Electronic Supplementary Information

Graphene Oxide Embedded Sandwich Nanostructures for Enhanced Raman Readout

and Their Applications in Pesticides Monitoring

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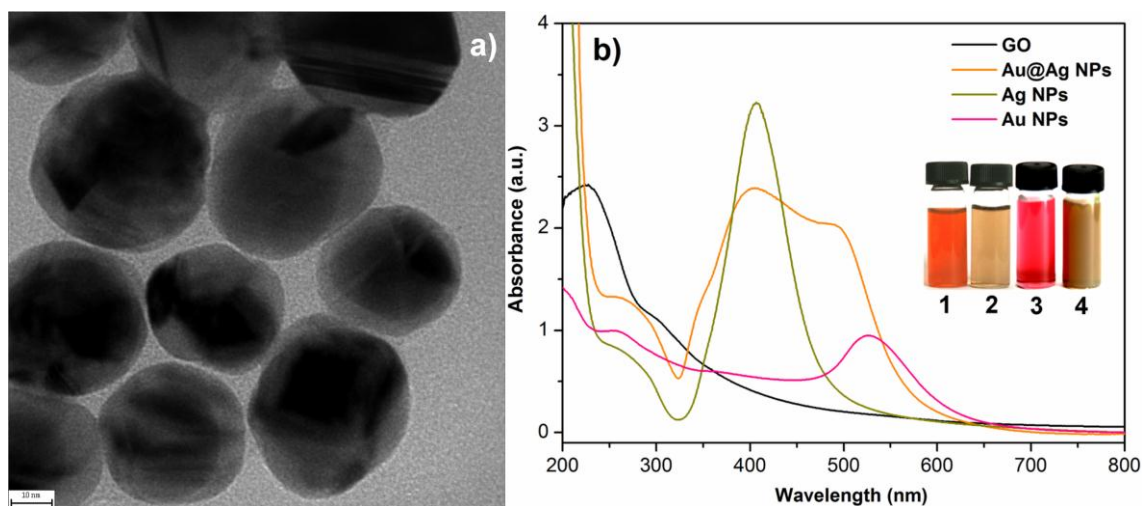
Figure S1. a) TEM image of the synthesized Au@Ag NPs. The scale bar is 10 nm. b) UV-Vis absorption spectra of the synthesized Au@Ag NPs, GO, Au NPs and Ag NPs dispersed in water. The inset is the photograph of the synthesized Au@Ag NPs (1), GO (2), Au NPs (3) and Ag NPs (4) dispersed in water.
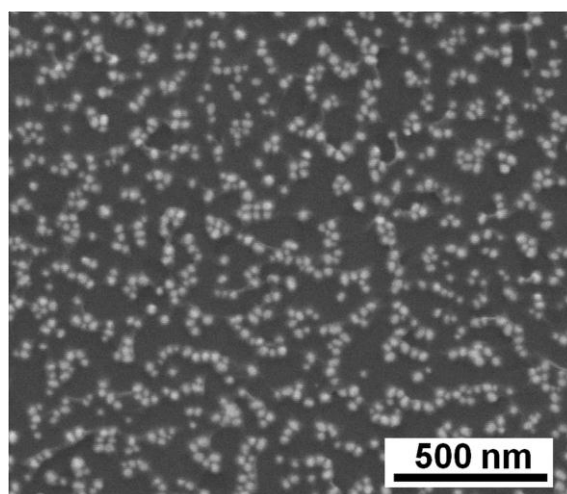

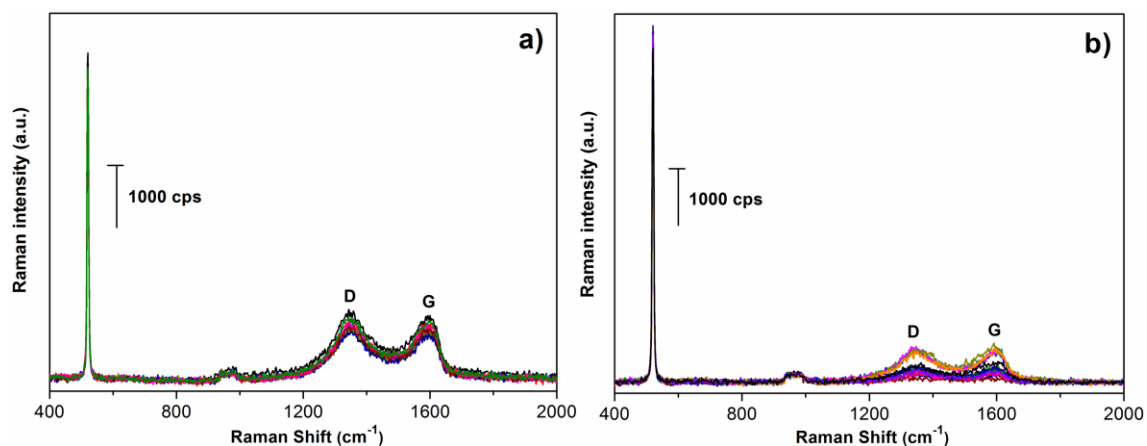**Figure S2.** Enlarged SEM image of GO coated Au@Ag NPs film.

Figure S3. a) Raman signals of GO on the PEI modified Au@Ag NPs film collected from 10 random spots. b) Raman signals of GO on the non-PEI modified Au@Ag NPs film collected from 10 random spots.
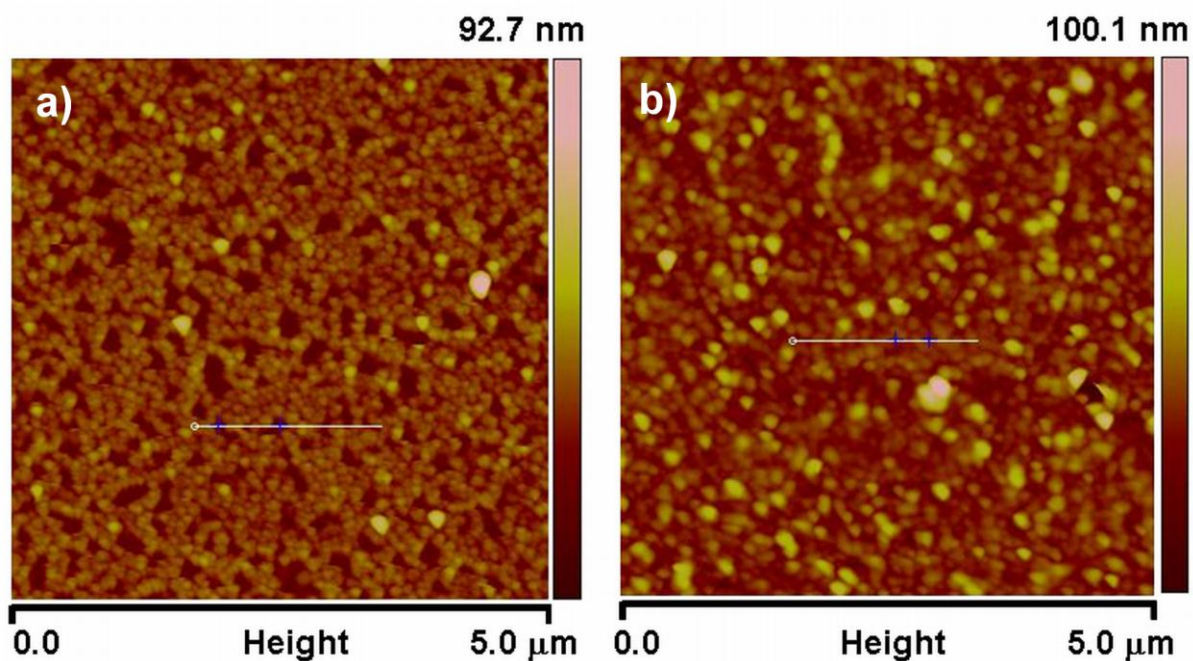

Figure S4. The typical AFM images of a) assembled Au@Ag NPs film, b) GO coated Au@Ag NPs film.

Table S1. Measured Average Zeta-Potential of GO and Au@Ag NPs.

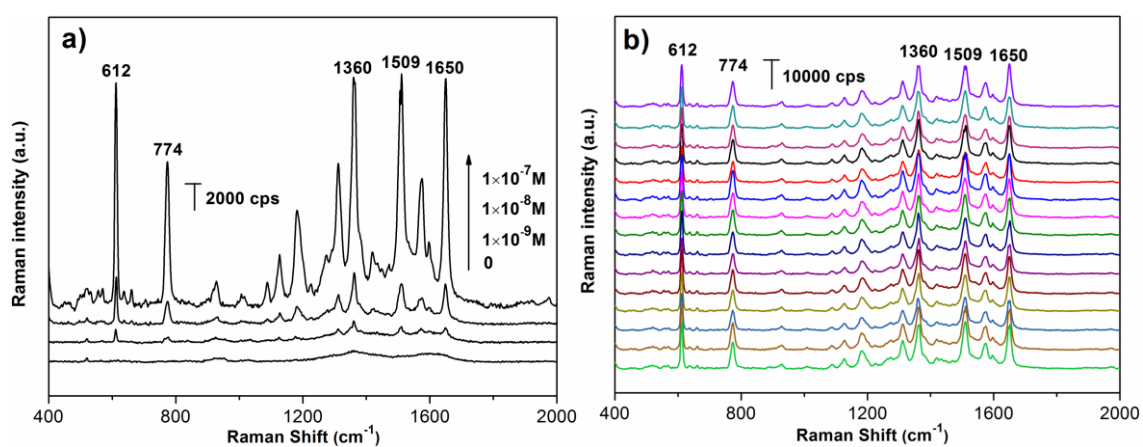|	GO	Au@Ag NPs
Zeta-Potential (mV)	-35.2	-53.4

Figure S5. a) SERS spectra of different concentrations of R6G dispersed on the prepared substrate. b) SERS spectra recorded from 15 random spots for 10^{-7} M R6G on the substrate.
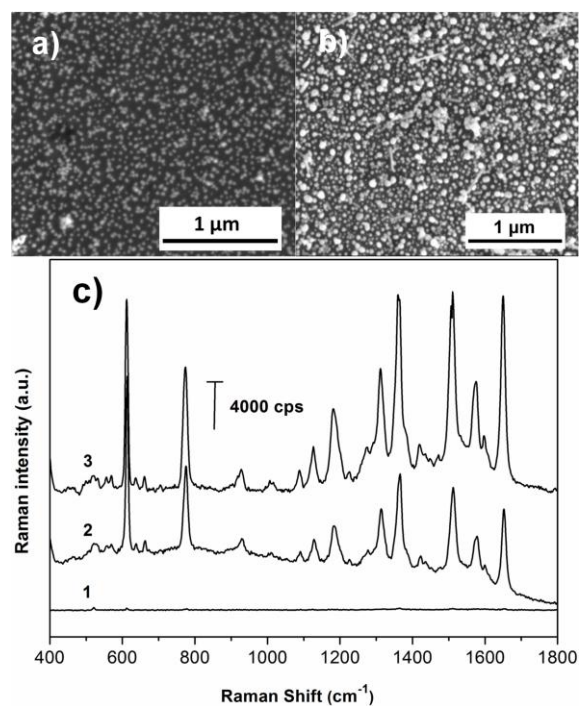
Figure S6. SEM images of a) assembled Au NPs/GO/Au NPs and b) Ag NPs/GO/ Ag NPs sandwich structure. (c) SERS spectra of 10^{-7} M R6G in ethanol on Au NPs/GO/Au NPs (curve 1), Ag NPs/GO/ Ag NPs (curve 2), and Au@Ag NPs/GO/Au@Ag NPs (curve 3).
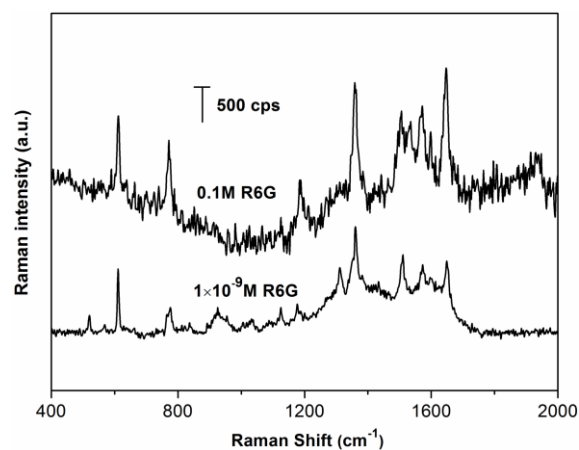

Figure S7. Raman spectra of 0.1 and 1×10^{-9} M rhodamine-6G (R6G) on a silicon substrate (upper) and on the Au@Ag NPs/GO/Au@Ag NPs film (bottom), respectively.
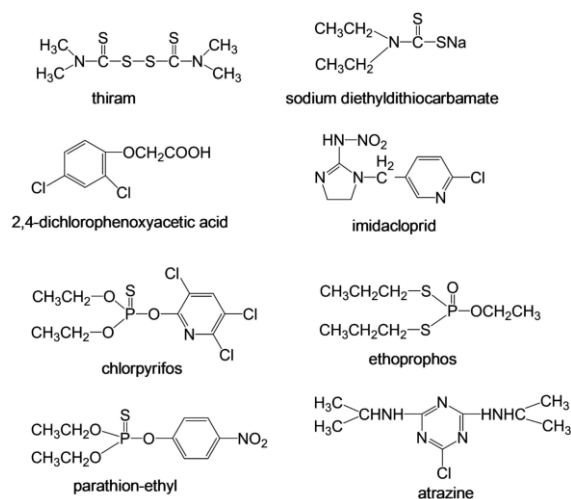
Figure S8. The chemical structures of the agricultural chemical compounds used for the selectivity study.
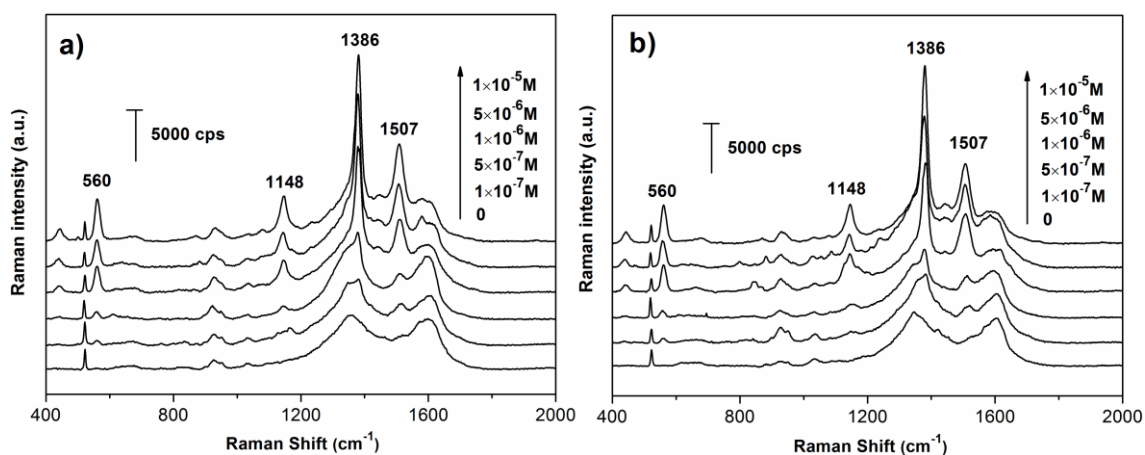

Figure S9. SERS spectra of thiram in ultrapure water a), real lake water b) at different spiked concentrations, respectively.