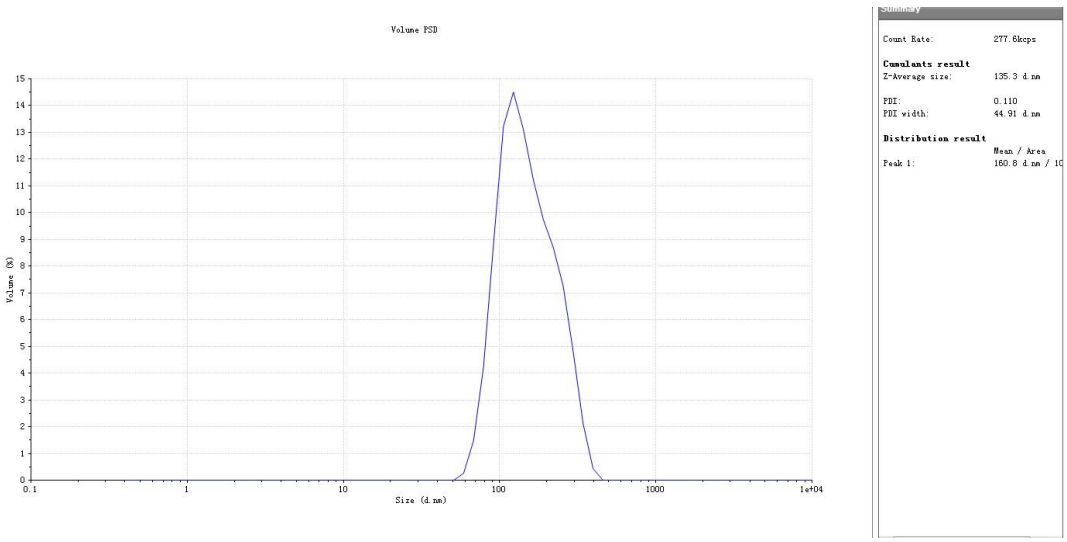

Fig. S9. Representive volume-averaged particle size distribution graph of bare FP nanaoparticles with water of pH 10 as antisolvent.

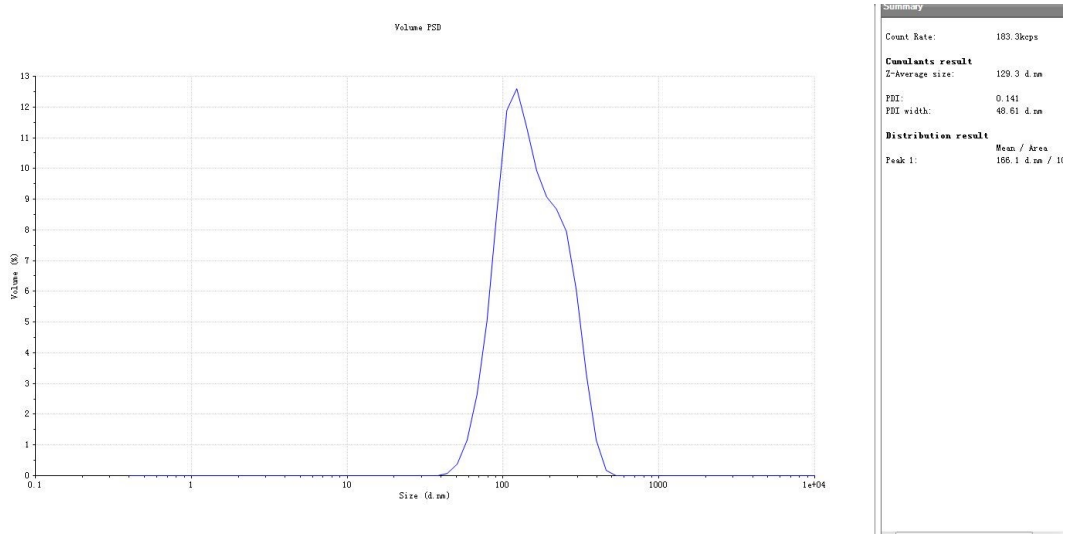

Fig. S10. Representive volume-averaged particle size distribution graph of bare FP nanaoparticles with water of pH 11 as antisolvent.

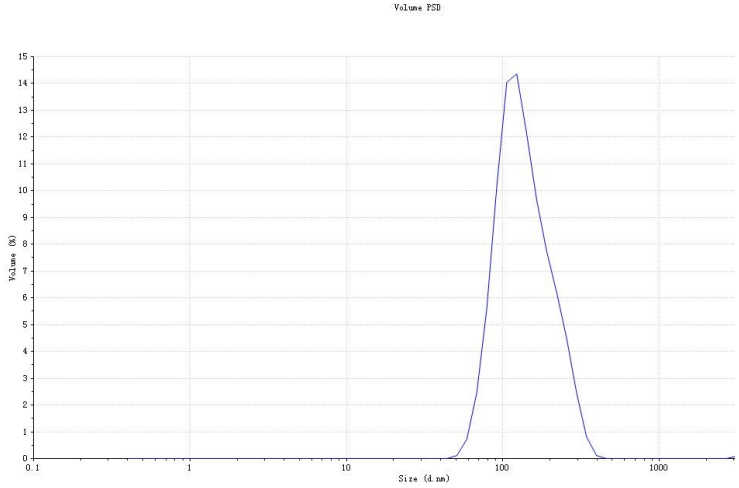

Fig. S11. Effect of 0.5 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

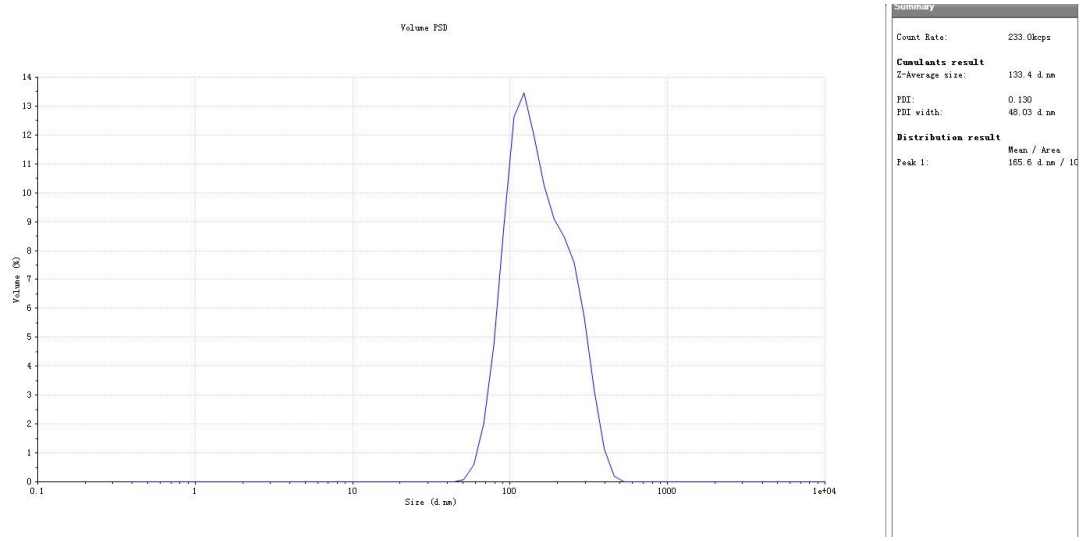

Fig. S12. Effect of 2 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

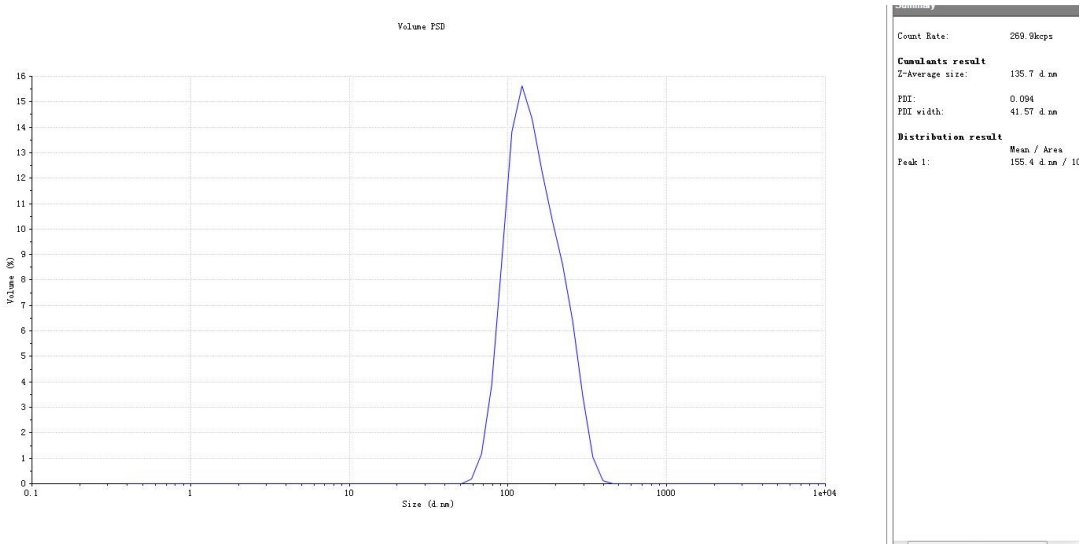

Fig. S13. Effect of 3 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

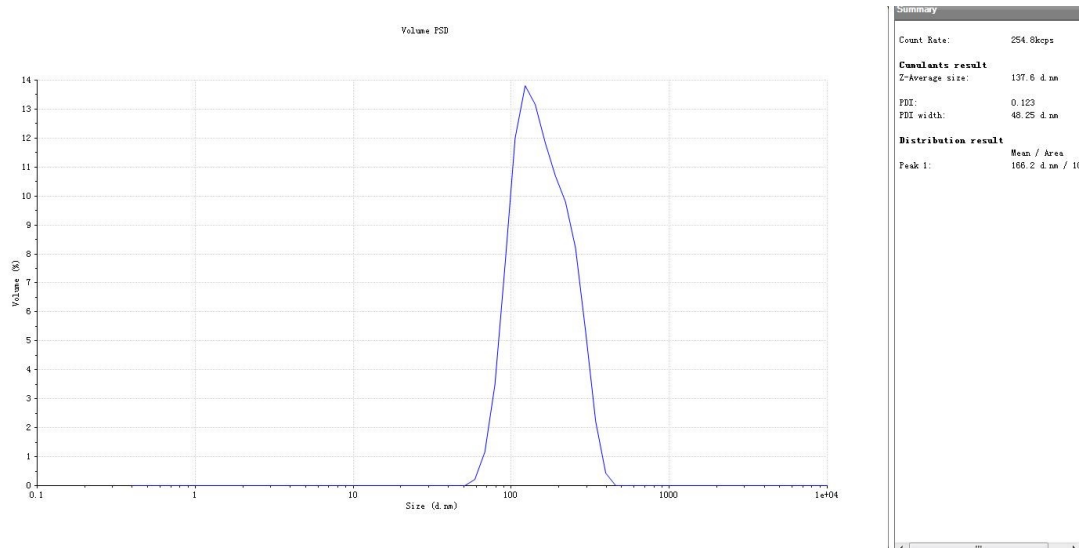

Fig. S14. Effect of 3.5 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

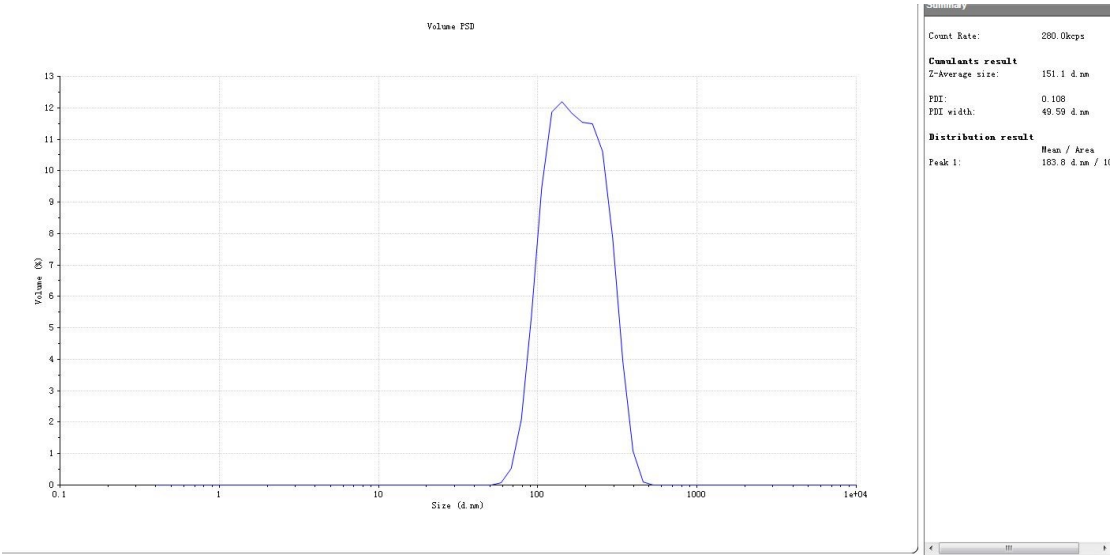

Fig. S15. Effect of 5 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

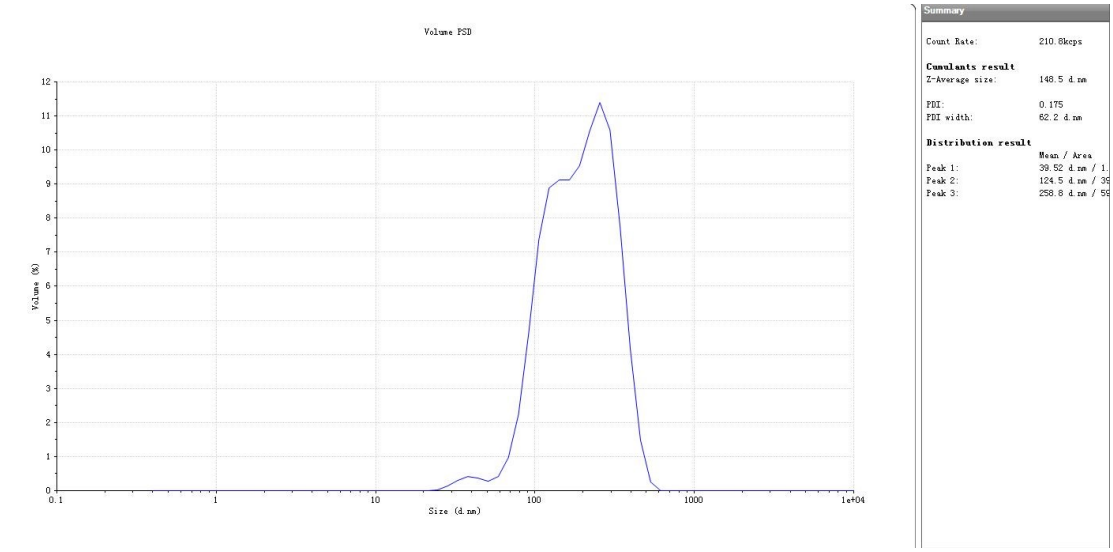

Fig. S16. Effect of 6 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

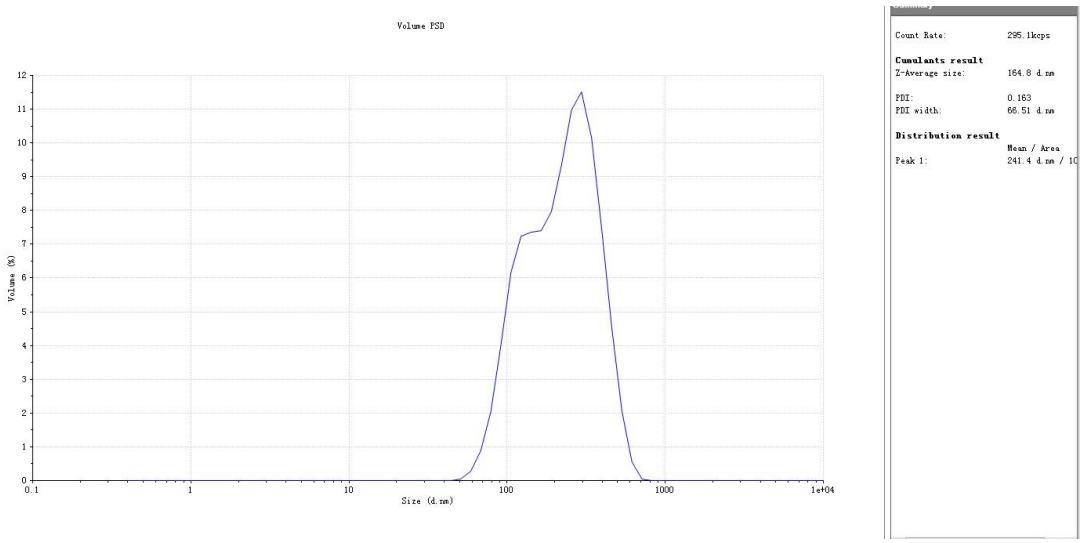

Fig. S17. Effect of 7 mg/mL of NaCas on the volume-averaged particle size distribution of FP/NaCas colloidal dispersion.

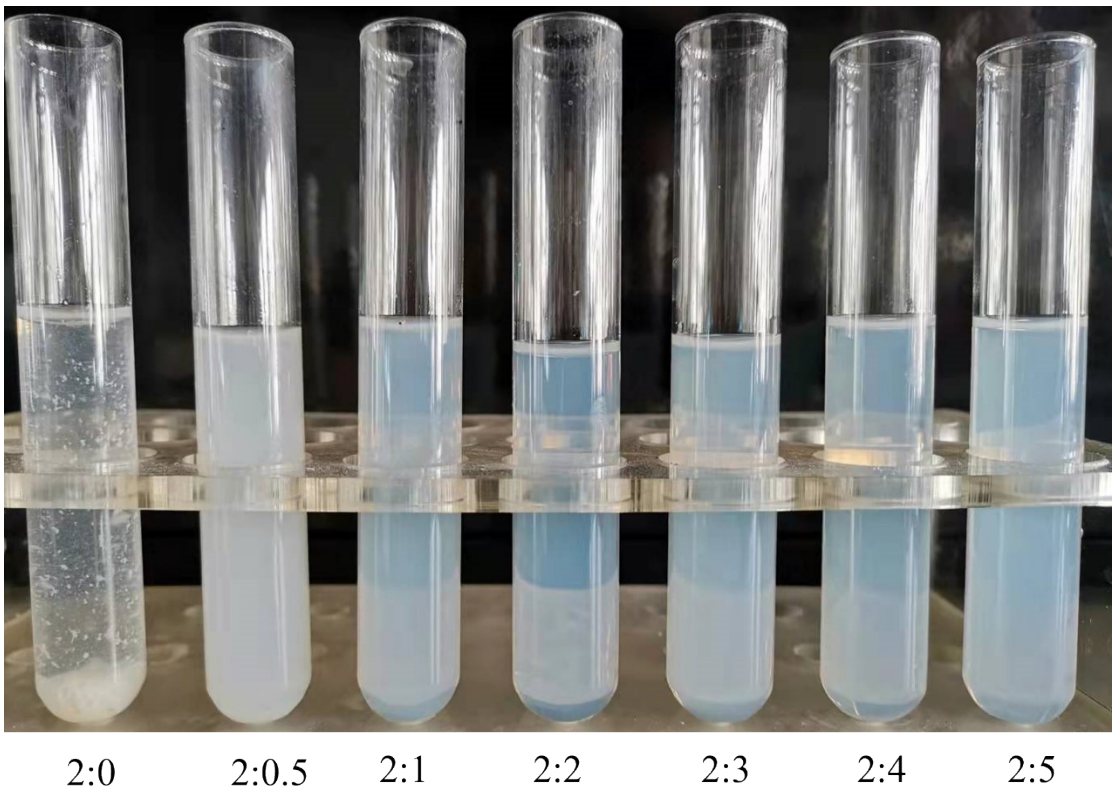

Fig. S18 Effect of pH 4.6 on the stability of FP−NaCas−CS NPs (mass ration of NaCas to CS were 2:0, 2:0.5, 2:1, 2:2, 2:3, 2:4, 2:5)