Supplementary information-1

Synthesis of crystalline zeolitic imidazole framework-8 nano-coating on single environment-sensitive viral particle for enhanced immune responses

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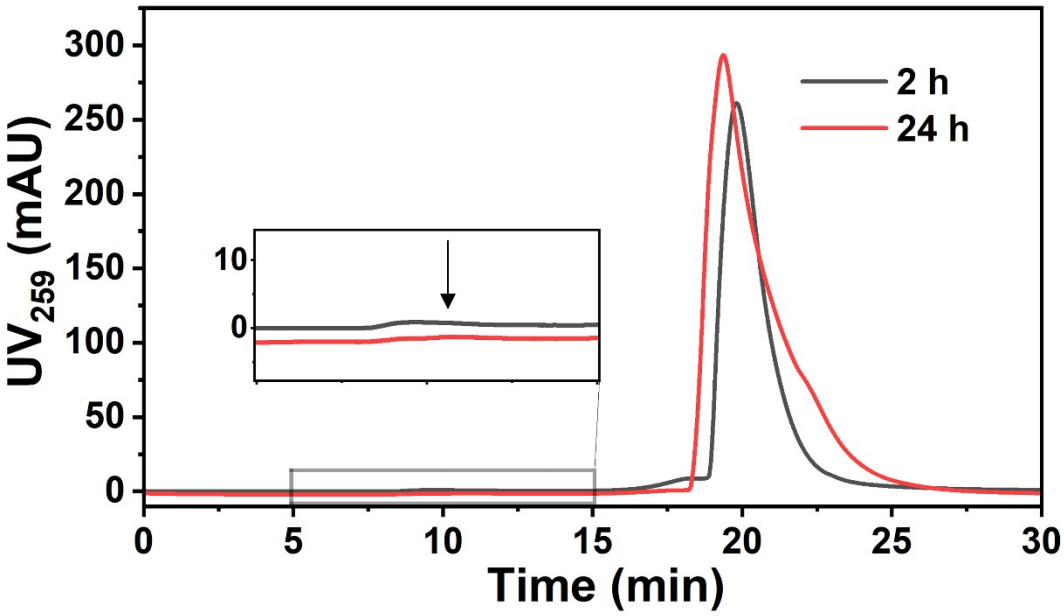

Figure. S1 HPSEC analyzing the content of 146S in the supernatant of EDTA treated 146S@ZIF-8. No 146S signal peak observed in the HPSEC spectrum (the black arrow represented the theoretical peak position).

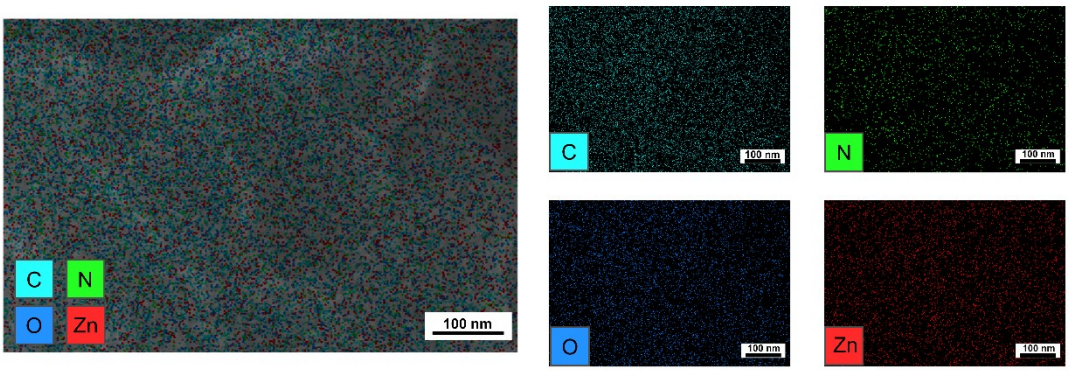

Figure. S2 EDS images of the precipitated obtained from the 146S@ZIF-8 treated by EDTA. The signals of C, N, O, and Zn showed the same distribution pattern.

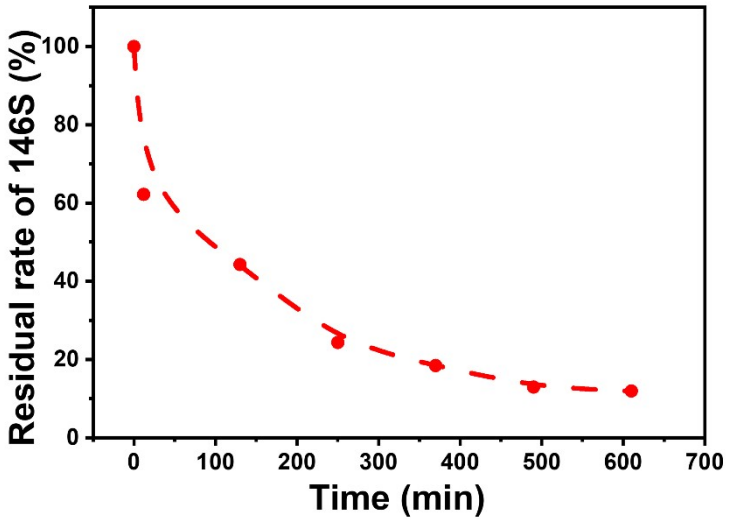

Figure. S3 Reaction speed of 146S@ZIF-8(1×Zn^{2+}) analyzed by HPSEC. The curve was plotted by measuring content of 146S remained in the reaction supernatant in each time point.

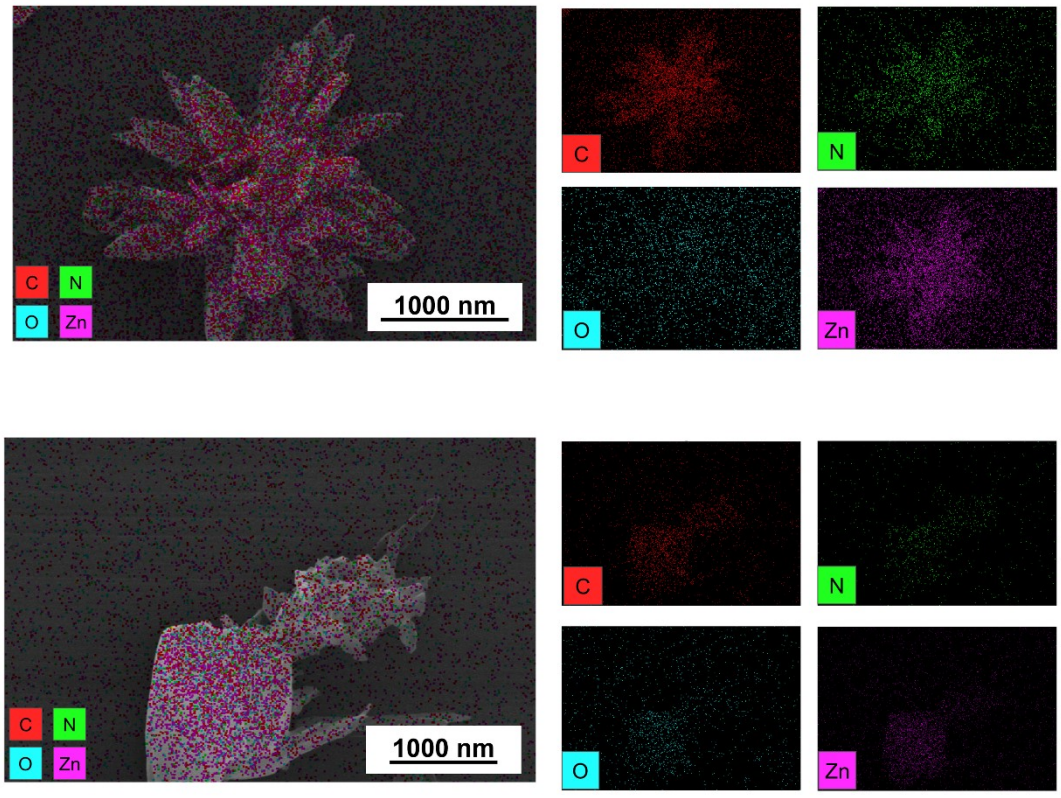

Figure. S4 The EDS images of 146S@ZIF-8(3×Zn^{2+}). The O signal only existed in the cube-shape particle shown in the bottom figure.

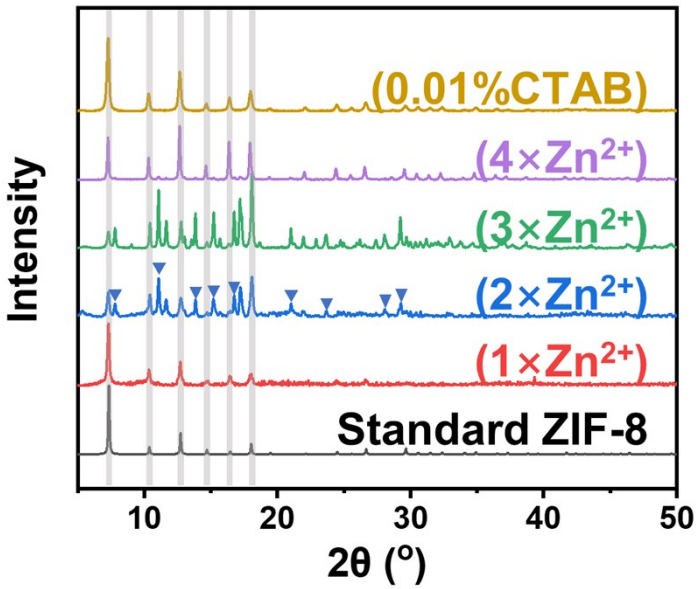

Figure. S5 Identification of 146S@ZIF-8 synthesized at different L/Zn ratios and adding 0.01% CTAB by using PXRD. The peaks corresponding to Zn(OH)2 was marked with blue triangles.

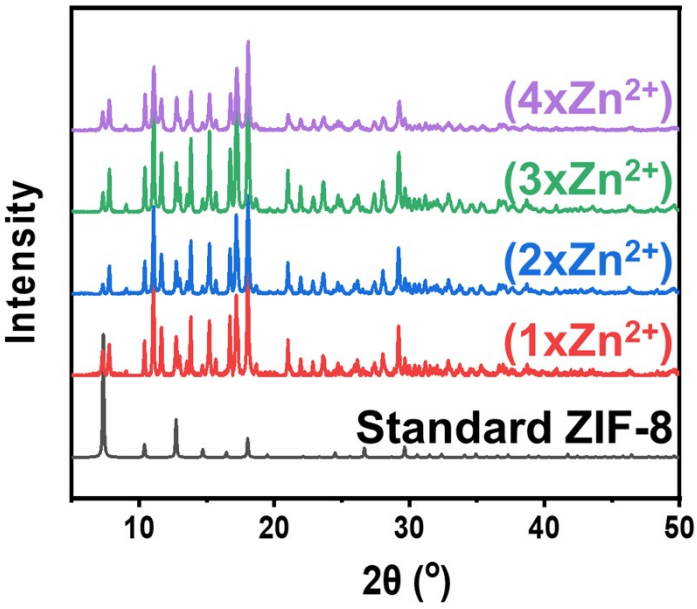

Figure. S6 The PXRD image of ZIF-8 synthesized at different L/Zn ratios without 146S, indicating that the existence of 146S was conducive to the synthesis of ZIF-8.

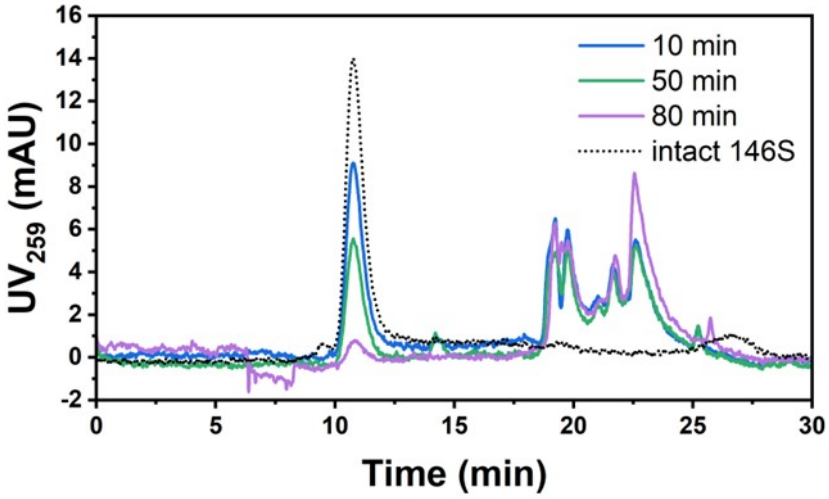

Figure. S7 Monitoring of the preparation process of 146S@ZIF-8(0.01%CTAB) by HPSEC.

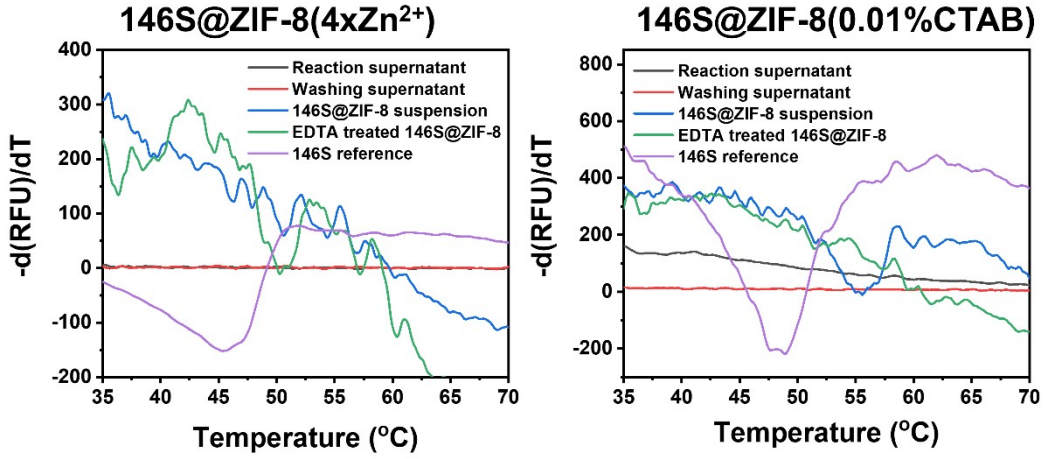

Figure. S8 The thermostability of 146S@ZIF-8(4×Zn^{2+}) and 146S@ZIF-8(0.01%CTAB) in ZIF-8 measured by using DSF. The existence of T_m values indicated the integrated structure of 146S in these two samples, and the increasing in the T_m values indicated enhanced 146S stability.

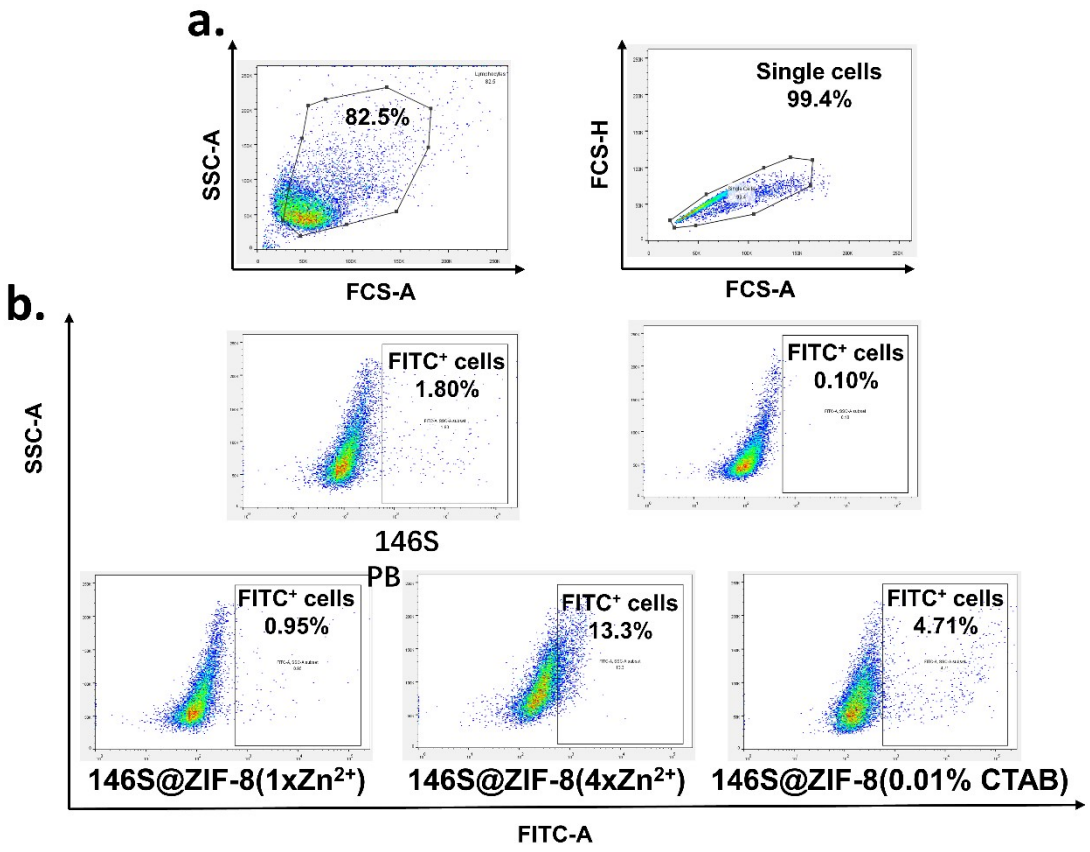

Figure. S9 (a) Gate strategy and (b) typical images of the antigen uptake by DC 2.4 cells measured by using flow cytometry.

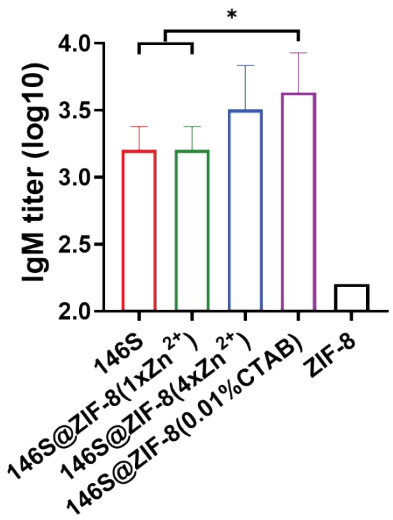

Figure. S10 Specific IgM titer in the serum of mice after 14 days of boosted immunization measured using ELISA (n = 6).

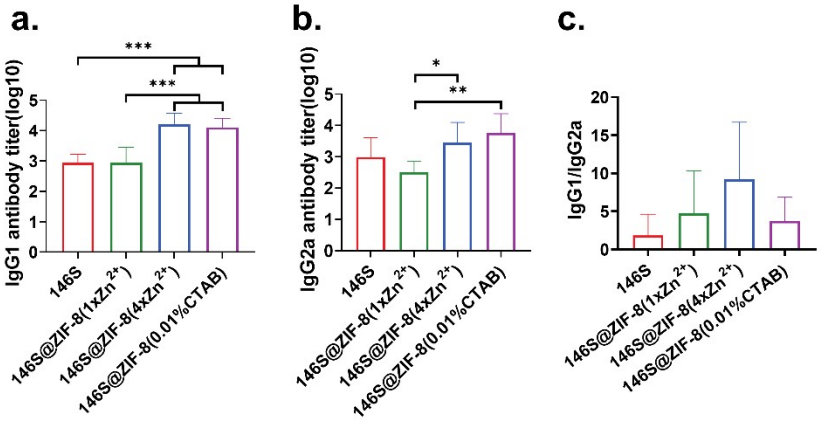

Figure. S11 Specific IgG1 (a), IgG2a (b) titers and IgG1/IgG2a (c) in the serum of mice after 28 days of primary immunization measured using ELISA (n = 6). The asterisks indicate significant differences ($^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$).

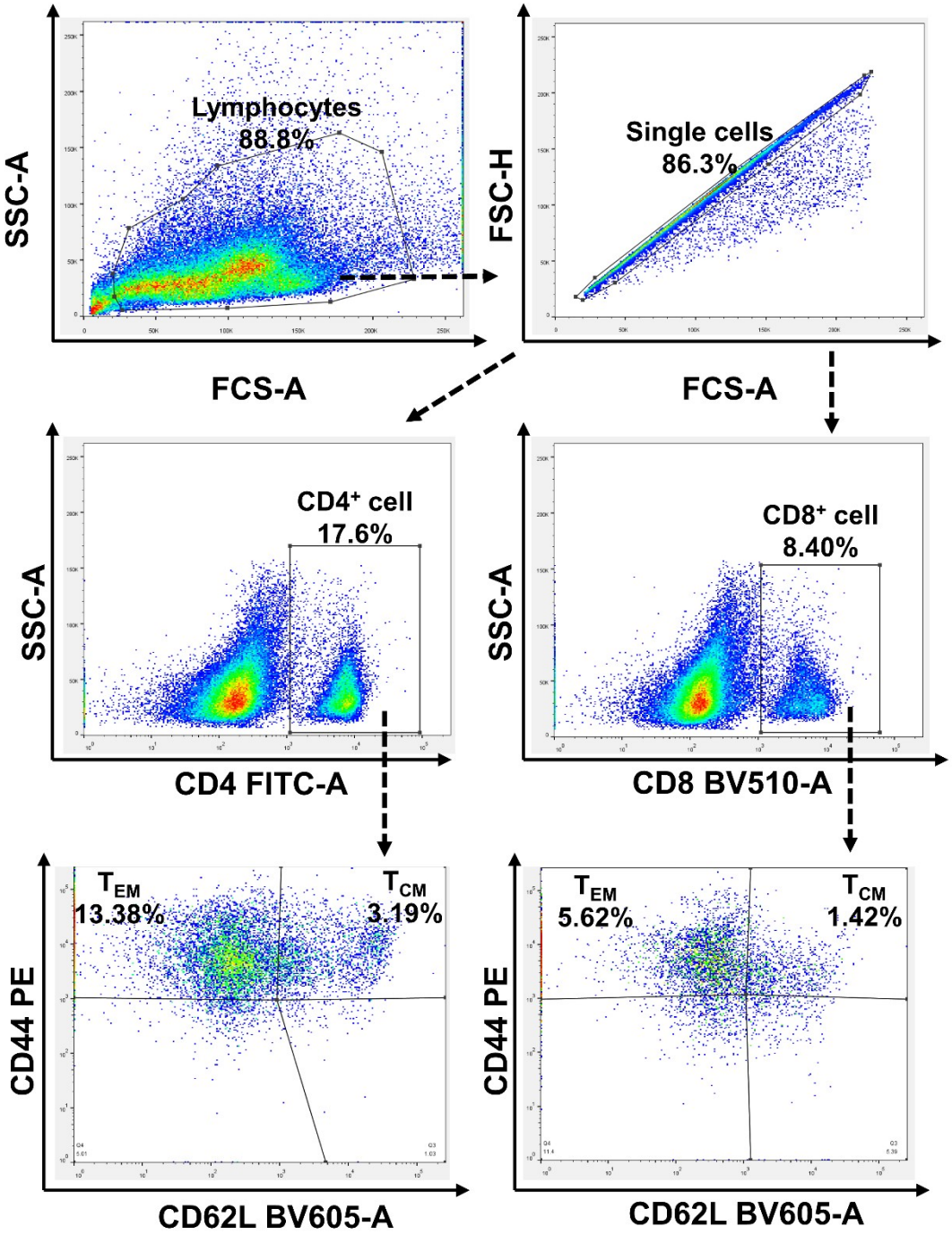

Figure. S12 Gate strategy of measuring the proliferation and differentiation of splenocytes ($CD4^+$, $CD8^+$, T_{EM} and T_{CM}) using flow cytometry.

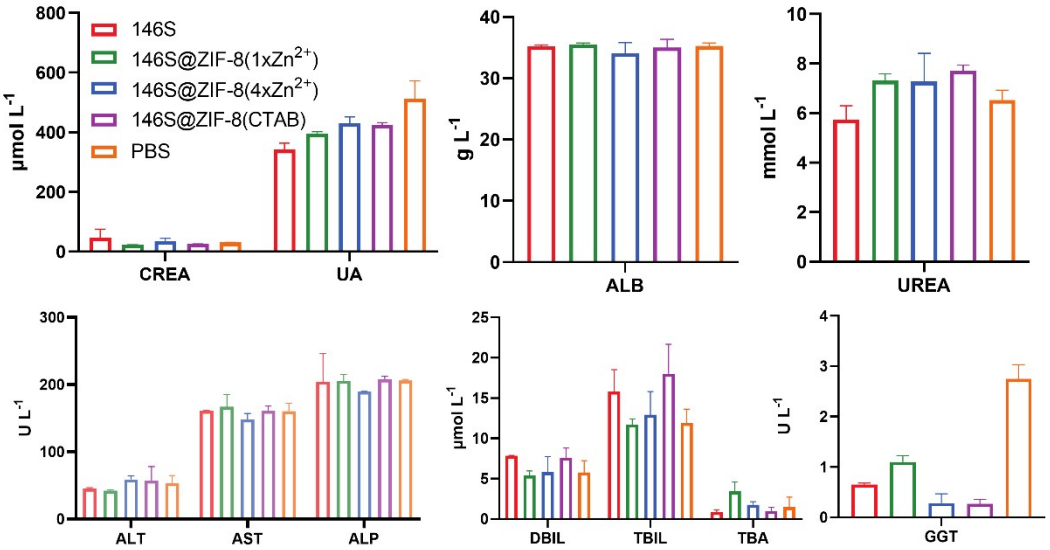

Figure. S13 The serum biochemical parameters 3 days after immunization (n = 2). The liver function and renal function were all within the normal range in each group except the UA value. The UA value was higher than the normal value, but there was no significant difference between the experimental group and the control and the PBS group. There was no significant difference between each group.

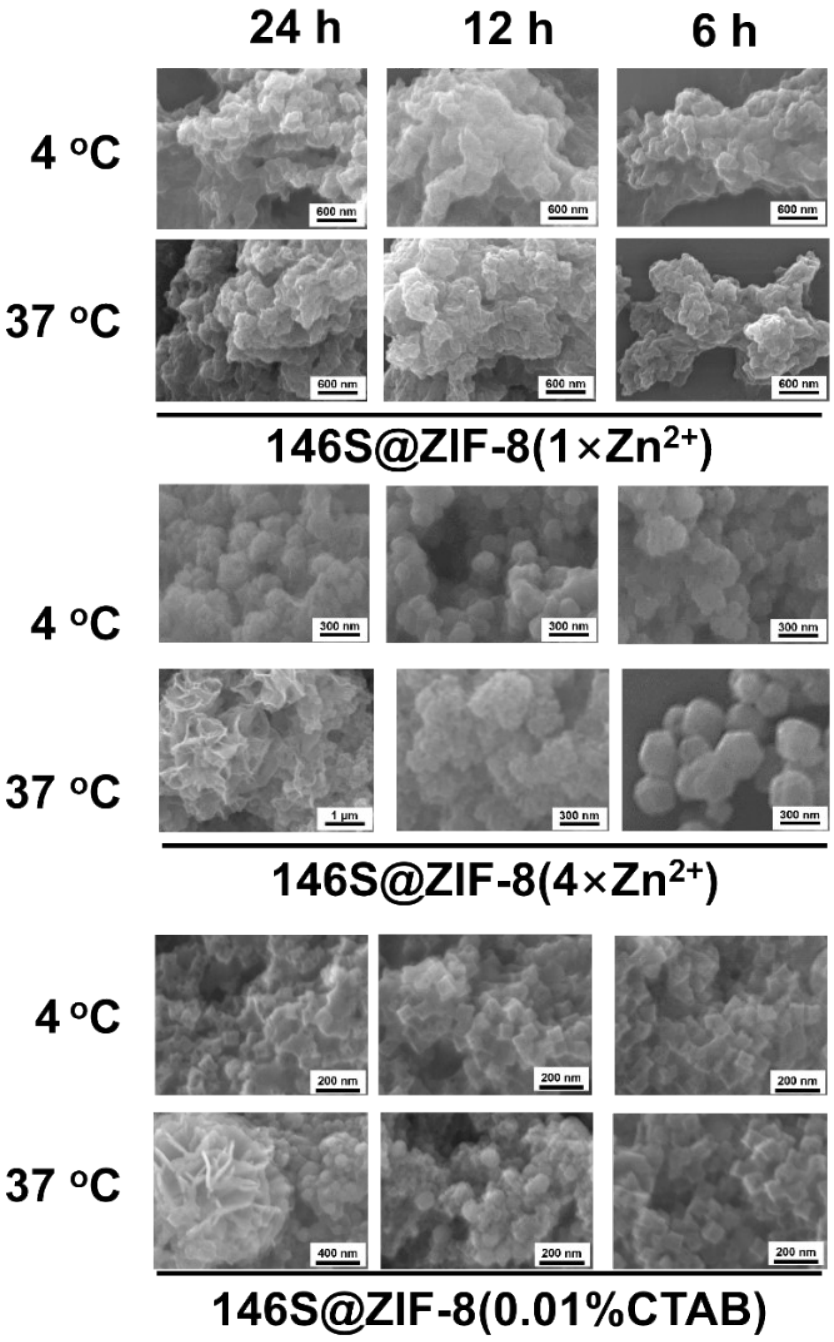

Figure. S14 Evaluation the stability of three kind of 146S@ZIF-8 Incubate with PBS in 4 °C and 37 °C.