Supplementary Material

Surface-enhanced Raman spectroscopy (SERS) substrate based on gold nanostars–silver nanostars for imidacloprid detection

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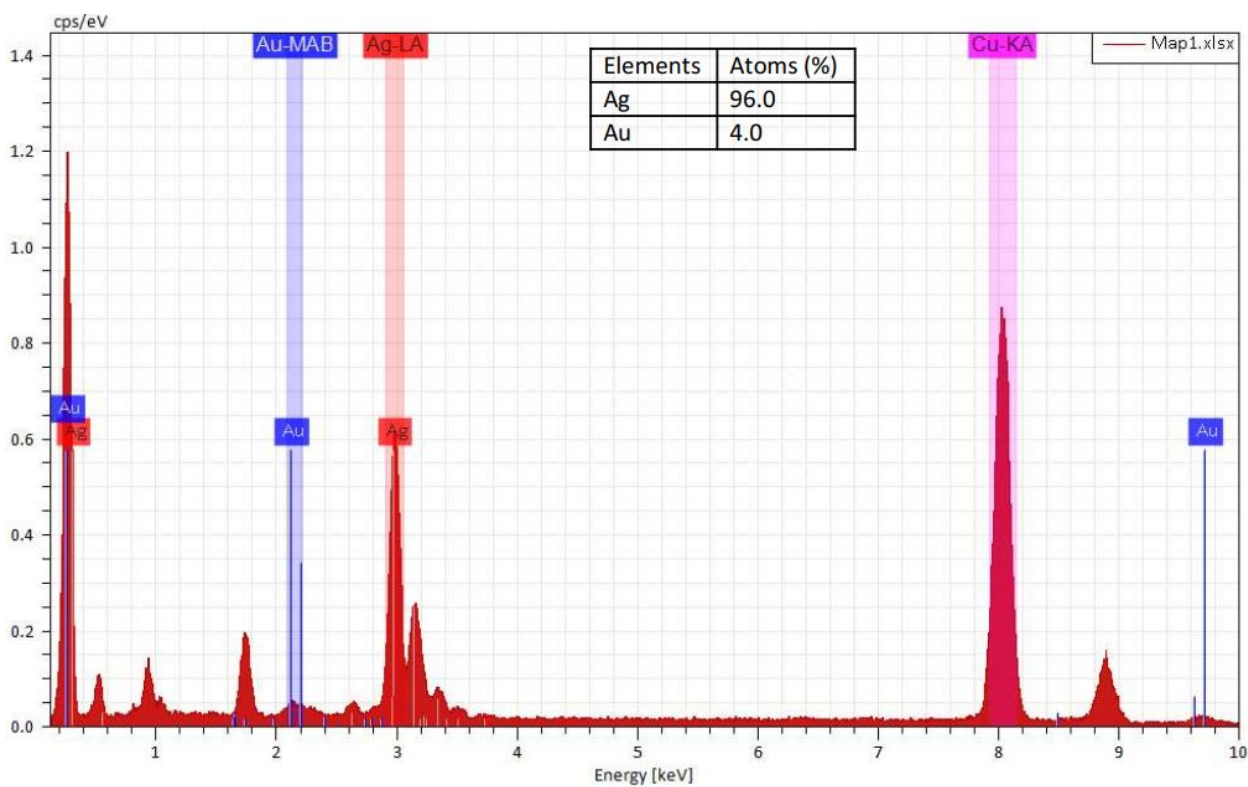*Correspondence to: Email: n.abubakar@uq.edu.au, norhayati.ab@ukm.edu.my

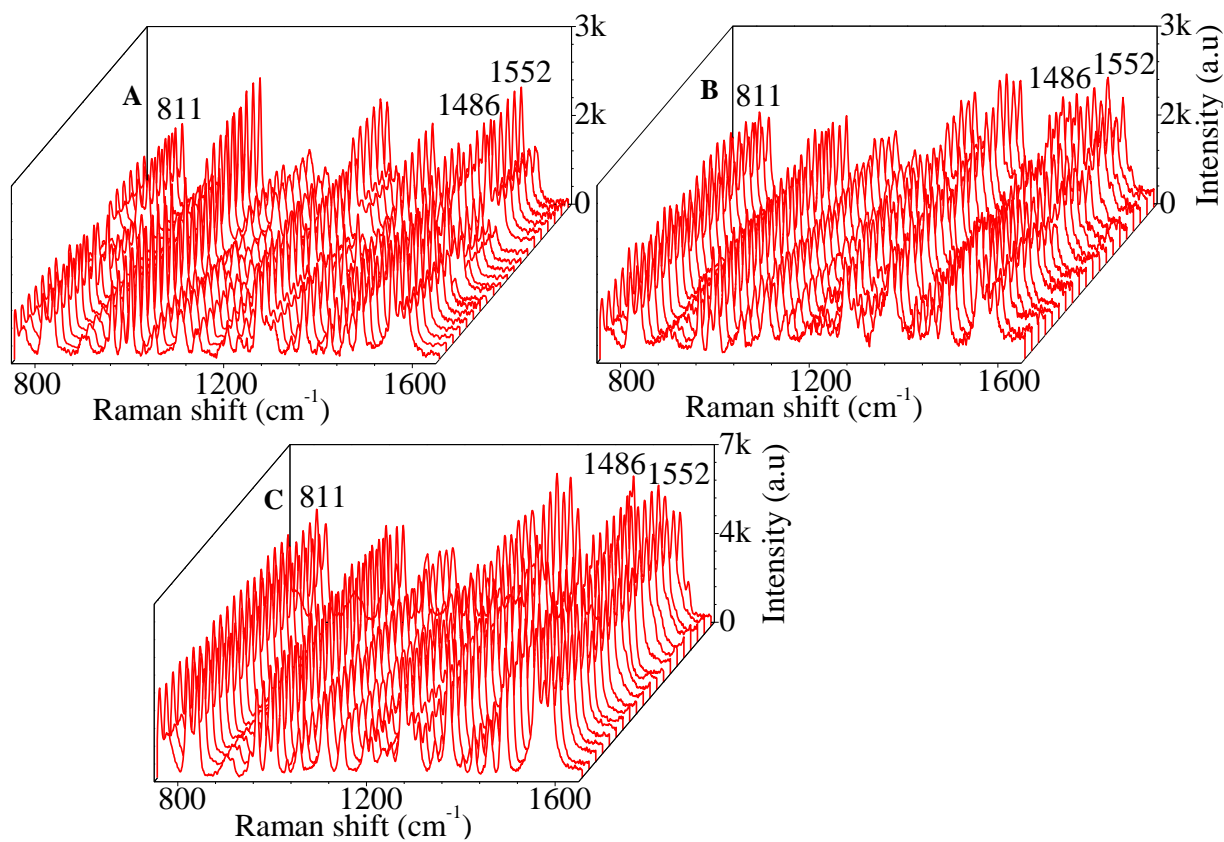**Fig. S1.** EDS analysis of AuNs/AgNs solution dropped on carbon grid.

Fig. S2. SERS measurement of 1 mg mL^{-1} IMD pesticide for 20 spots of the same SERS substrate surface
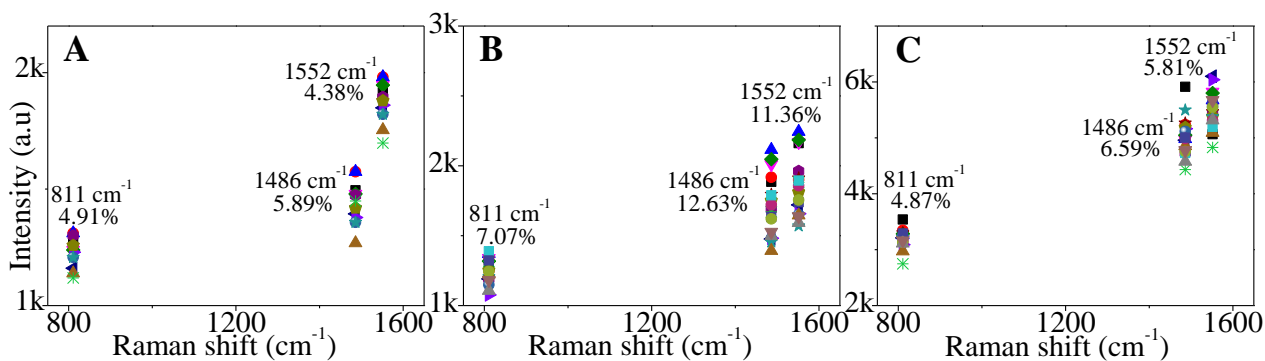
(A) AuNs, (B) AgNs, (C) AuNs/AgNs.

Fig. S3. RSD for 20 different spots of 1 mg mL^{-1} IMD on the same SERS substrate surfaces (A) AuNs, (B) AgNs, (C) AuNs/AgNs.
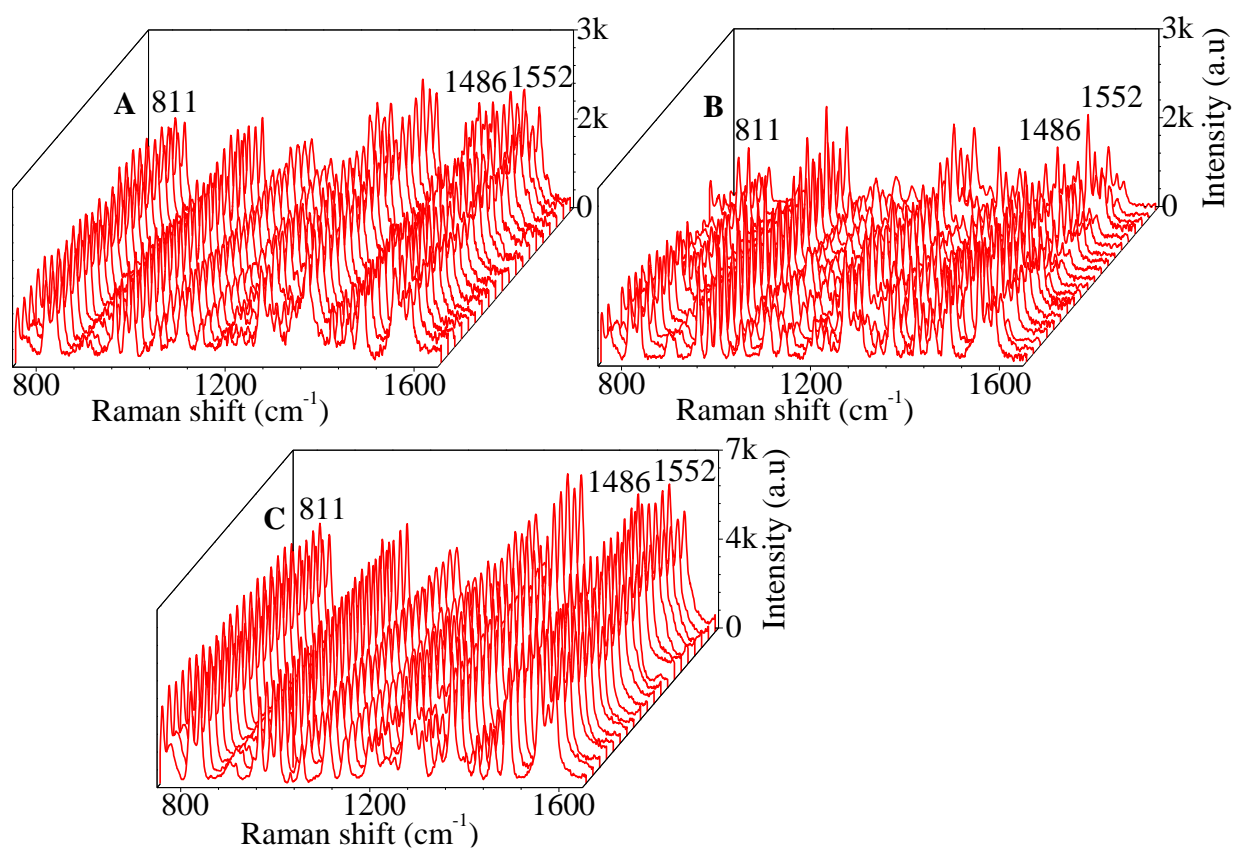

Fig. S4. SERS measurement of 1 mg mL^{-1} IMD pesticide for 20 different samples of SERS substrate surfaces (A) AuNs, (B) AgNs, (C) AuNs/AgNs.
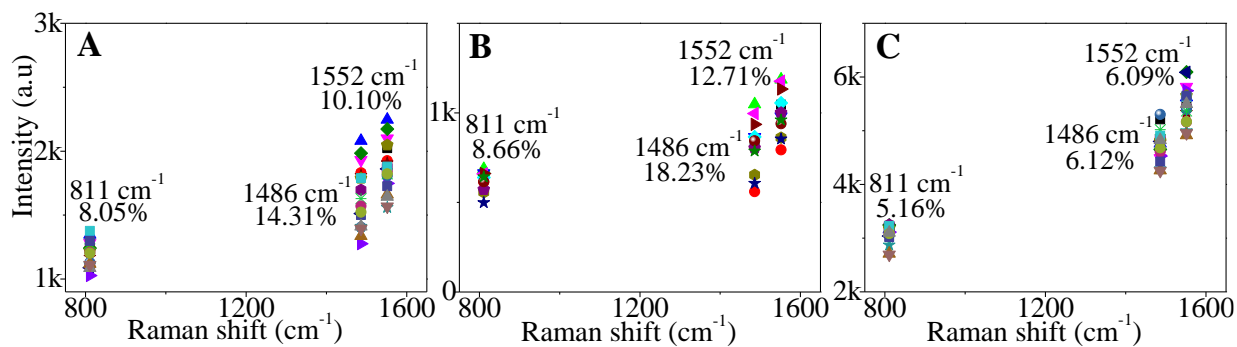
Fig. S5. RSD for 20 different samples of 1 mg mL^{-1} IMD on SERS substrate surfaces (A) AuNs, (B) AgNs, (C) AuNs/AgNs.
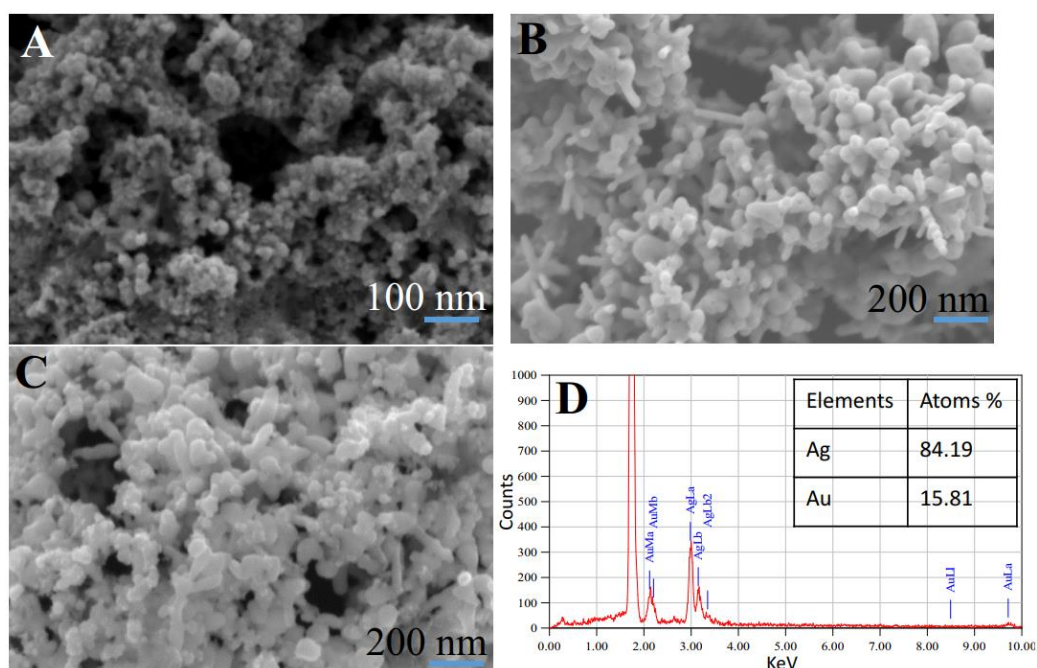

Fig. S6. SEM images for SERS substrate surfaces after 5th cycle washing (A) AuNs, (B) AgNs, (C) AuNs/AgNs, (D) Atomic percentage of AuNs/AgNs surfaces after 5th washing cycle.
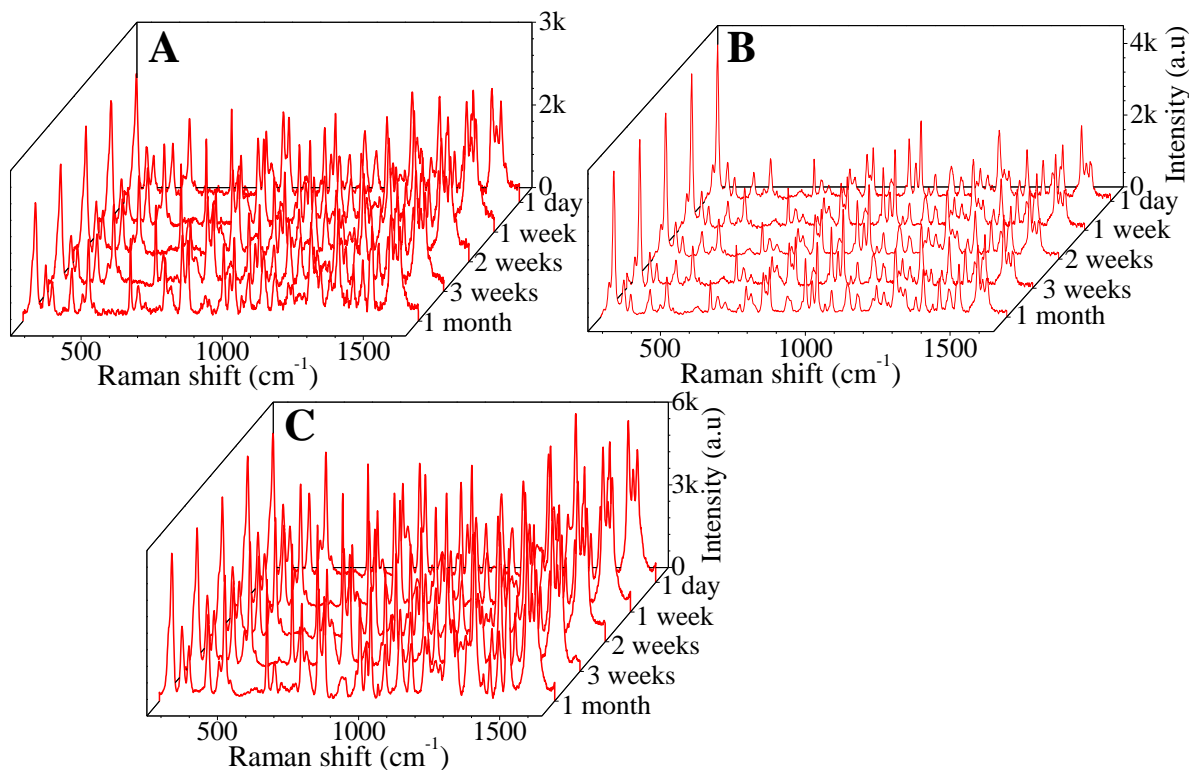
Fig. S7. The SERS signal stability of 1 mg mL^{-1} IMD on SERS substrate surfaces (A) AuNs, (B) AgNs, (C) AuNs/AgNs.
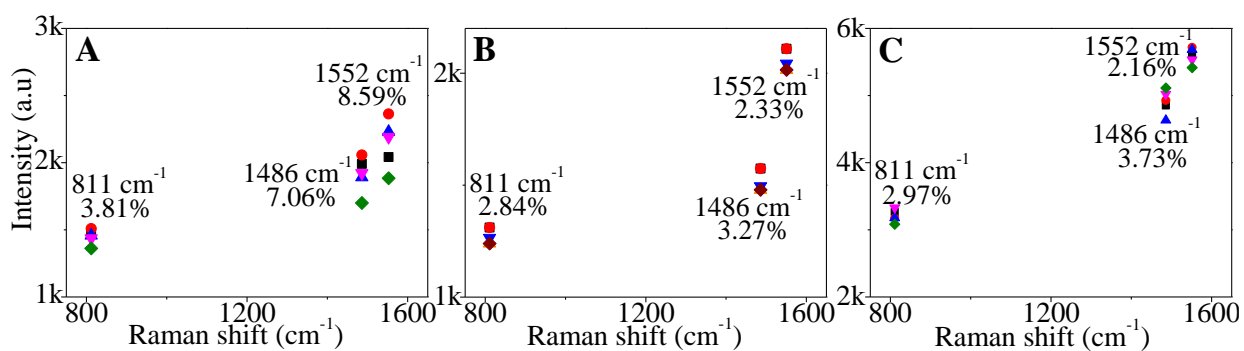

Fig. S8. RSD for three peaks from 1 day to 1 month on SERS substrate surfaces (A) AuNs, (B) AgNs, (C) AuNs/AgNs.

Table S1.   The vibrational assignment for the SERS signal of imidacloprid.

SERS (cm^{-1})	Assignments
295	C-H rocking, C-Cl bending
329	C-N wagging, C-N bending
477	C-N rocking, C-N bending, C-Cl stretching, C-C wagging, C-N twisting
628	C-N bending, C-C bending
751	N-O bending, C-N bending, C-C stretching, C-H rocking
811	C-N bending, C-C stretching, C-Cl stretching, C-H rocking
997	C-N bending, C-N bending
1106	C-H bending, C-Cl stretching
1140	C-C bending, C-H wagging
1190	C-H twisting
1242	C-C twisting, C-H wagging, C-N stretching, N-N stretching
1266	N-O stretching, C-H twisting, C-H wagging, C-H bending
1300	C-H wagging, C-H bending, N-O stretching
1363	C-C stretching, C-N stretching, C-H wagging
1450	C-C stretching, C-N stretching, C-H bending
1486	C-H bending
1552	C-C stretching
1583	C-C stretching