Supporting Information

Lignosulfonate as a versatile regulator for the mediated synthesis of Ag@AgCl nanocubes

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S1 Influences of LS concentration on the morphology of Ag@AgCl nanocubes

Table S1. Dosages of LS, NaCl and $AgNO_3$

Sample No	LS (mM)	NaCl (mM)	$AgNO_3$ (mM)
Ag@AgCl-1	0	10	10
Ag@AgCl-2	0.025	10	10
Ag@AgCl-3	0.125	10	10
Ag@AgCl-4	0.25	10	10
Ag@AgCl-5	0.5	10	10
Ag@AgCl-6	1.0	10	10
Ag@AgCl-7	1.5	10	10
Ag@AgCl-8	2.0	10	10
Ag@AgCl-9	3.0	10	10
Ag@AgCl-10	4.0	10	10
Ag@AgCl-11	5.0	10	10

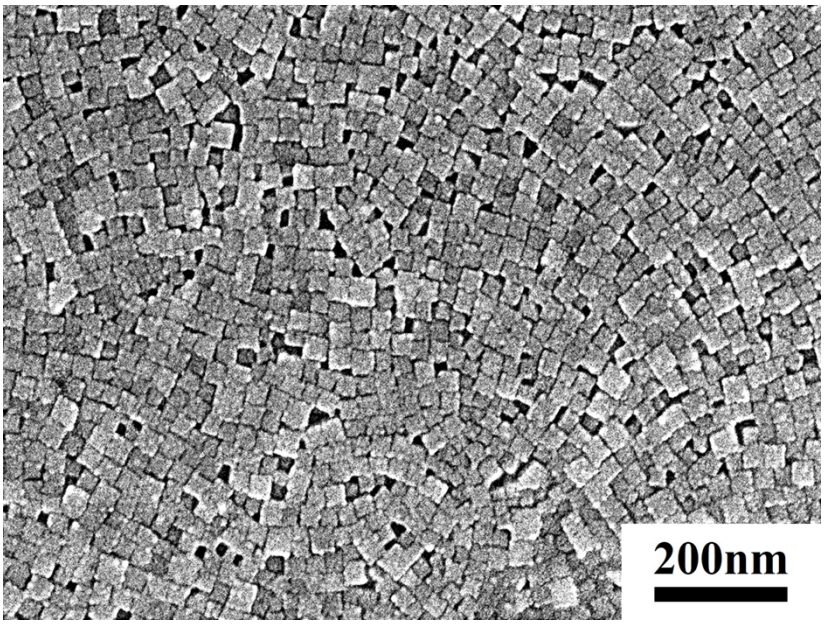

Figure S1. FESEM images of Ag@AgCl nanocubes after one week of placement at a regulated concentration of 1.0mM.

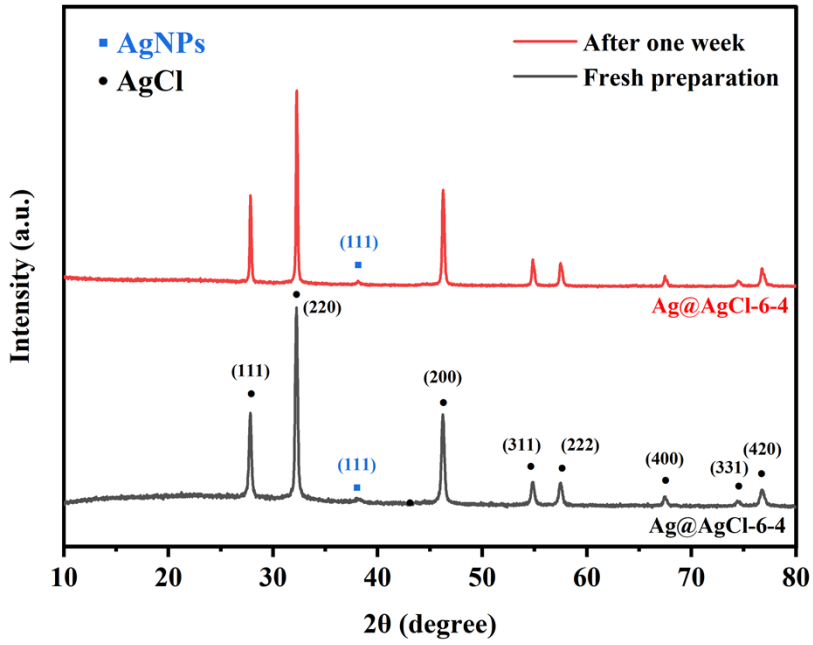

Figure S2. XRD pattern of Ag@AgCl nanocubes after preserving for one week.

S2 Influence of reaction time on the morphology of Ag@AgCl nanocubes

Table S2. Different reaction times in the synthesis of Ag@AgCl nanocubes

Sample No	Time (min)	LS concentration (mM)
Ag@AgCl-6-1	1	1.0
Ag@AgCl-6-2	10	1.0
Ag@AgCl-6-3	30	1.0
Ag@AgCl-6-4	60	1.0
Ag@AgCl-6-5	600	1.0
Ag@AgCl-6-6	900	1.0
Ag@AgCl-6-7	1200	1.0
Ag@AgCl-6-8	1800	1.0

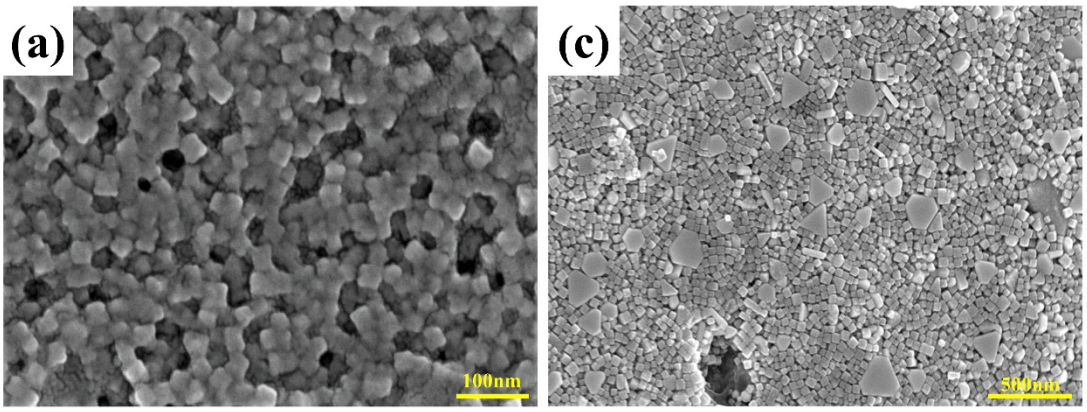

Figure S3. FESEM images of Ag@AgCl nanocubes after (a) 10 h and (b) 20 h reaction time, respectively.

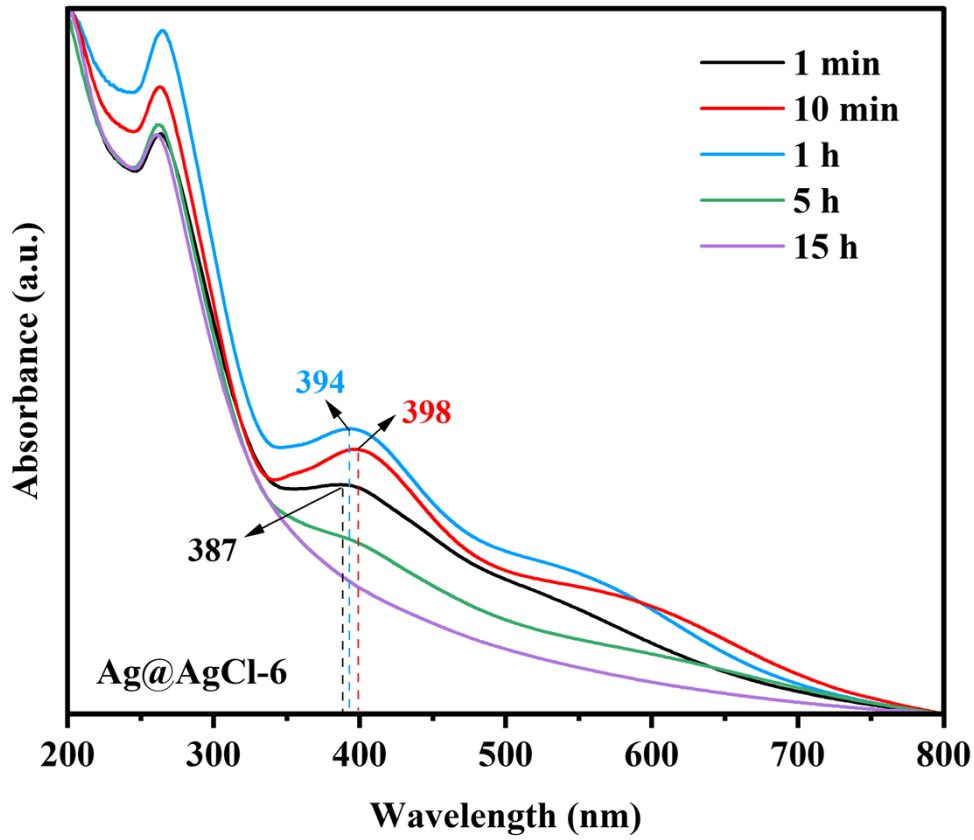

Figure S4. UV-vis spectra of Ag@AgCl-6 nanocubes at different reaction times.

S3 FTIR analysis

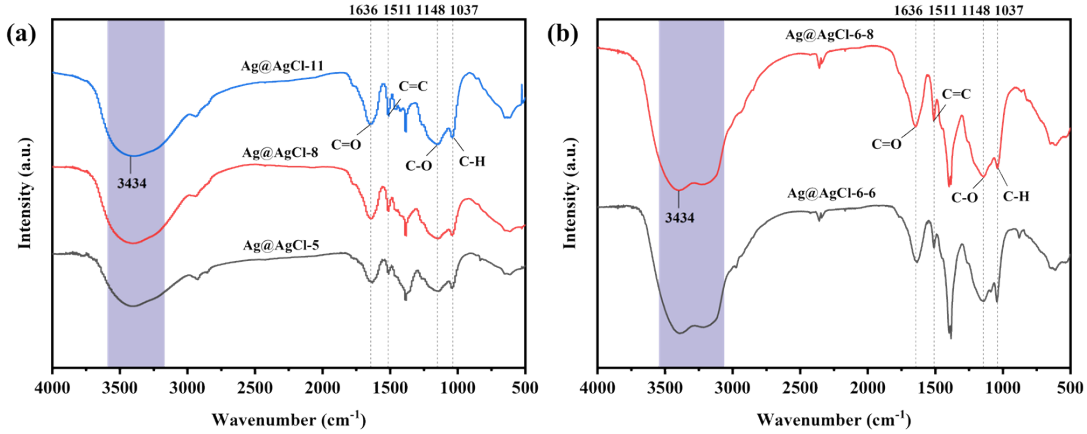

Figure S5. FTIR spectra of Ag@AgCl nanocomposites regulated by (a) different reaction times and (b) LS concentrations.

S4 XPS analysis of Ag@AgCl nanocubes

Table S3. Relative contentsof Ag elements in Ag3d XPS spectrum

Sample No	Ag^0: Ag^+
Ag@AgCl-1-4	0:1.0
Ag@AgCl@-6-4	0.39:1.0
Ag@AgCl@-11-4	2.83:1.0

Table S4. Relative contents of C element in C1s XPS spectrum

Sample No	C=O:C=C
Ag@AgCl-1-4	0.2:1.0
Ag@AgCl-6-4	0.6:1.0
Ag@AgCl@-11-4	0.52:1.0

Table S5. Relative contents of O elements in O1s XPS spectrum

Sample No	C-O:C=O:SO_3^-
Ag@AgCl-1-4	0.49:1.0:0
Ag@AgCl-6-4	0.40:1.0:0.65
Ag@AgCl-11-4	0.04:1.0:0.24

Table S6. Relative contents of Cl elements in Cl2p XPS spectrum

Sample No	$Cl2p_{1/2}$: $Cl2p_{3/2}$
Ag@AgCl-1-4	0.75:1.0
Ag@AgCl-6-4	0.49:1.0
Ag@AgCl-11-4	0.48:1.0

Overall, the zeta potential showed a gradual upward trend over time, increasing from -20.77 mV to -16.36 mV (Figure S6.). This suggests that the electrostatic repulsion between the composites weakens over time, probably due to the saturation of LS adsorption, leading to a decrease in dispersion stability. However, the Zeta potential was roughly maintained between -16 mV and -20 mV, reflecting the dynamic balance between the dispersion and aggregation of silver nanoparticles in the solution during the whole observation period, and the stability of the suspension was good.

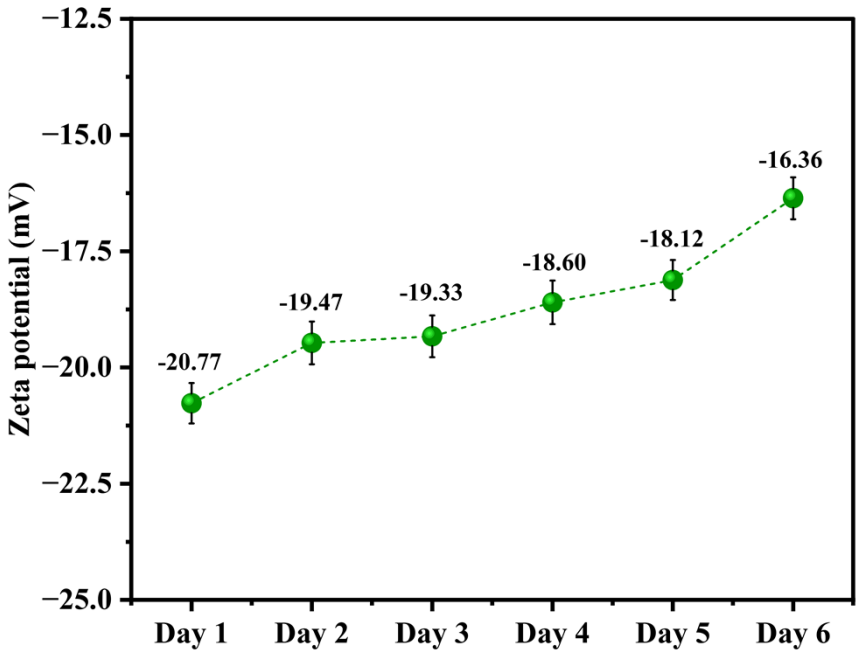

Figure S6. Zeta potential map of Ag@AgCl nanocubes at different reaction times.

Table S7. The yield of the Ag@AgCl nanocube and the proportion of silver

nanoparticles deposited on the surface

	Ag@AgCl-6-4
Ag^0: Ag^+	0.39:1.0
the yield of the Ag@AgCl nanocube	84.37 %
the proportion of silver nanoparticles deposited on the Ag@AgCl nanocube surface	28.06 %