Electronic Supplementary Material (ESI) for Analytical Methods.

Plasmonic AgNPs decorated heterostructure substrate for synergetic surface-enhanced Raman scattering identification and quantification of pesticide residues on real samples

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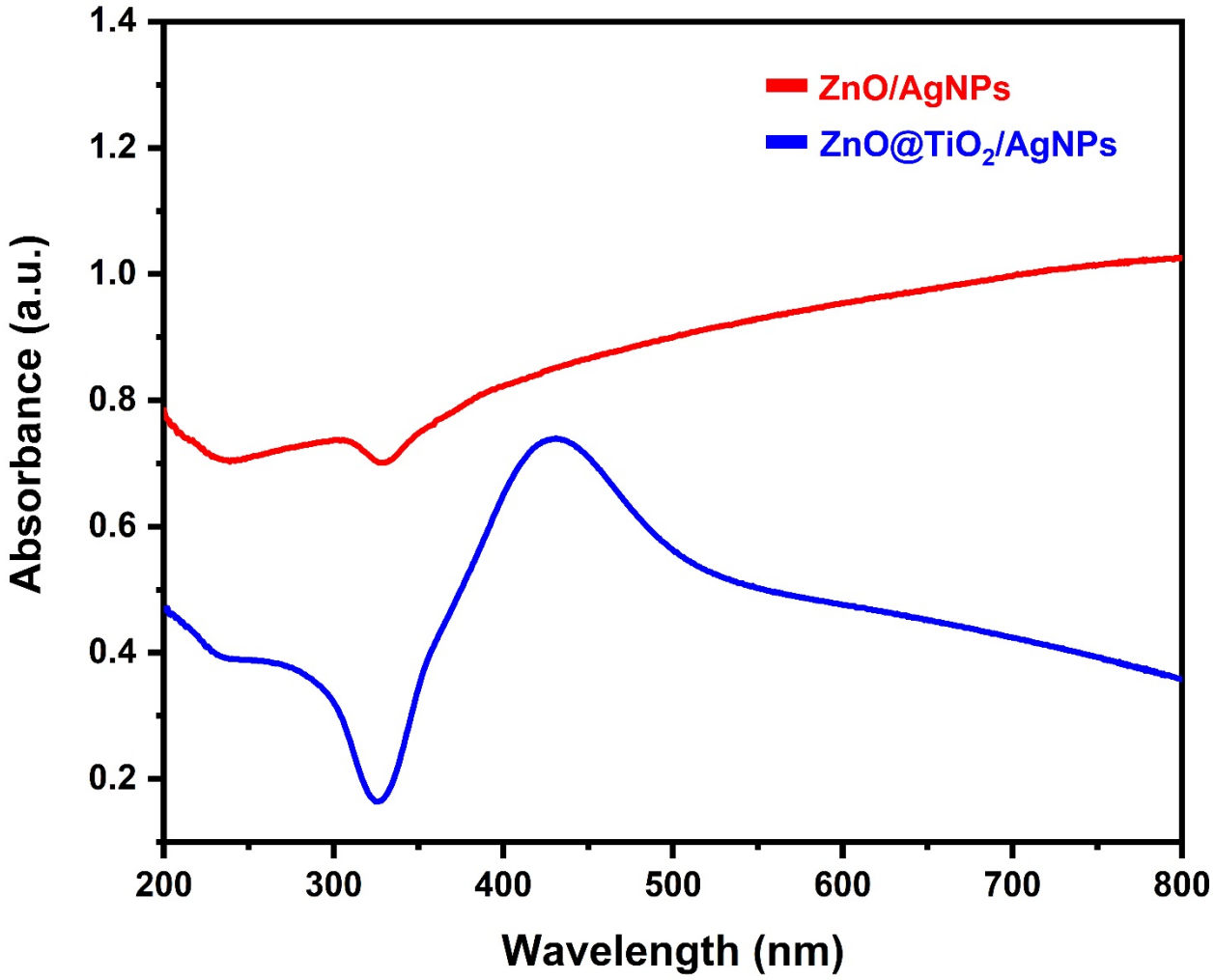

Fig. S1. Ultraviolet absorption spectra of ZnO/AgNPs and ZnO@TiO_2/AgNPs.

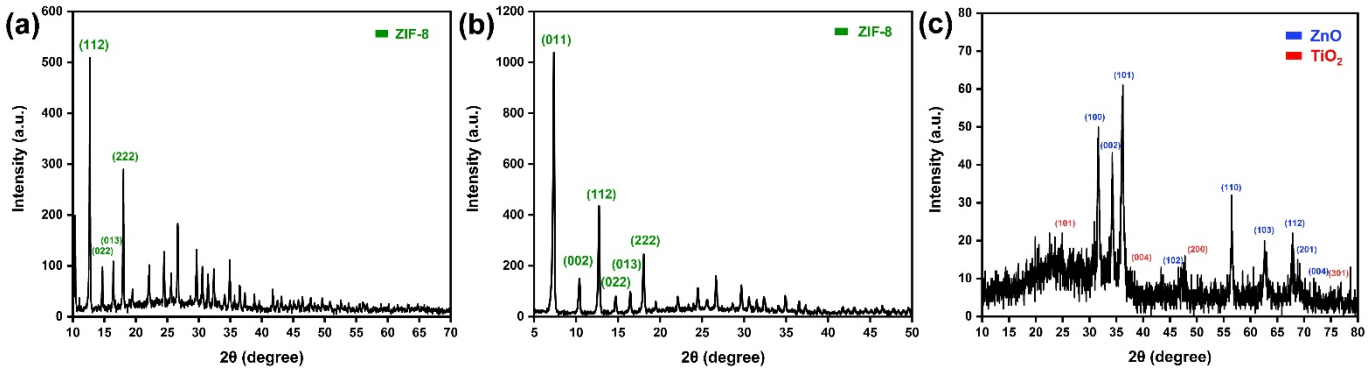

Fig. S2. XRD patterns of different samples: (a) ZIF-8; (b) ZIF-8@TiO_2; (c) ZnO@TiO_2.

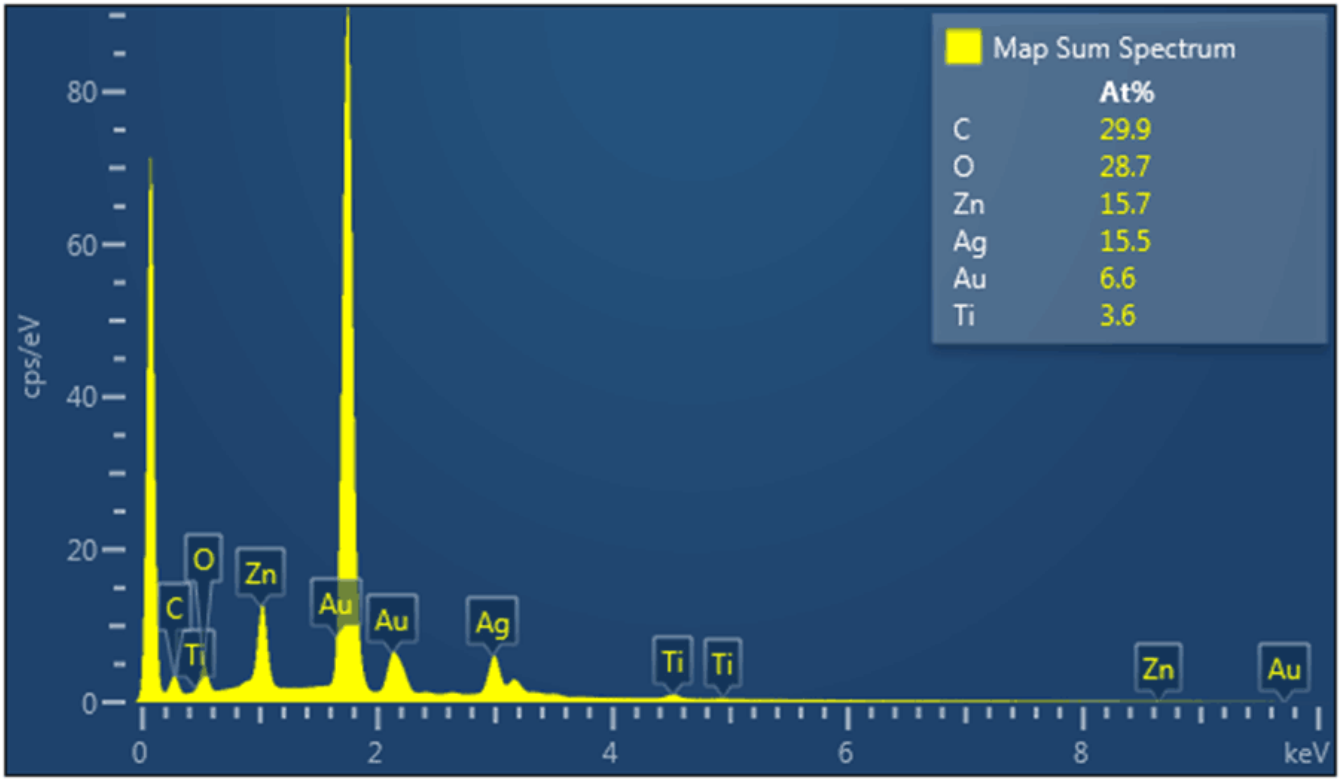

Fig. S3. EDS spectrum of ZnO@TiO_2/AgNPs sample.

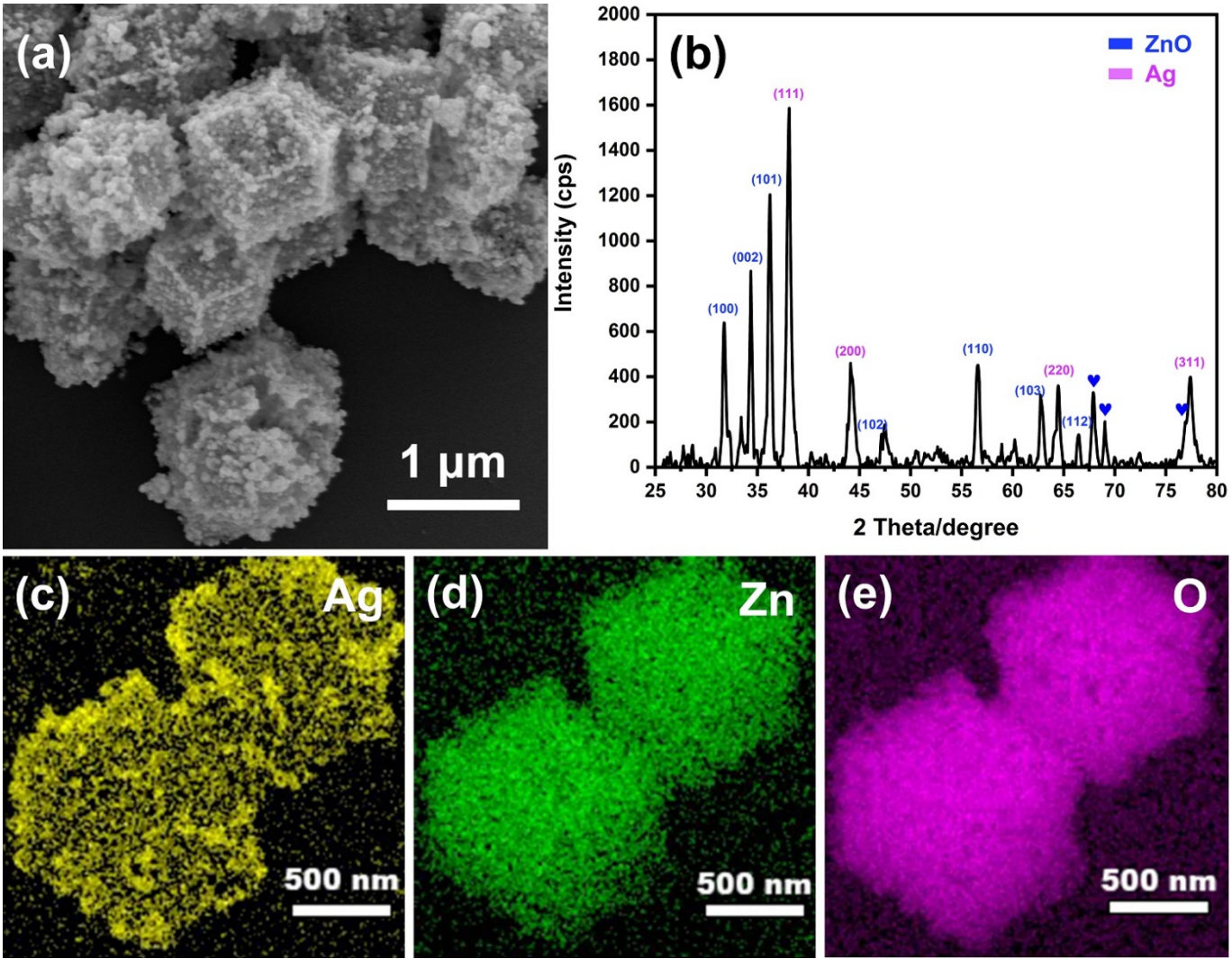

Fig. S4. (a) SEM images of ZnO/AgNPs, (b) XRD patterns of ZnO/AgNPs, (c-e) element mapping

of ZnO/AgNPs.

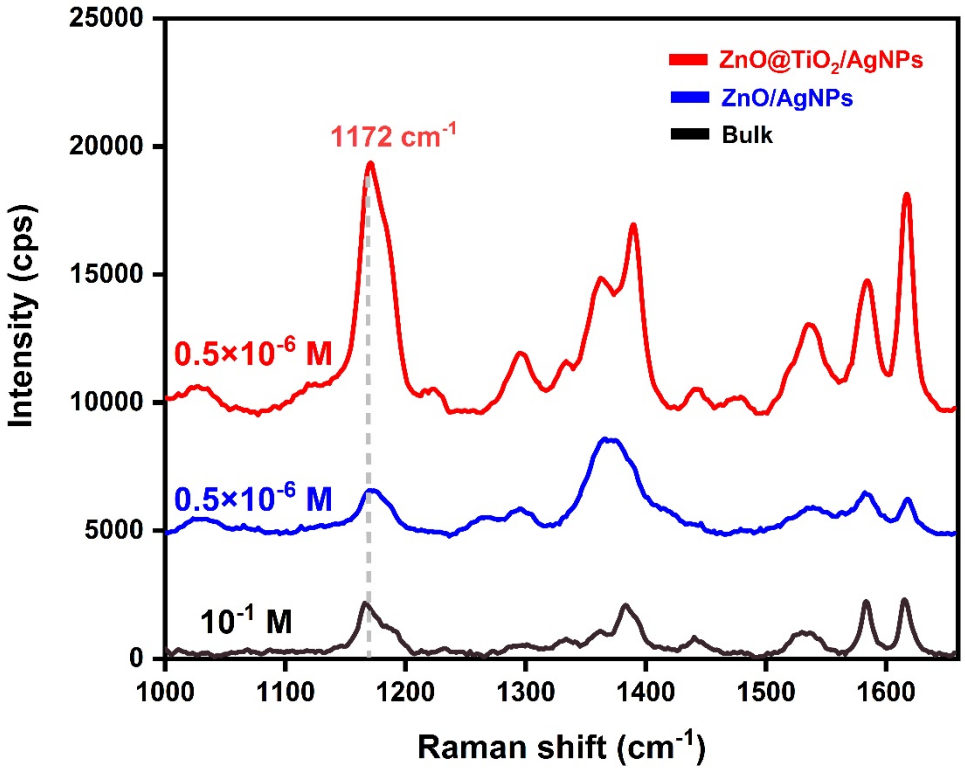

Fig. S5. SERS spectra obtained from bulk CV (10^{-1} M), ZnO/Ag substrate with CV (0.5×10^{-6} M) and ZnO@TiO_2/AgNPs substrate with CV (0.5×10^{-6} M)

Calculation of SERS enhancement factor (EF)

To quantify the enhancement contribution from ZnO/AgNPs and ZnO@TiO_2/AgNPs substrates, we calculated their enhancement factor (EF) based on the following formula:

$EF = (I_{SERS} / I_{BULK}) \times (N_{BULK} / N_{SERS})$

where I_{SERS} and I_{BULK} represent the intensities of SERS and normal Raman scattering, whereas N_{SERS} and N_{BULK}, respectively, denote the numbers of corresponding CV molecules effectively excited by a laser beam. According to the above formula, the EF for the ZnO/AgNPs substrate is calculated to be 0.86×10^5. The EF is calculated to be 7.68×10^5 for the ZnO@TiO_2/AgNPs substrate.

N_{BULK} = (Laser spot area/Diffusion area) * (N_A * Volume $_{BULK}$ * Concentration $_{BULK}$)

N_{SERS} = (Laser spot area/Substrate area) * (N_A * Volume $_{SERS}$ * Concentration $_{SERS}$)

Diffusion area=$\pi(d/2)^2=0.5027 cm^{-2}$

Substrate area=$0.25 cm^{-2}$

Volume $_{BULK}$ =Volume $_{SERS}$

Concentration $_{BULK}$ = 10^5 * Concentration $_{SERS}$

$N_{BULK} / N_{SERS} = (0.25/0.5027) \times10^5=4.97\times10^4$

I = intensity of the 1172 cm^{-1} peak

I $_{BULK}$=21196.96 a.u.

I $_{SERS,\ ZnO/AgNPs}$=36739.28 a.u.

I $_{SERS,\ ZnO/AgNPs}$/I $_{BULK}$=1.73

$EF = (I_{SERS} / I_{BULK}) \times (N_{BULK} / N_{SERS}) =0.86\times10^5$

$I_{SERS,\ ZnO@TiO2/AgNPs}$ =327581.56 a.u.

$I_{SERS,\ ZnO@TiO_2/AgNPs} / I_{BULK} = 15.45$

$EF = (I_{SERS} / I_{BULK}) \times (N_{BULK} / N_{SERS}) = 7.68 \times 10^5$.