Supporting Information for

Surface-Enhanced Raman Spectroscopy on Liquid Interfacial Nanoparticle Arrays for Multiplex Detecting Drugs in Urine

Yongmei Ma,[†,‡] Honglin Liu,[,†,§] Mei Mao,[†,⊥] Juan Meng,[†] Liangbao Yang,[*,†] and Jinhuai Liu[†]*

[†]Institute of Intelligent Machines, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei 230031, China

[‡]Chongqing Institute of Green and Intelligent Technology, Chinese Academy of Sciences, Chongqing 400714, China

[§]Molecular Sciences and Biomedicine Laboratory, State Key Laboratory for Chemo/Biosensing and Chemometrics, College of Chemistry and Chemical Engineering and College of Biology, Collaborative Innovation Center for Molecular Engineering and Theranostics, Hunan University, Changsha 410082, China

[⊥]Department of Chemistry, University of Science and Technology of China, Hefei 230026, China

*Email: liuhonglin@mail.ustc.edu.cn (H.L.L.); lbyang@iim.ac.cn (L.B.Y.).

Outlines

Section 1: Separation and concentration of drug additives from real human urine.

Section 2: Nanoparticle size and interparticle gap distribution histograms of GNPs monolayer

Section 3: The Raman spectra of MAMP.

Section 4: The SEM observation of GNP arrays on Si wafer surface.

Section 5: The linear relationship between intensity at 1030 cm^{-1} and concentration of MAMP.

Section 6: The SERS spectra for the multiphase detection of CV and MAMP.

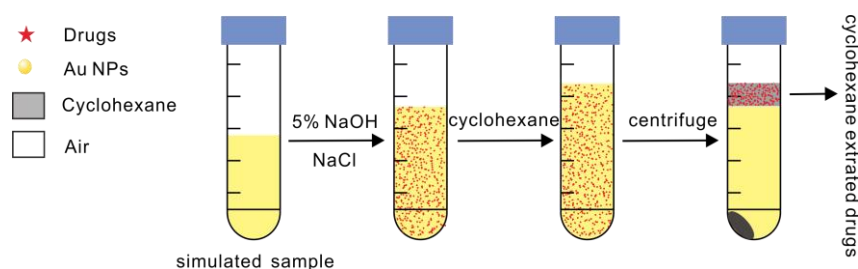Section 1: Separation and concentration of drug additives from real human urine.

Figure S1. Schematic procedures for separation and concentration of drug additives from real human urine.

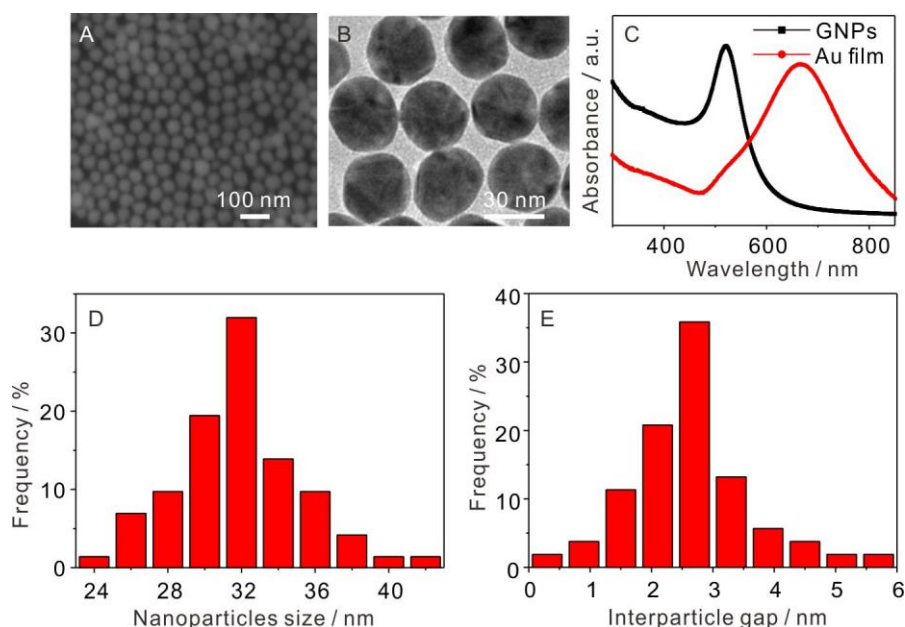Section 2: Nanoparticle size and interparticle gap distribution histograms of GNPs monolayer.

Figure S2. (A) SEM and (B) TEM observations on GNP arrays. (C) Absorbance spectra of GNP colloids (black line) and self-assembled arrays (red line) transferred onto quartz glass surface. (D) Nanoparticle size distribution histograms of GNPs monolayer. (E) Interparticle gap distribution histograms of GNPs monolayer.

The statistical average diameter of GNPs is about 32 ± 2.1 nm (Figure S2D) and the statistical distances between GNPs of the monolayer are ca. 2–3 nm (Figure S2E). These interparticle gaps can produce strong electromagnetic enhancement (EM) which can lead to a significant enhancement of SERS signals.

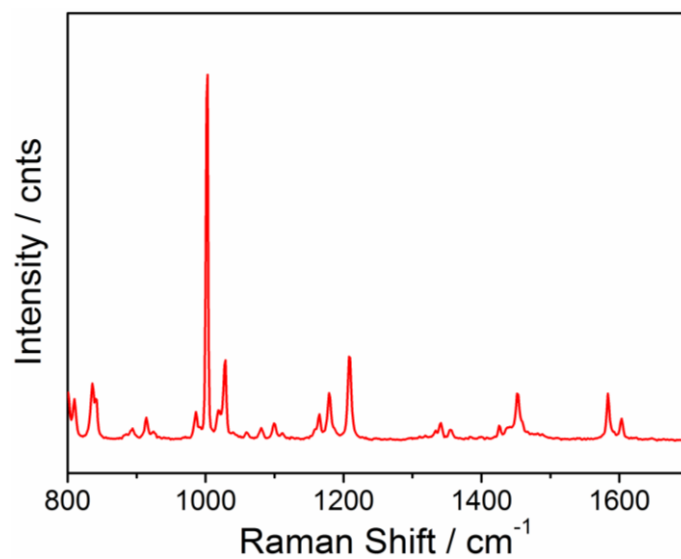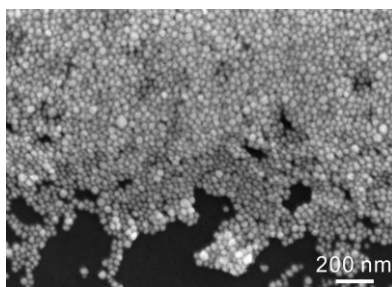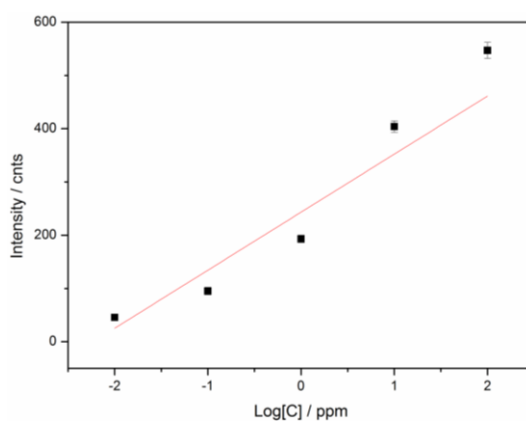Section 3: The Raman spectra of MAMP.

Figure S3 The normal Raman spectrum of MAMP powder.

Section 4: The SEM observation of GNP arrays on Si wafer surface.

Figure S4. The SEM observation of GNP arrays on Si wafer surface.

Section 5: The linear relationship between intensity at 1030 cm^{-1} and concentration of MAMP.

Figure S5. The linear relationship between Raman intensity at 1206 cm^{-1} and the logarithm of MAMP concentrations.

The intensity of the 1206 cm^{-1} peak exhibited a good linear relationship with the concentration ranging from 100 ppm to 10 ppb. The calibrated linear regression equation is I_{1206} = [*MAMP*]*108.99 + 243.25, and the correlation coefficient (R^2) is 0.8865.

Section 6: The SERS spectra for the multiphase detection of CV and MAMP.
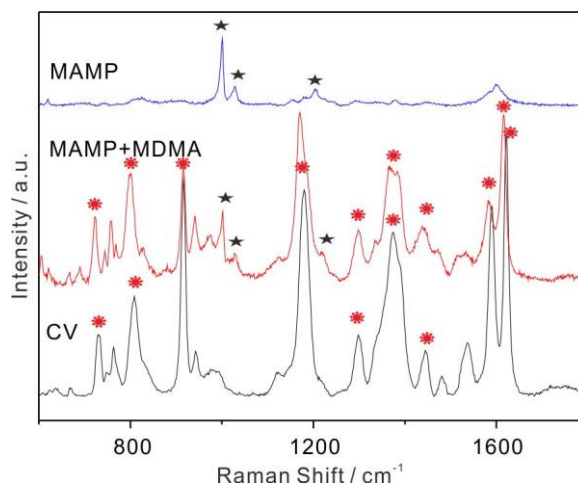
Figure S6. SERS spectra for the multiphase detection of 0.05 nmol CV and 57.1 nmol MAMP (red line), sole 0.025 nmol CV (black line) and 57.1 nmol MAMP (blue line) in human urine.

References

(1)   Lee, P. C.; Meisel, D. *J. Phys. Chem.* **1982**, *86*, 3391.

(2)   Han, Z. Z.; Liu, H. L.; Wang, B.; Weng, S. Z.; Yang, L. B.; Liu, J. H. *Anal. Chem.* **2015**, *87*, 4821.

(3)   Shin, Y.; Song, J.; Kim, D.; Kang, T. *Adv. Mater.* **2015**, *27*, 4344.