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Supplementary Information

For

One-step rapid colorimetric detection of K^+ using silver nanoparticles modified by crown ether

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Table S1. Cavity sizes of crown ethers estimated from atomic models and diameter of various cations[1]

Crown ethers	Cavity sizes (Å)	Cations	Diameter of cations (Å)
12-crown-4	1.2-1.5	Li^+ / Mg^{2+} / Fe^{3+}	1.2 / 1.44 / 1.29
15-crown-5	1.7-2.2	Na^+ / Ca^{2+}	2.04 / 2
18-crown-6	2.6-3.2	K^+	2.76
21-crown-7	3.4-4.3	Cs^+	3.34

Table S2. O 1s XPS data of Ag NPs and ADC-Ag NPs

	Attribution	Peak position/eV	Peak area	Content/%
Ag NPs	C-O	532.9	788.1	37.18
	C=O	531.1	1331.2	62.82
ADC-Ag NPs	C-O	532.9	3415.1	57.07
	C=O	531.1	2568.0	42.93

Table S3. C 1s XPS data of Ag NPs and ADC-Ag NPs

	Attribution	Peak position/eV	Peak area	Content/%
Ag NPs	C-C/C-H	284.8	1192.0	66.67
	C-O	286.5	315.5	17.64
	C=O	288.4	280.6	15.69
ADC-Ag NPs	C-C/C-H	284.8	2239.3	54.27
	C-O	286.5	1361.0	32.98
	C=O	288.4	526.1	12.75

Table S4 Comparison of our developed sensor with other methods for K^+ determination

Method	Materials	Preparation methods	Incubation	LOD	Reference
Raman scattering spectroscopy detection	Sodium cobaltinitrite	/	/	10 μM	2
Fluorescence detection	TBAC12-AgNCs	/	/	0.4 mM	3
photoelectrochemical detection	K-Pdots	Sedimentation	Periodic lighting	0.42 nM	4
Colorimetric detection	PBA-Au NPs + Y5GL	Heating	Incubate for 45min	10 nM	5

Colorimetric detection	Au NPs + ABC	/	Incubate for 3min	5.24 μM	6
Colorimetric detection	ADC- Ag NPs	/	/	2.16 μM	This work

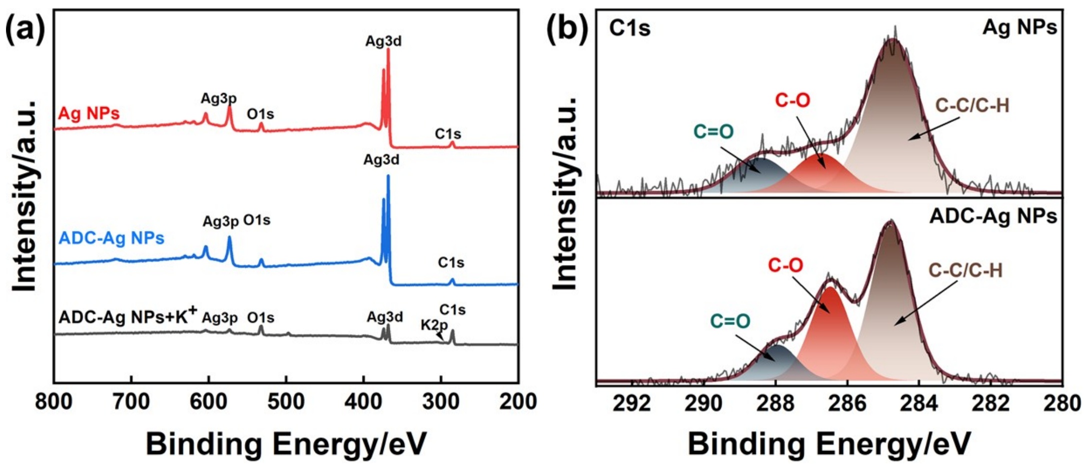

Figure S1. XPS spectra of Ag NPs under different conditions. (a) Wide scan XPS spectra of Ag NPs, ADC-Ag NPs and ADC-Ag NPs with K^+ in the range of 200-800 eV and (b) C1s XPS spectra of Ag NPs and ADC-Ag NPs (The concentration of K^+ is 100 μM).

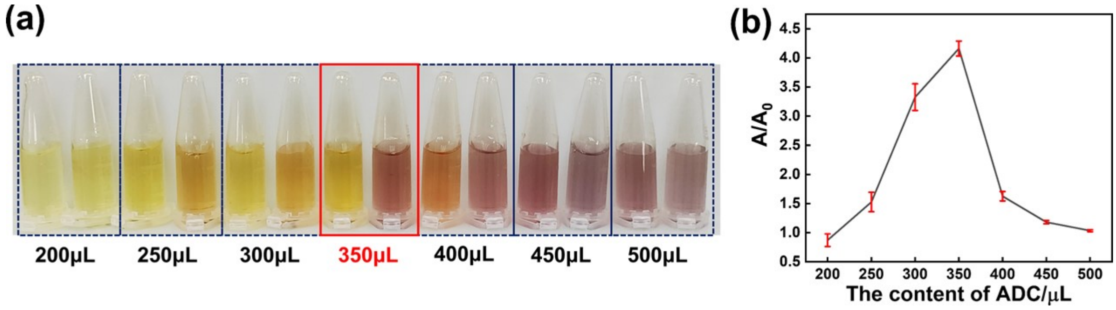

Figure S2. Effect of ADC content (200, 250, 300, 350, 400, 450, 500 μL) on the detection of K^+ (a) Colorimetric photograph (In each group, the blank sample is on the left and the experimental group containing K^+ is on the right); (b) UV-vis absorption intensity ratio A/A_0 of ADC-Ag NPs solutions with different content of ADC (A represents the absorption intensity ratio of ADC-Ag NPs solution containing K^+ at 520 nm and 400 nm, A_0 represents the absorption intensity ratio of the blank sample. The concentration of K^+ is 50 μM).

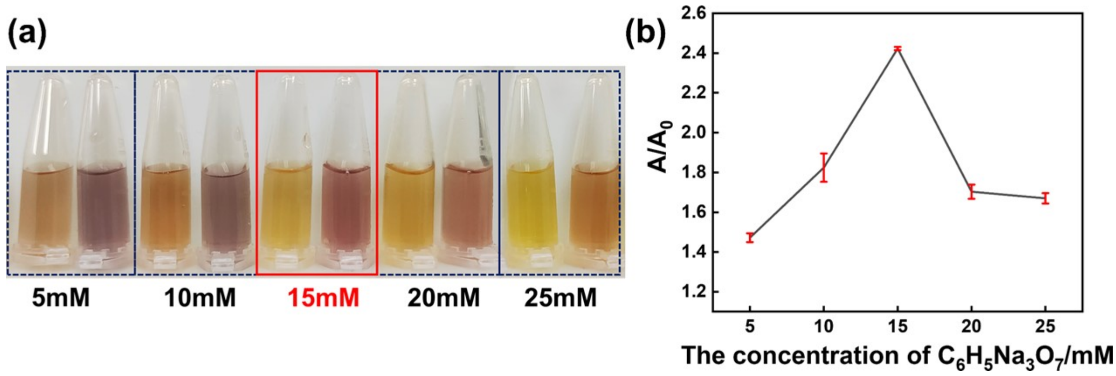

Figure S3. Effect of $C_6H_5Na_3O_7$ concentration (5, 10, 15, 20, 25 mM) on the detection of K^+. (a) Colorimetric photograph (In each group, the blank sample is on the left and the experimental group containing K^+ is on the right); (b) UV-vis absorption intensity ratio of ADC-Ag NPs solutions with different concentration of $C_6H_5Na_3O_7$ (The concentration of K^+ is 50 μM).

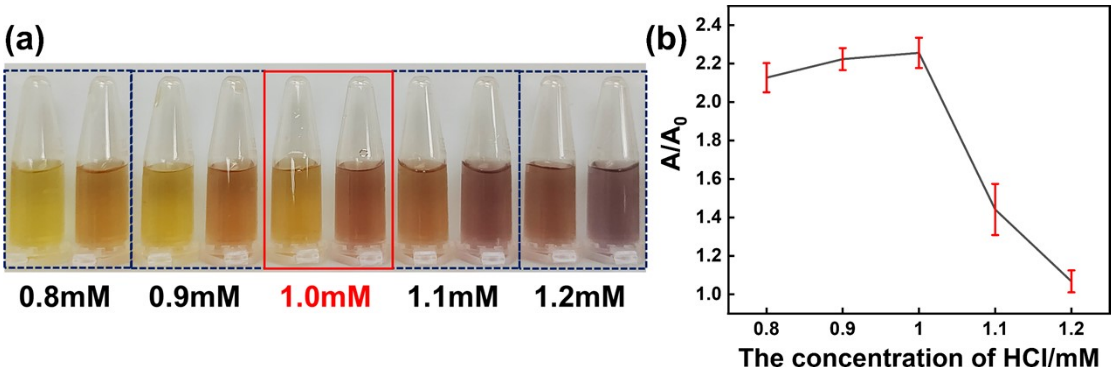

Figure S4. Effect of HCl concentration (0.8, 0.9, 1.0, 1.1, 1.2 mM) on the detection effect of K^+. (a) Photograph of the colorimetric results (In each group, the blank sample is on the left and the experimental group containing K^+ is on the right); (b) UV-vis absorption intensity ratio of ADC-Ag NPs solutions with different concentration of HCl (The concentration of K^+ is 50 μM).

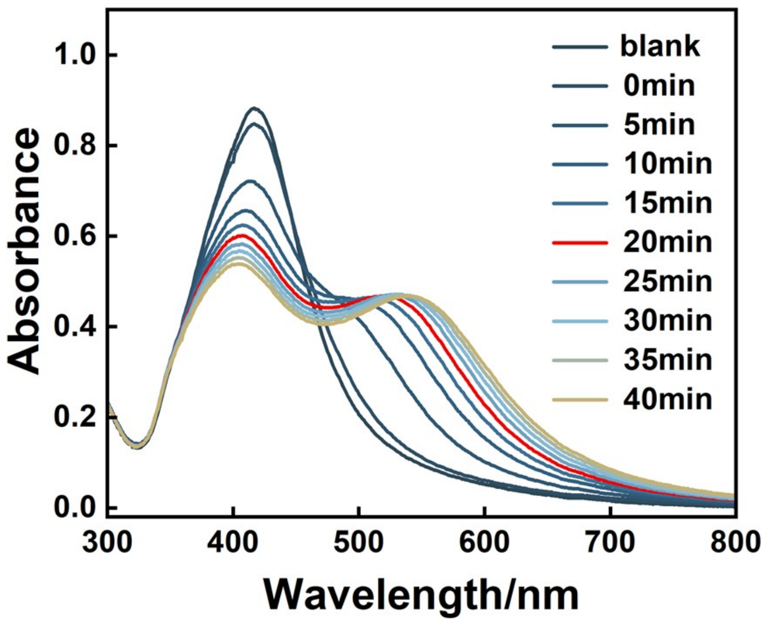

Figure S5. Time dependent UV-vis absorption spectra of ADC-Ag NPs solution containing K^+ (0, 5, 10, 15, 20, 25, 30, 35, 40 min. The concentration of K^+ is 50 μM).

References

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