Electronic Supplementary Material (ESI) for Analytical Methods.

Supporting Information

Exploring the utility of PVP@Au-Polyamide-Triton X-114 for SERS tracking of extracellular senescence associated-beta-galactosidase activity

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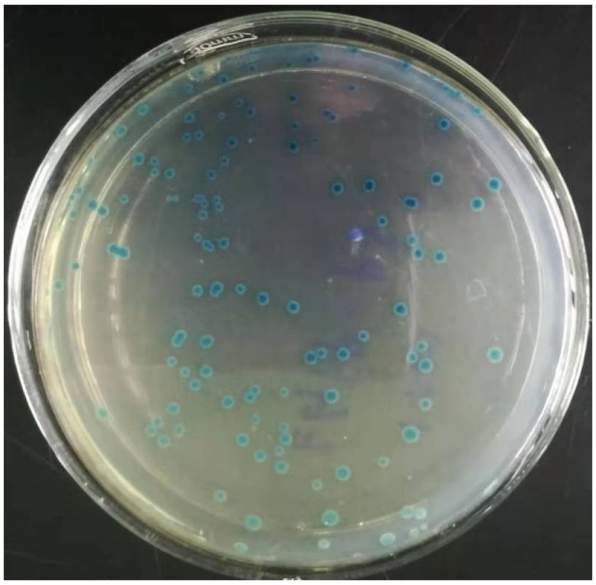

Fig. S1 X-gal staining for *E. coli* DH5α containing pUC18 vector. Colonies were cultured on the Luria-Bertani (LB) solid plate medium containing 1 mmol L^{-1} IPTG and 0.1 mmol L^{-1} X-gal at 37°C overnight, and they appeared blue by X-gal staining.

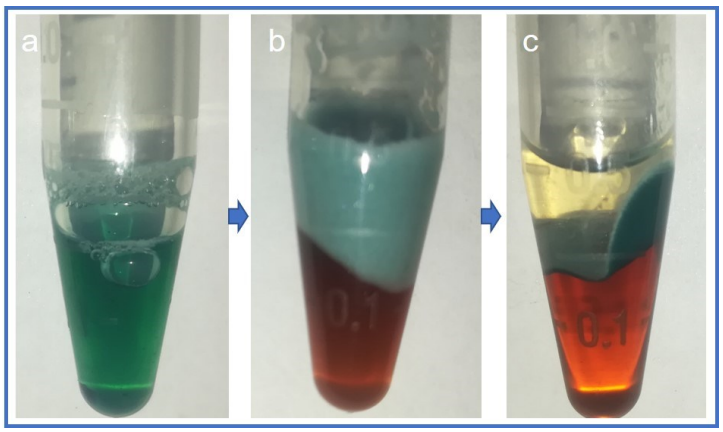

Fig. S2 Phenol-chloroform-isoamyl alcohol extraction. Colonies of *E. coli* DH5*α* containing pUC18 vector were cultured in LB liquid medium containing 1 mmol L^{-1} IPTG and 0.1 mmol L^{-1} X-gal at 37°C overnight. After centrifuging the culture at high speed, the supernatant was collected. (a) The blue supernatant of the culture for *E. coli* DH5*α* containing pUC18 vector. (b) Phenol-chloroform-isoamyl alcohol mixture was added in the blue supernatant. (c) The proteins with the blue X-gal hydrolysates were kept at interface between aqueous and organic layer.

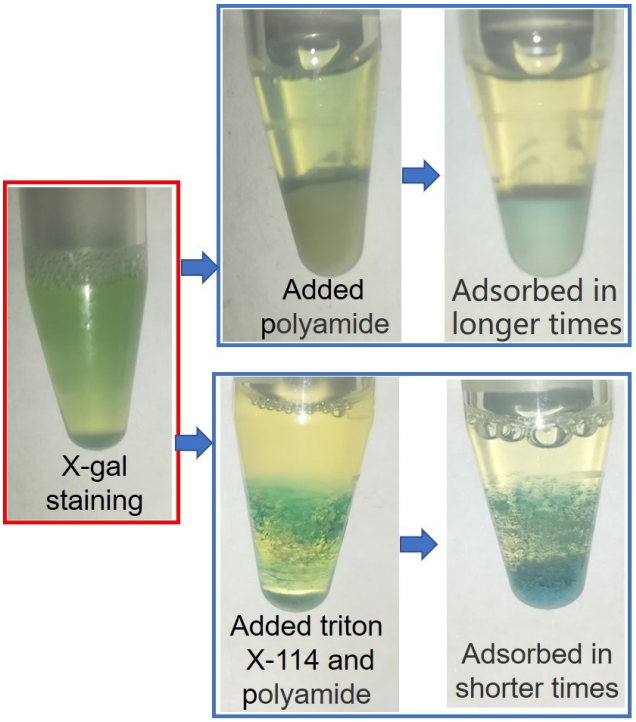

Fig. S3 Adsorption performance of polyamide powder for X-gal hydrolysates. Polyamide powder and triton X-114 were investigated. Blue supernatant by adding amide powder became transparent in more than one hour, and blue supernatant by adding triton X-114 and polyamide powder could effectively adsorb X-gal hydrolysates in 5 minutes without the heating process of cloud point extraction.

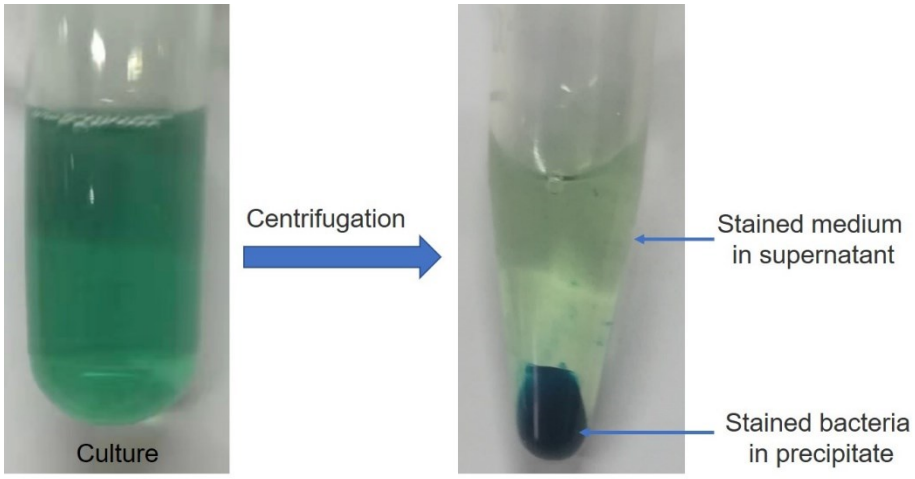

Fig. S4 X-gal staining in liquid medium. Colonies of *E. coli* DH5*α* containing pUC18 vector were cultured in LB liquid medium containing 1 mmol L^{-1} IPTG and 0.1 mmol L^{-1} X-gal at 37°C for 6 hours. Both bacteria and medium could be dyed to the distinct blue color.

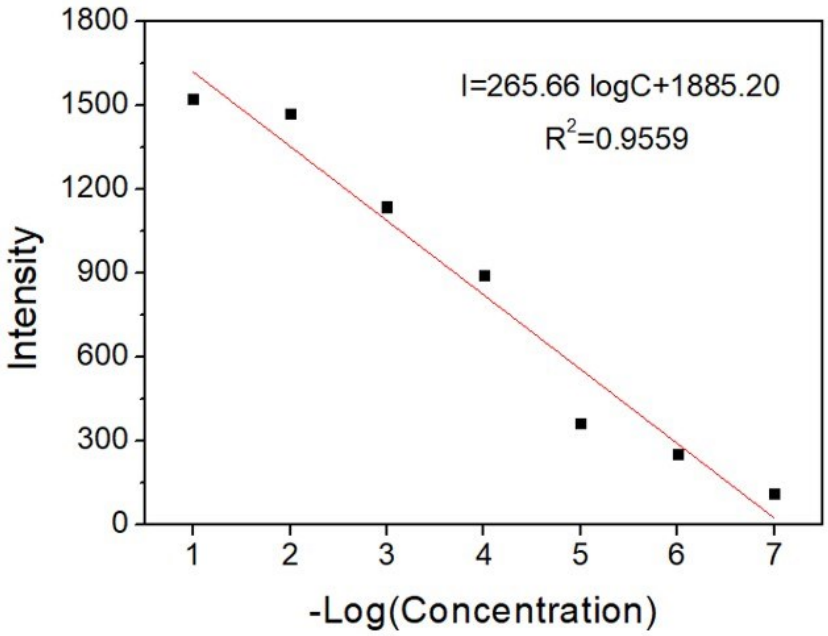

Fig. S5 The relationship between the intensity of the SERS characteristic peak at 599 cm^{-1} and the concentration of X-gal hydrolysates for samples b1-b7 in Fig 2. The numbers on the abscissa represent the exponent of 10-fold dilutions.

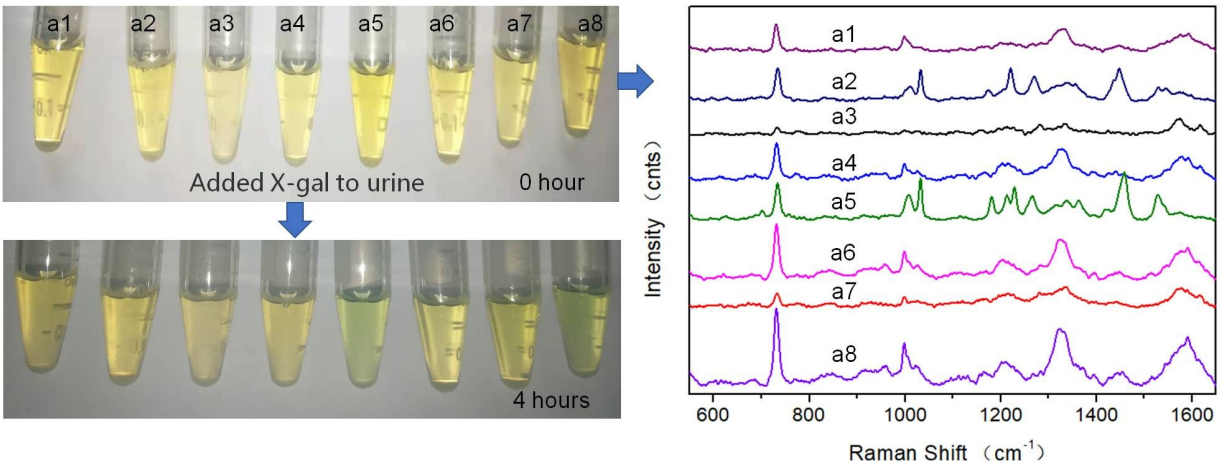

Fig. S6 Evaluation on SERS performance of Au@PVP-Polyamide-Triton X-114 for urine SA-*β*-gal activity. a1-a8 denote eight urine specimens from four healthy children and four patients with chronic kidney disease diagnosed by clinic. The color of X-gal hydrolysates was absent for all specimens in the beginning and gradually appeared at 4 hours. Moreover, the feature Raman band of X-gal hydrolysates at 599 cm^{-1} was absent for all specimens in the beginning.

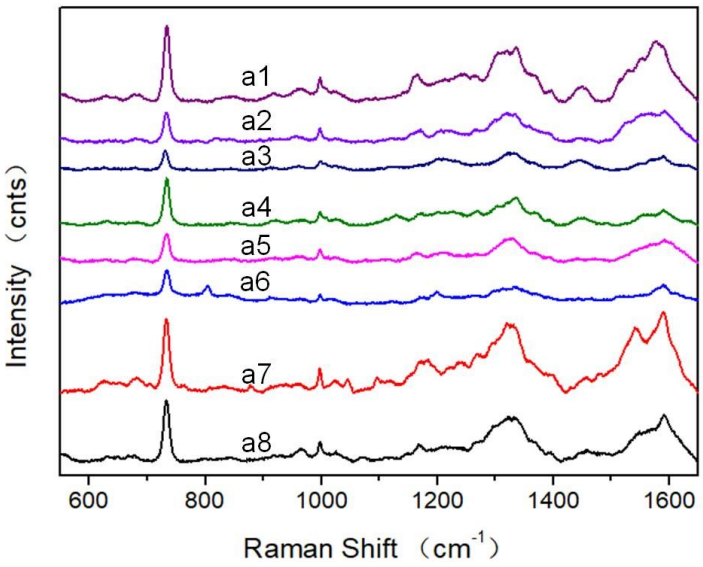

Fig. S7 SERS spectrum analyzed by Au@PVP for the stained urine specimens at half an hour. The feature Raman band at 599 cm^{-1} was also absent for all specimens.

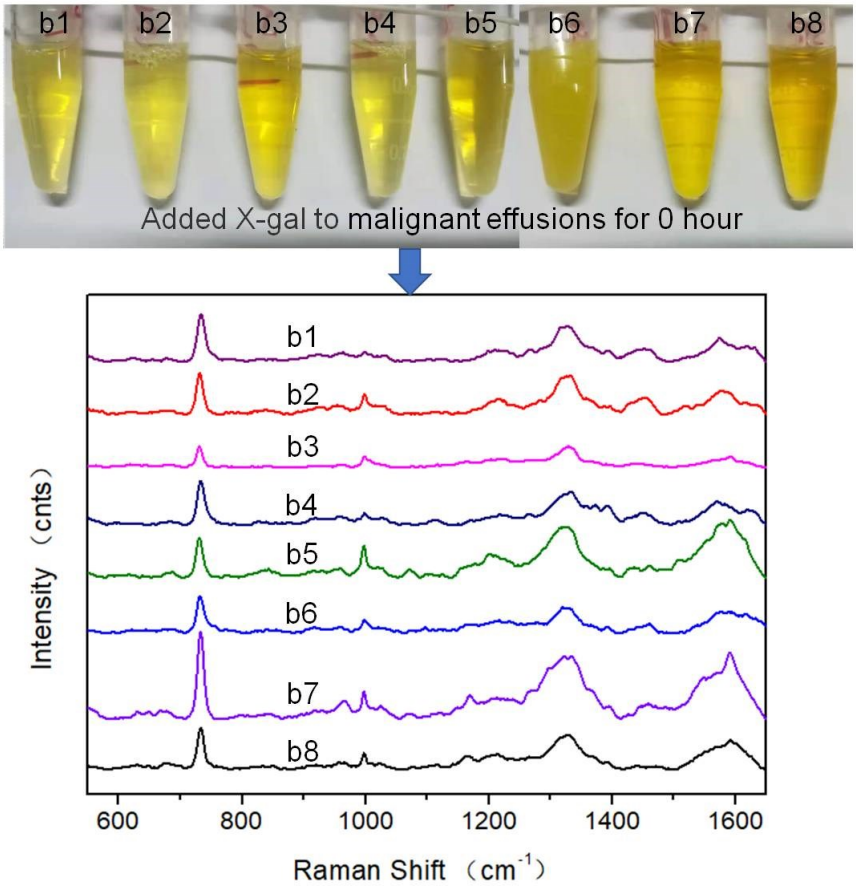

Fig. S8 Evaluation on SERS performance of Au@PVP-Polyamide-Triton X-114 for malignant effusion SA-*β*-gal activity. a1-a8 denote eight specimens from eight patients with different types of malignancies diagnosed by clinic. The color and feature Raman band of X-gal hydrolysis at 599 cm^{-1} were absent for all specimens in the beginning.

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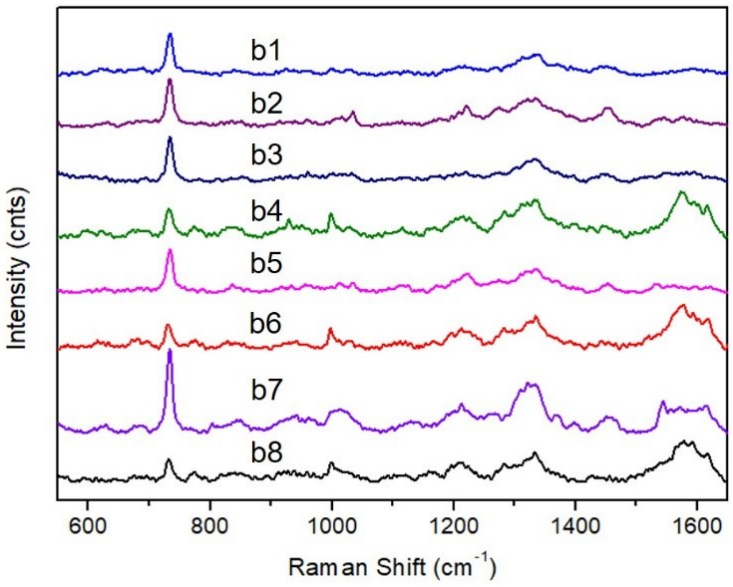

Fig. S9 SERS spectrum analyzed by Au@PVP for the stained malignant effusions SA-*β*-gal activity. The feature Raman band of X-gal hydrolysis at 599 cm^{-1} was absent in all at 2 hours.

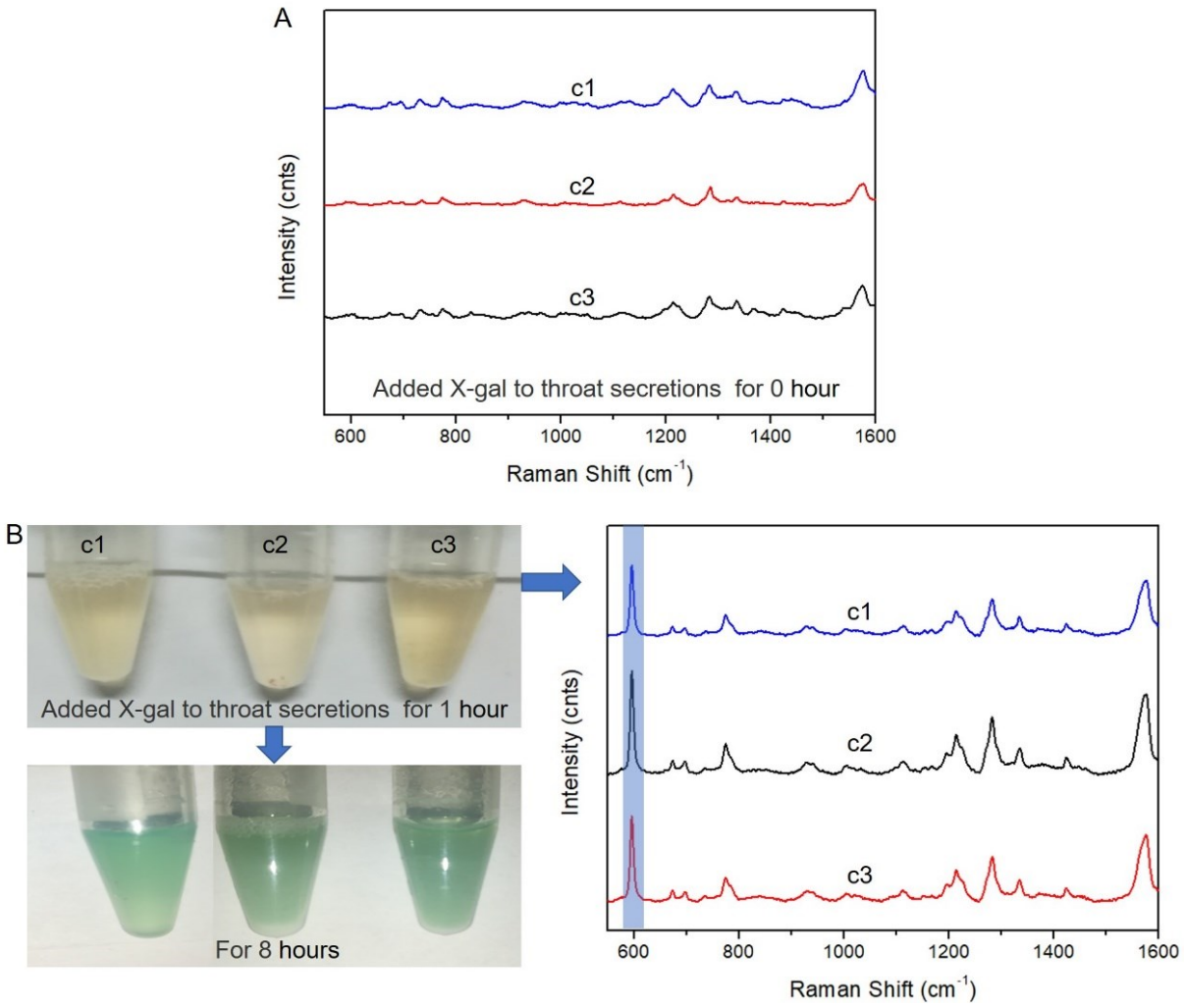

Fig. S10 Evaluation on SERS performance of Au@PVP-Polyamide-Triton X-114 for throat secretions SA-*β*-gal activity. c1-c3 denote three specimens from three patients with respiratory tract infection diagnosed by clinic. The blue band indicates the marker of X-gal hydrolysates at 599 cm^{-1}. (A) The feature Raman band of X-gal hydrolysates at 599 cm^{-1} was absent for all specimens at the beginning. (B) The color of X-gal hydrolysates was absent for all specimens at 1 hour, and that became obvious after 8 hours. The feature Raman band of X-gal hydrolysates at 599 cm^{-1} could be obviously distinguished at 1 hour.

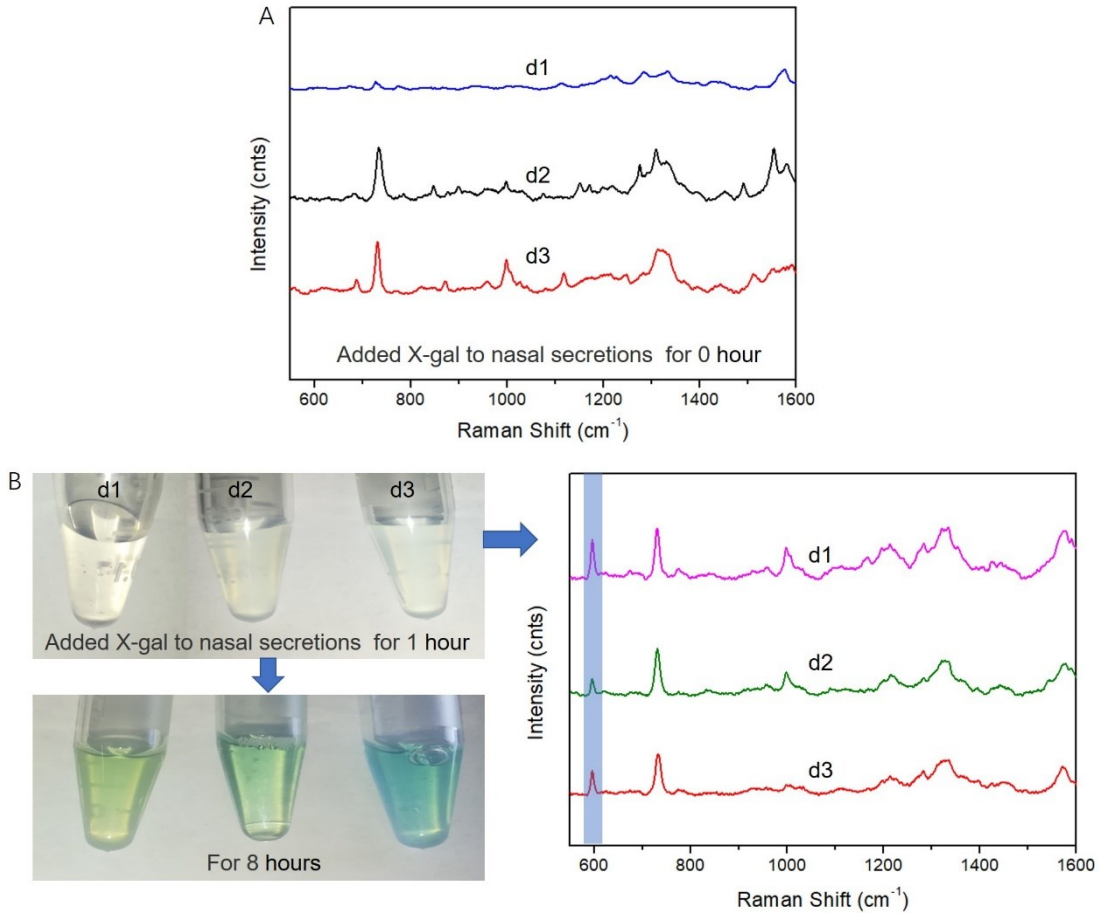

Fig. S11 Evaluation on SERS performance of Au@PVP-Polyamide-Triton X-114 for nasal secretions SA-β-gal activity. d1-d3 denote three specimens from three patients with respiratory tract infection. The blue band indicates the marker of X-gal hydrolysates at 599 cm^{-1}. (A) The feature Raman band of X-gal hydrolysis at 599 cm^{-1} was absent for all specimens at the beginning. (B) The color of X-gal hydrolysates was absent for all specimens at 1 hour, and that became obvious after 12 hours. The feature Raman band of X-gal hydrolysis at 599 cm^{-1} could be obviously distinguished at 1 hour.

Table S1 Summary table of approximately detected times of X-gal hydrolysates by different methods.

Target molcules	X-gal hydrolysates		
Types of body fluids	Urines	Malignant effusions	Throat and nasal secretions
Developed method	Half an hour	2 hours	1 hour
Colorimetric	4-12 hours	12 hours	8 hours