Electronic Supplementary Material (ESI) for Analyst.

Electronic Supplementary Information for

The disordered silver nanowires membrane for extraction surface-enhanced Raman spectroscopy detection

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16. SERS spectra of the contaminants in drinking water absorbed on the membrane by flow-through method.

1. Intensity of the 1076 cm^{-1} PATP Raman peak with different loading volumes of the silver nanowires colloid into the membrane.

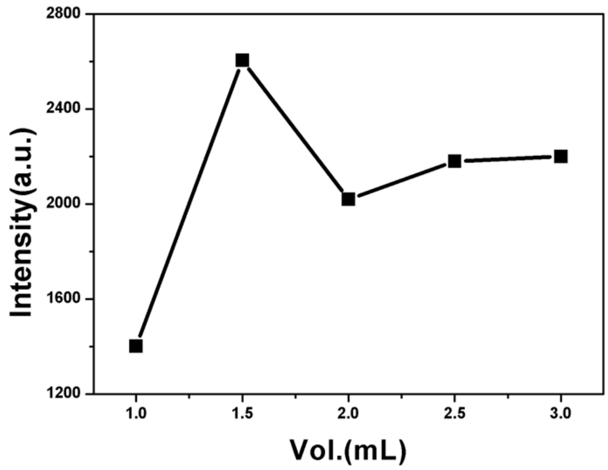


Fig. S1 Intensity of the 1076 cm^{-1} PATP SERS peak with different loading volumes of the silver nanowires colloid into the membrane.

2. UV-Vis absorption spectrum of silver nanowires.

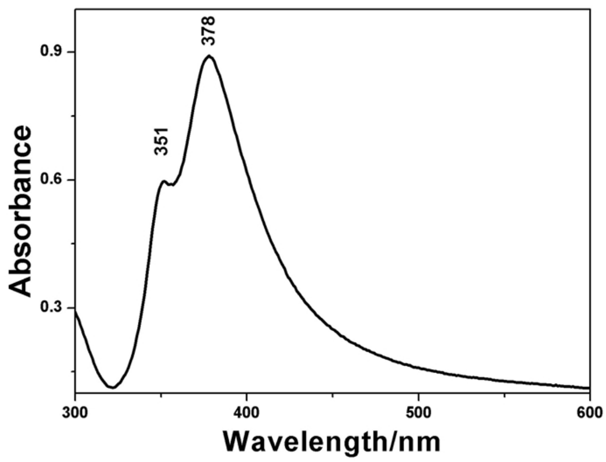


Fig. S2 UV-Vis absorption spectrum of the silver nanowires.

3. SEM image of the membrane without coating silver nanowires.

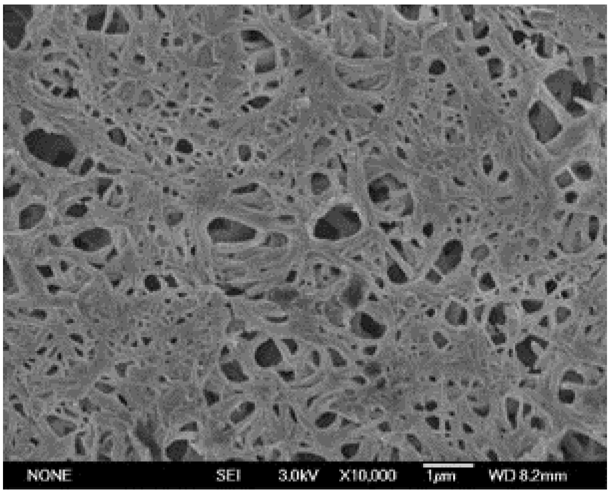
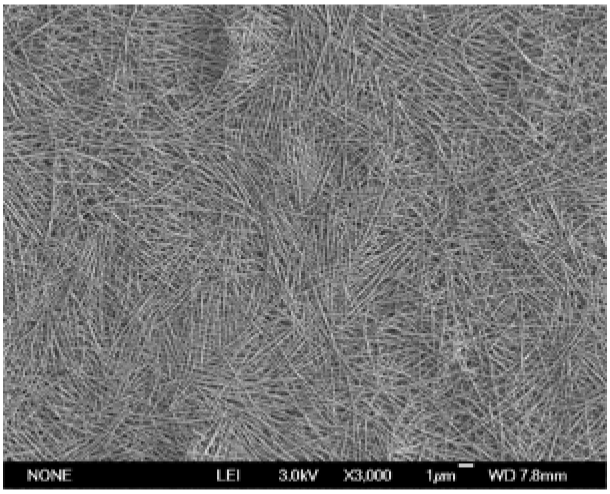


Fig.S3 SEM image of the membrane without coating silver nanowires.

4. SEM image of silver nanowires loaded into the filter membrane.



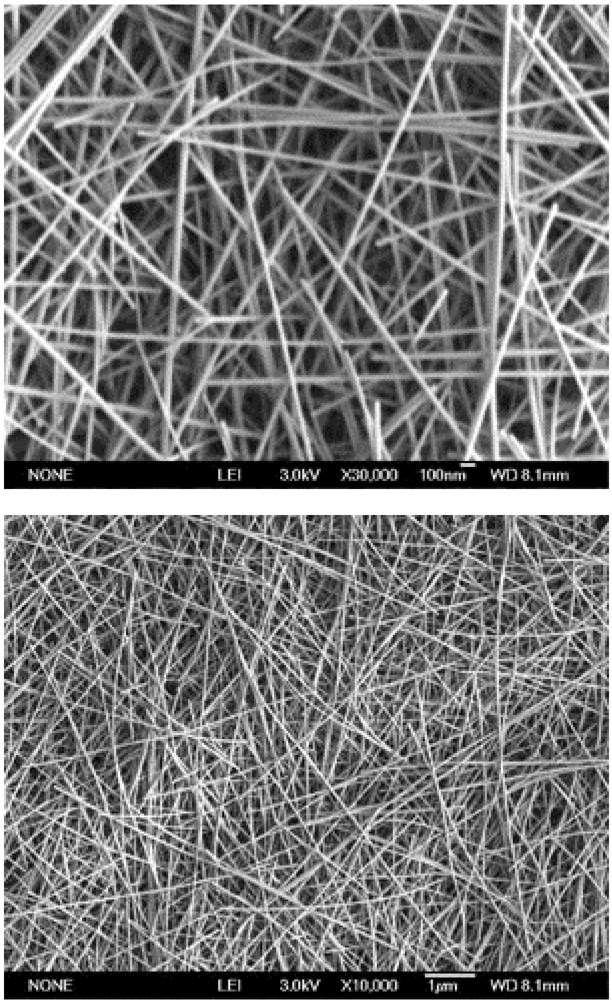


Fig. S4 SEM image of silver nanowires loaded into the filter membrane.

5. Cross-sectional SEM images of the silver nanowires membrane.

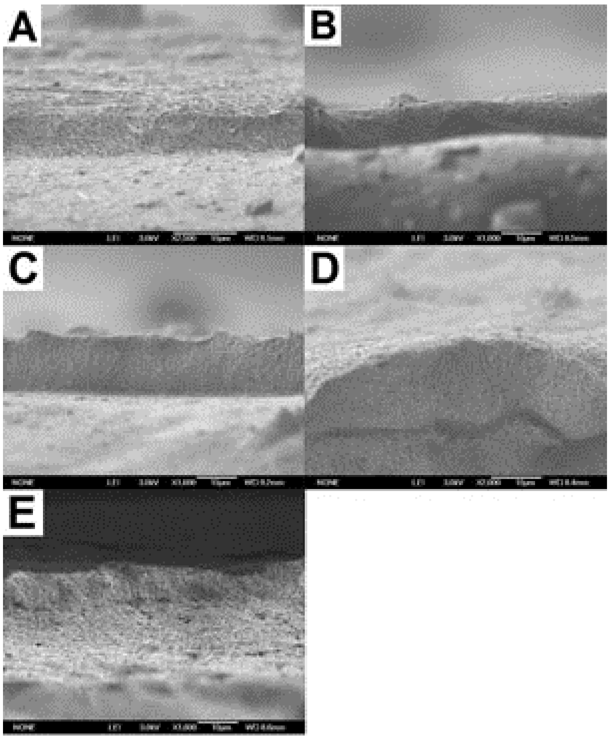


Fig. S5 Cross-sectional SEM images of the silver nanowires membrane by filtering (A) 1.0 mL; (B) 1.5 mL; (C) 2.0 mL; (D) 2.5 mL; (E) 3.0 mL silver nanowires colloid.

6. The calculation of the pore density of the silver nanowires membrane.

Given that the pore size distribution of silver nanowires membrane is uniform. The pore density of the silver nanowires membrane is calculated by the following equation:

$$\rho = (V_{mem} - V_{Ag}) / m$$

V_{mem} is the volume of silver nanowires membrane and $V_{mem} = S_{mem}h = \Pi r_{mem}^2 \bullet h$; $V_{Ag} = m / \rho_{Ag}$, V_{Ag} is the volume of silver nanowires membrane without pore.

Where h, r and m are the thickness, radius and mass of the silver nanowires membrane, respectively. The density of pure silver is 10.53 g/cm^3. The thicknesses of the silver nanowires membranes have been obtained in SEM image in Fig. S5. The radius of the silver nanowires membrane is 1 cm. The density of the silver nanowires colloid is 18.4 mg/mL.

V/ mL	h/ 10^{-4}cm	ρ/$cm^3 \cdot g^{-1}$
1.0	6.64	0.018
1.5	10	0.018
2.0	13.54	0.020
2.5	16.72	0.019
3.0	21.79	0.022

V, h and ρ are the volume of filtered silver nanowires colloid, thickness and the pore density of the silver nanowires membrane in the above table, respectively.

7. The calculation of enhancement factor of SERS-active silver nanowires membrane.

The enhancement factor (EF) was calculated by the following equation:

$EF= (I_{SERS}/I_{Raman})\cdot(N_{bulk}/N_{ads})$

$N_{ads} =A/A_{sum} \square V_{ads}\cdot C_1$

$N_{bulk}= A\cdot H_{eff}\cdot C_{sol}$

$EF = (I_{SERS}/I_{Raman}) \cdot (A_{eff} \cdot H_{eff} \cdot Csol)/ (A_{eff} /A_{sum}\cdot V_{sum}\cdot C_1)$

$= (I_{SERS}/I_{Raman}) \cdot (A_{sum}\cdot H_{eff} \cdot C_{sol})/ (V_{ads}\cdot C_1)$

$=1.32 \cdot I_{SERS} \cdot C_{sol} / (I_{Raman} \cdot C_1)$

N_{ads} is the number of PATP molecules under laser radiation adsorbed on substrate;

A_{eff} is the effective area of spot size;

A_{sum} is the area of the substrate, 3 mm×3 mm;

V_{ads} is the volume that is spotted onto the substrate, 10 μL;

C_1 is the concentration of the solution that is to be measured.

N_{bulk} is the number of PATP molecules in the scattering volume in bulk solution;

H_{eff} is the effective length of of the scattering volume and here was estimated as the depth of field, 2.2 mm;

C_{sol} is 10^{-4} g/mL PATP solution for the non-SERS measurement.

The enhancement factor value of the SERS-active membrane to P-aminothiophenol was $6.3 \cdot 10^6$.

8. Measured intensity of the 1076 cm^{-1} PATP SERS peak for increasing volumes of sample loaded into the membrane filter.

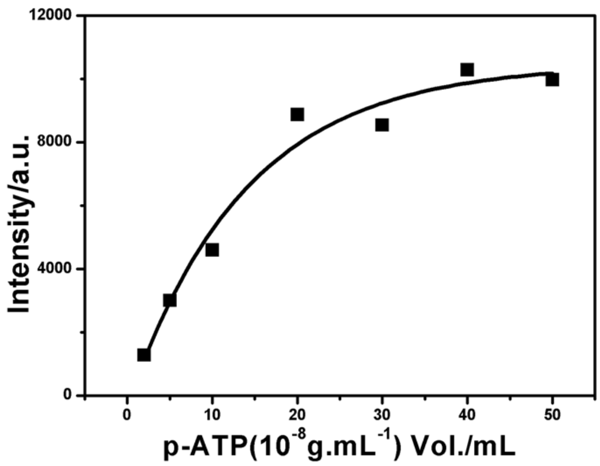


Fig. S6 Measured intensity of the 1076 cm^{-1} PATP SERS peak for increasing volumes of sample loaded into the membrane filter.

9. SERS spectra of phorate and melamine.

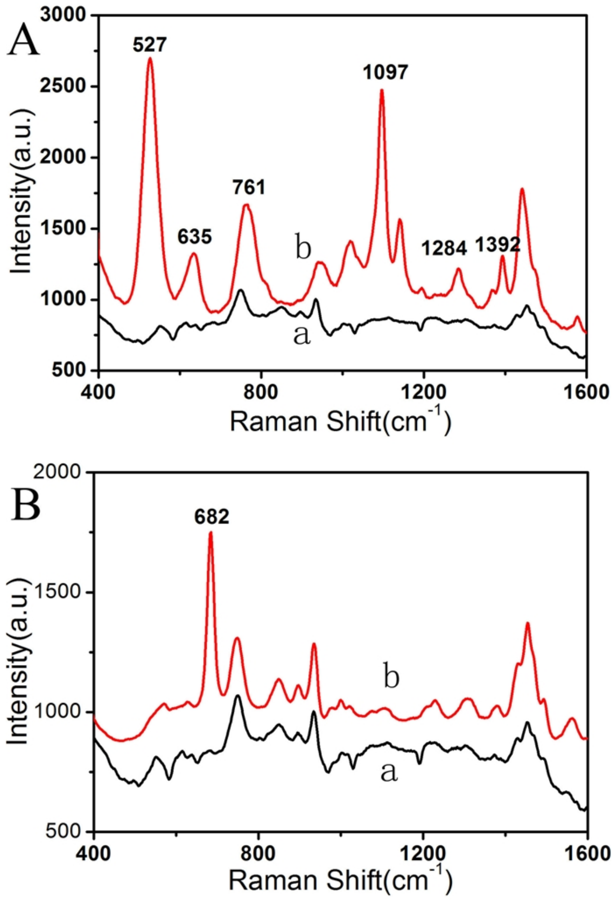


Fig. S7 SERS spectra of phorate (A) and melamine (B). (SERS spectrum of the blank sample (a))

10. Plot of the intensity of the 1076 cm^{-1} SERS peak for different PATP concentrations in aqueous solution.

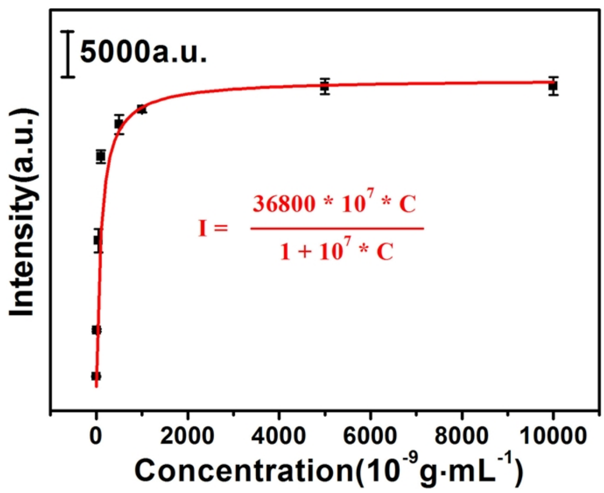


Fig. S8 Plot of the intensity of the 1076 cm^{-1} SERS peak for different PATP concentrations in aqueous solution.

11. Plot of the intensity of the 1097 cm^{-1} SERS peak for different phorate concentrations in aqueous solution.

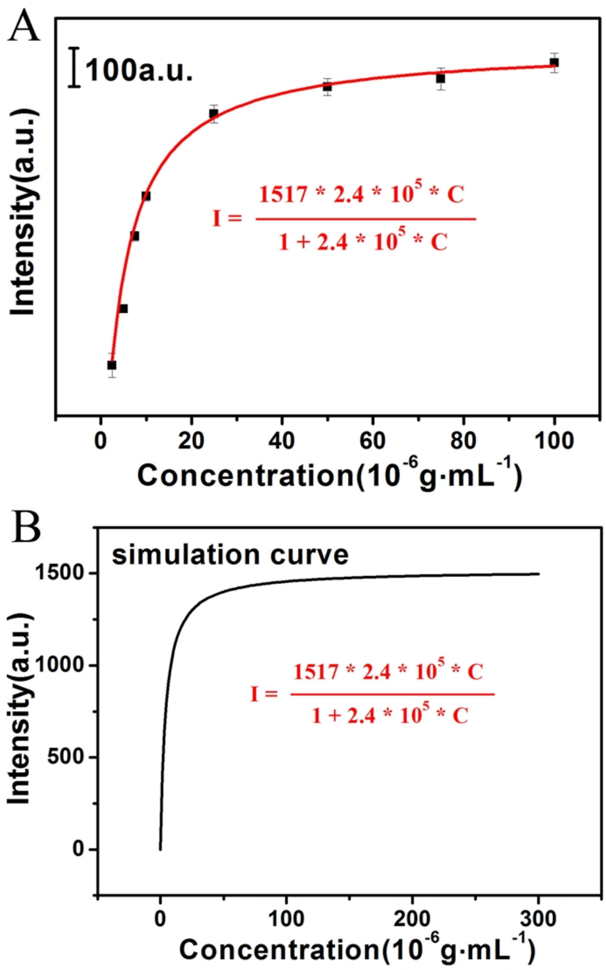


Fig. S9 (A) Plot of the intensity of the 1097 cm^{-1} SERS peak for different phorate concentrations in aqueous solution. (B) Simulation curve of the 1097 cm^{-1} SERS peak for different phorate concentrations in aqueous solution.

12. Plot of the intensity of the 682 cm-1 SERS peak for different melamine concentrations in aqueous solution.

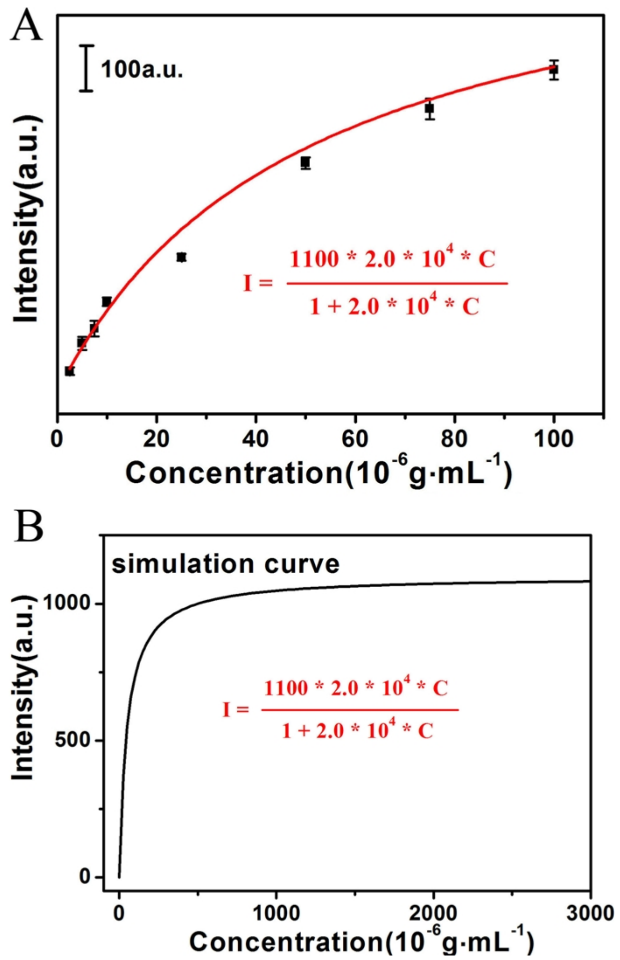


Fig. S10 (A) Plot of the intensity of the 682 cm^{-1} SERS peak for different melamine concentrations in aqueous solution. (B) Simulation curve of the 682 cm^{-1} SERS peak for different melamine concentrations in aqueous solution.

13. Simulated (FDTD) spatial distribution of the electric fields from the y-z (A) and x-y (B) modes of crossed silver nanowires; Inset show the mode of the silver nanowires crossed.

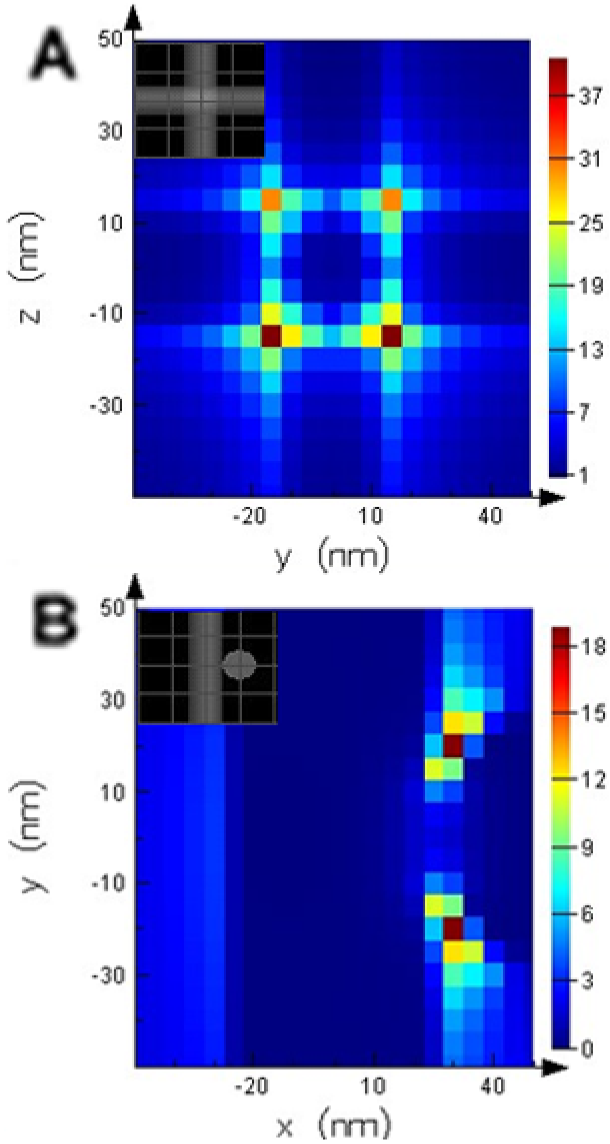


Fig. S11 Simulated (FDTD) spatial distribution of the electric fields from the y-z (A) and x-y (B) modes of crossed silver nanowires. Inset show the mode of the silver nanowires crossed.

14. SERS spectra of the contaminants in ground water absorbed on the membrane by flow-through method.

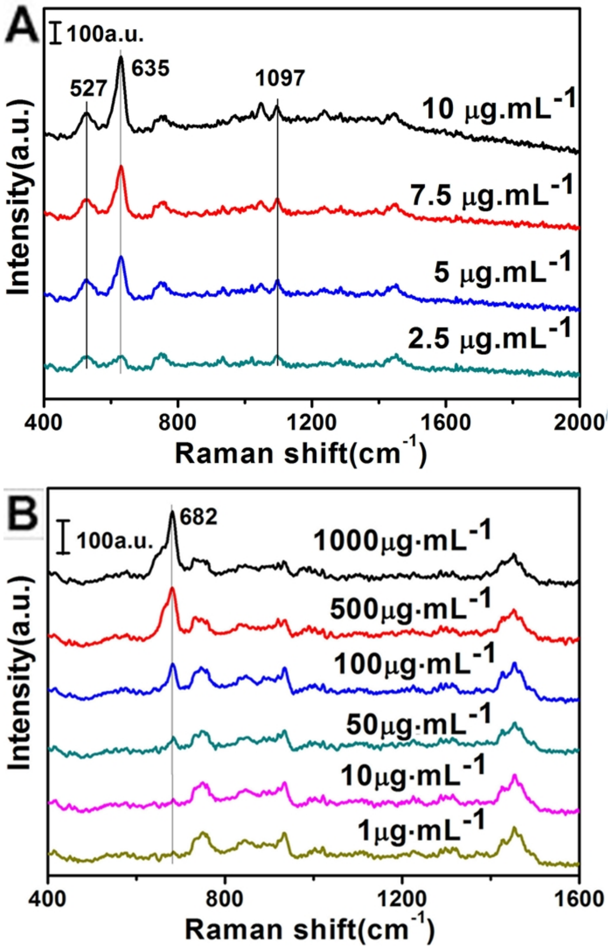


Fig.S12 SERS spectra of (A) phorate and (B) melamine in ground water in the different concentrations by flow-through method.

15. SERS spectra of the contaminants in surface water absorbed on the membrane by flow-through method.

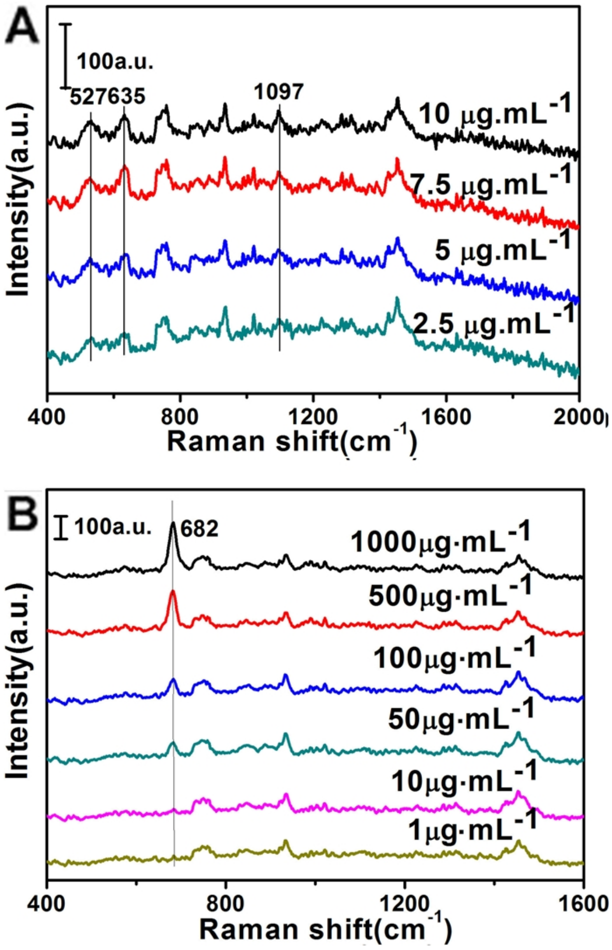


Fig.S13 SERS spectra of (A) phorate and (B) melamine in surface water in the different concentrations by flow-through method.

16. SERS spectra of the contaminants in drinking water absorbed on the membrane by flow-through method.

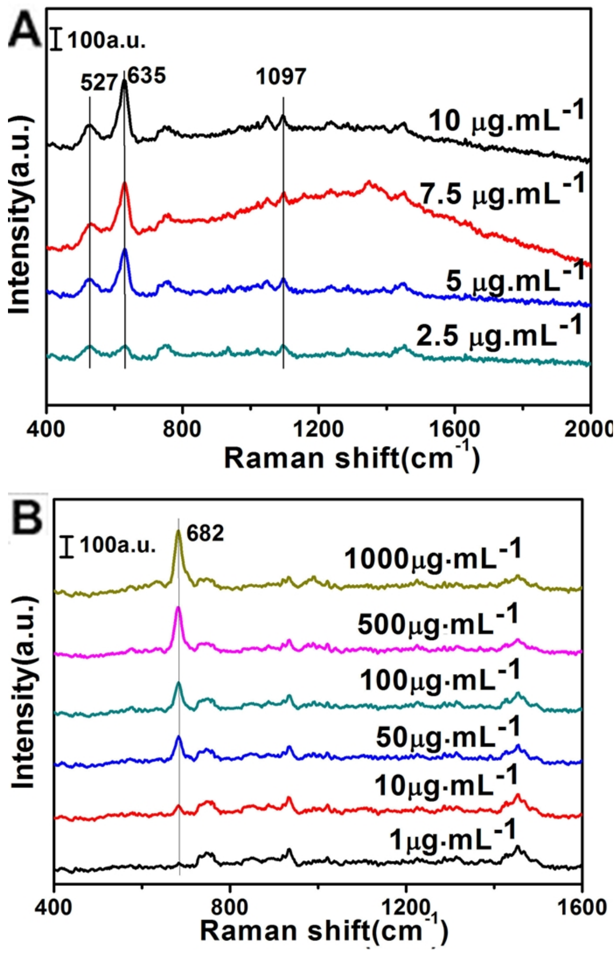


Fig.S14 SERS spectra of (A) phorate and (B) melamine in drinking water in the different concentrations by flow-through method.