

Microplasma-assisted and one-step fabrication of Ag nanoparticle/paper for disposable surface-enhanced Raman scattering substrate

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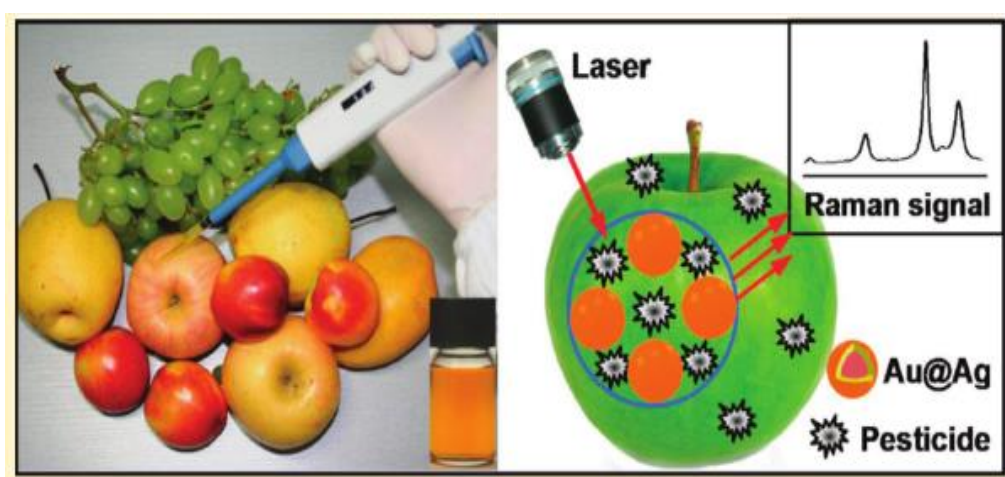
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Motivation

Application

Heavy metal & Pesticide



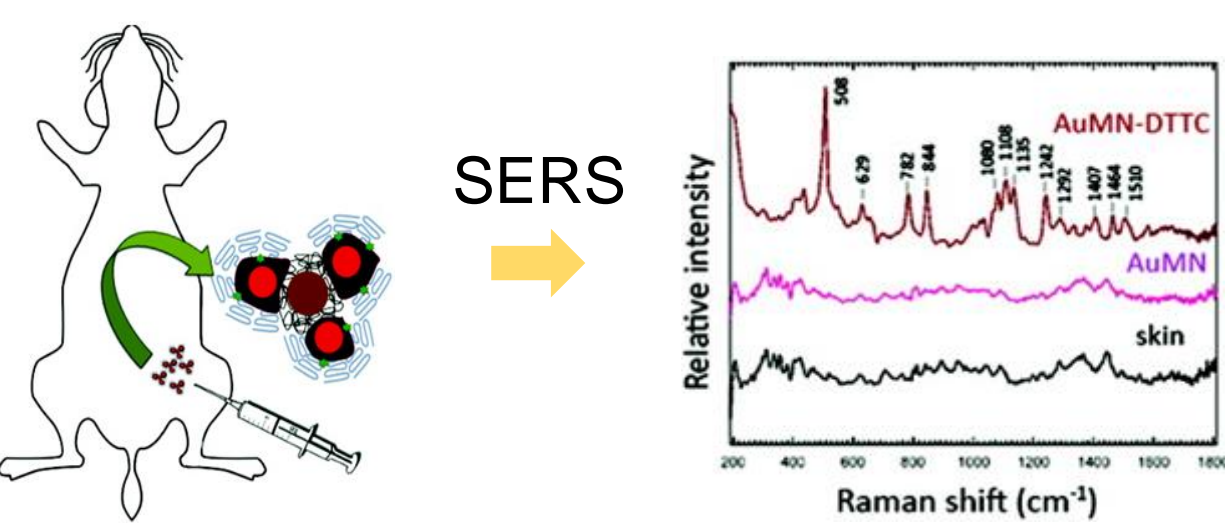
B. Liu et al., Anal Chem (2012)

Explosive



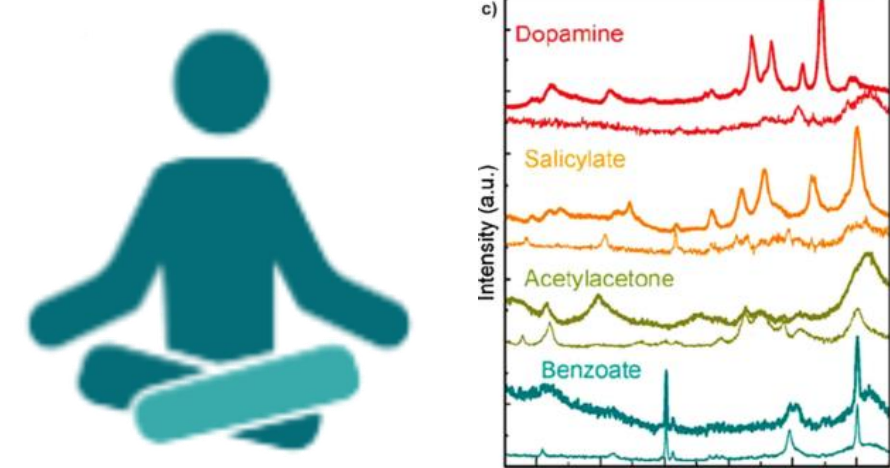
Demeritte et al., Analyst, (2012)

In vivo imaging



Yigit et al., ACS Nano (2011)

Disease



X. Tan et al., Chem Phys Chem (2016)

Approach

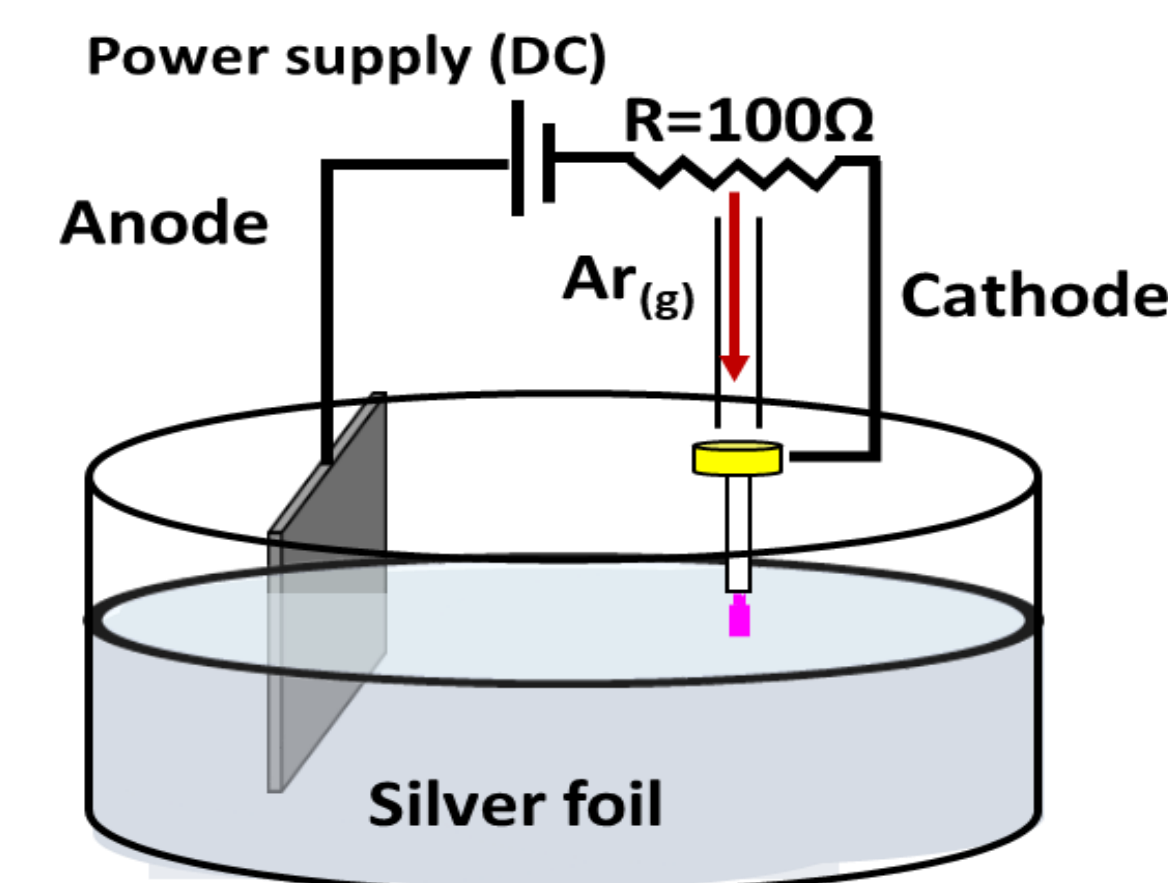
Advantage of paper-based substrate

- ✓ Low-cost analytical tests
- ✓ Flexible property
- ✓ Disposable paper
- ✓ Large surface area for adsorption

Current way (Microplasma system)

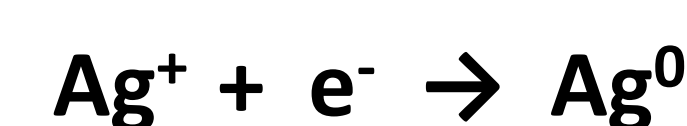
- ✓ Short reaction times (10 mins)
- ✓ Green synthesis
- ✓ One-step process
- ✓ High Raman intensity

Experiment Set up



Electrode dissolve (ED)

Plasma Cathode



Silver anode

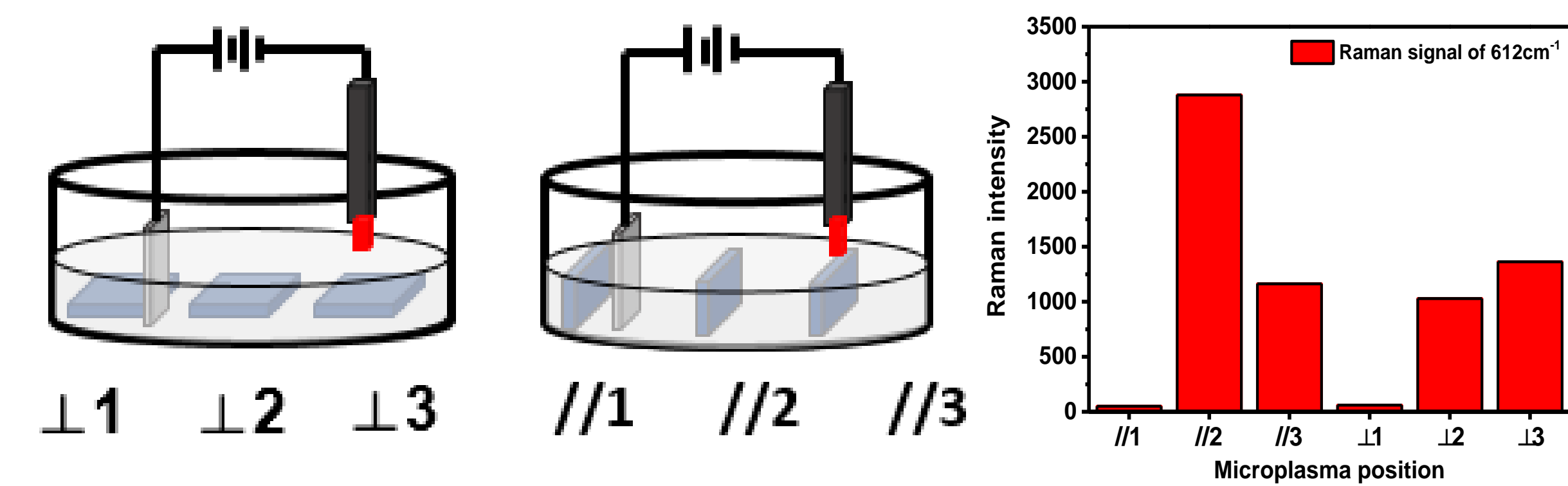


Precursor : Nitric acid , Fructose , H₂O

Result and Discussion

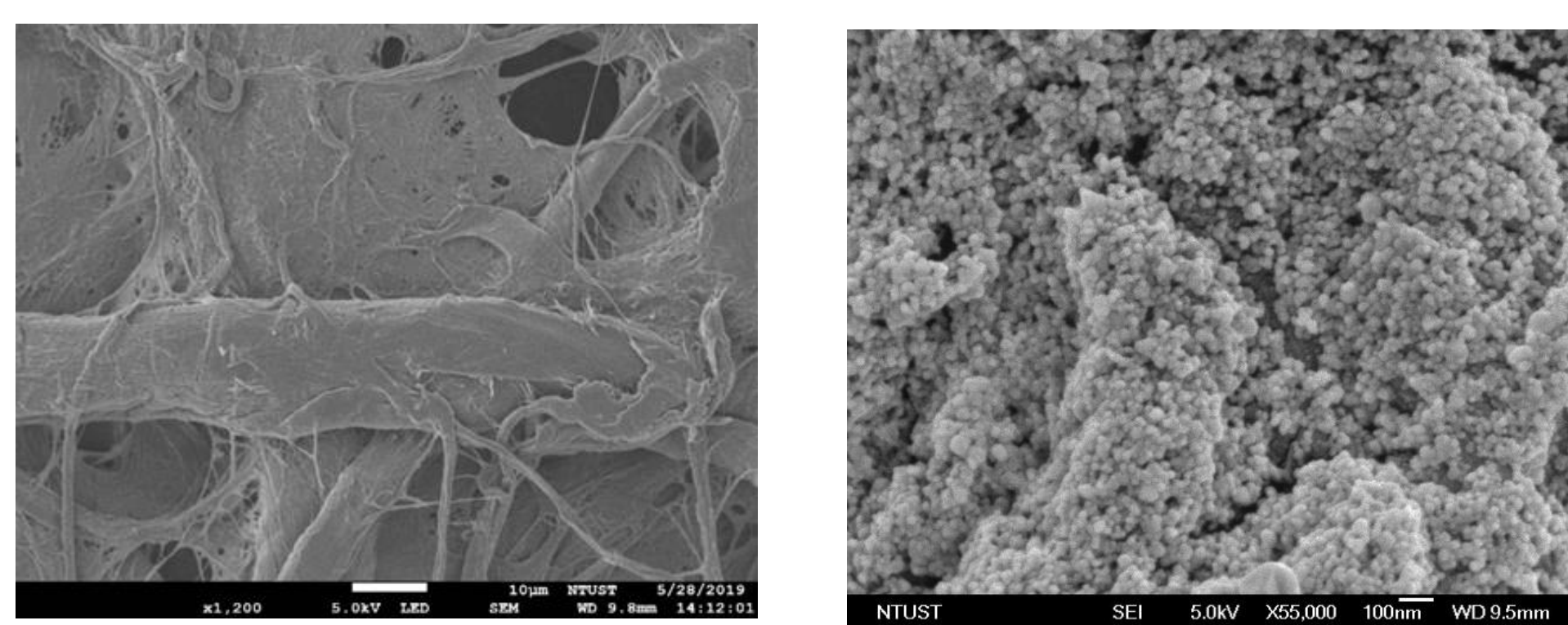
Process

Detect position in the microplasma system



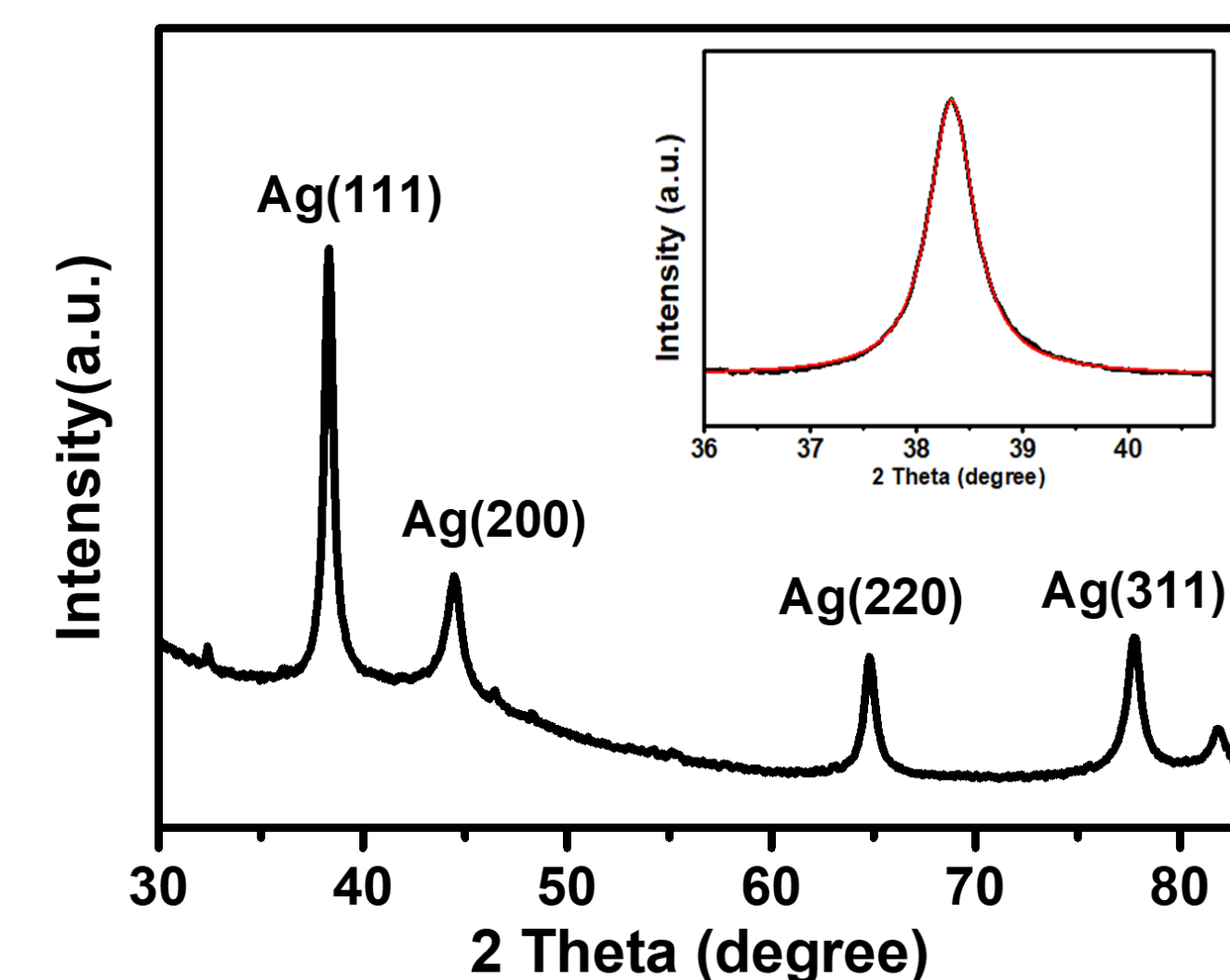
SEM

Detect morphology



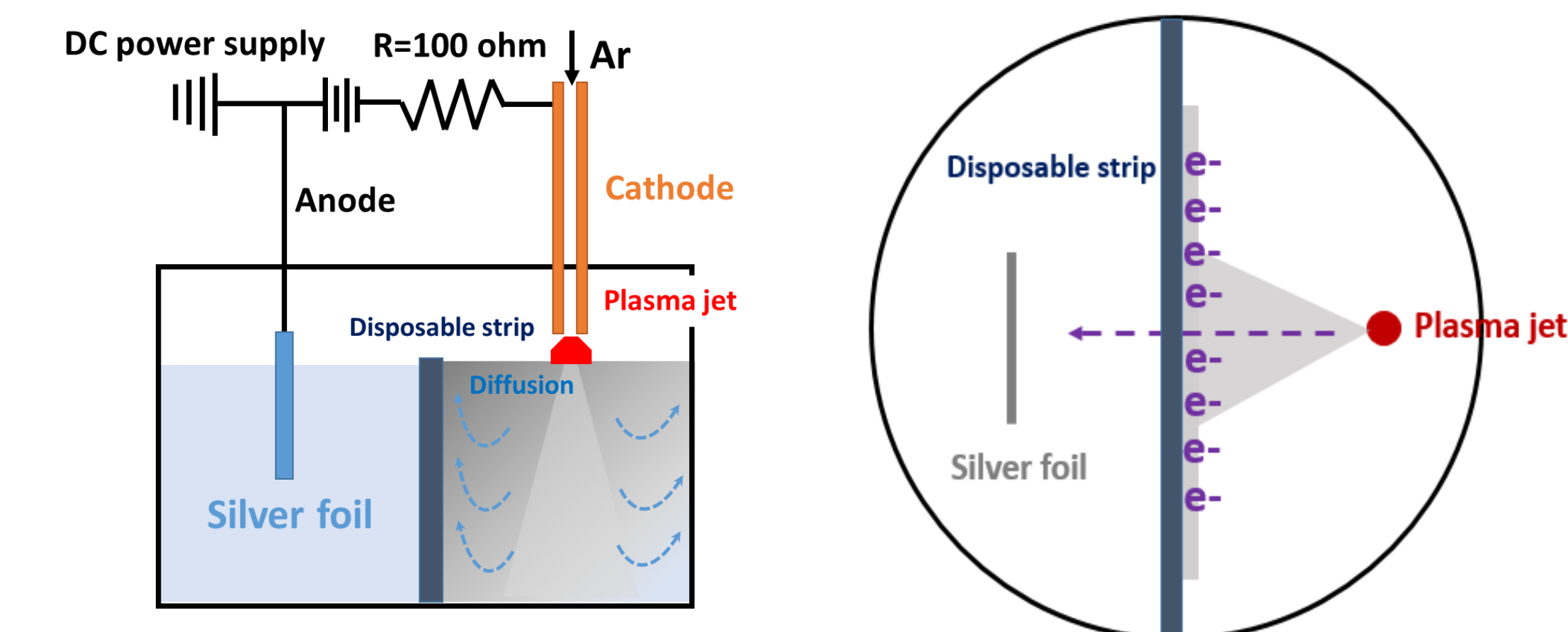
XRD

Detect average size of nanoparticles

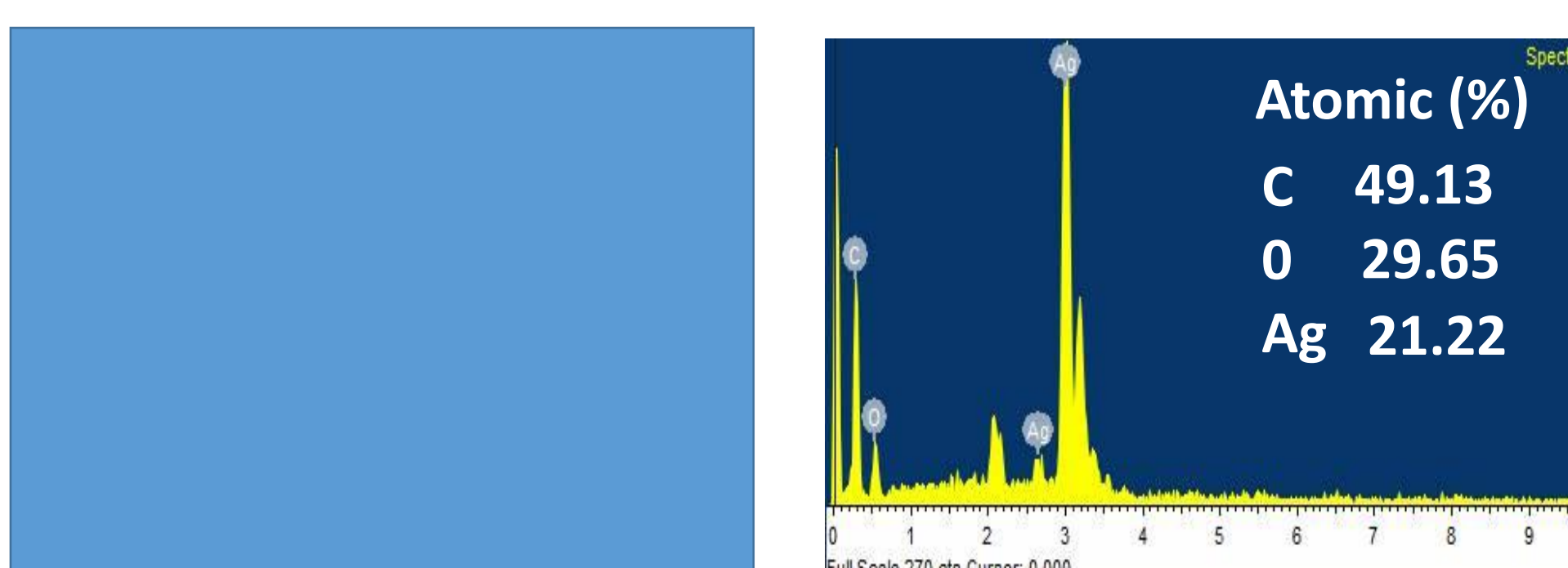


| | |
|------------|------------|
| 2 theta | 38.33 |
| FWHM | 0.620 |
| D-spacing | 2.348 atom |
| Grain size | 14.2 nm |

Demo diffusion and electromagnetic interaction



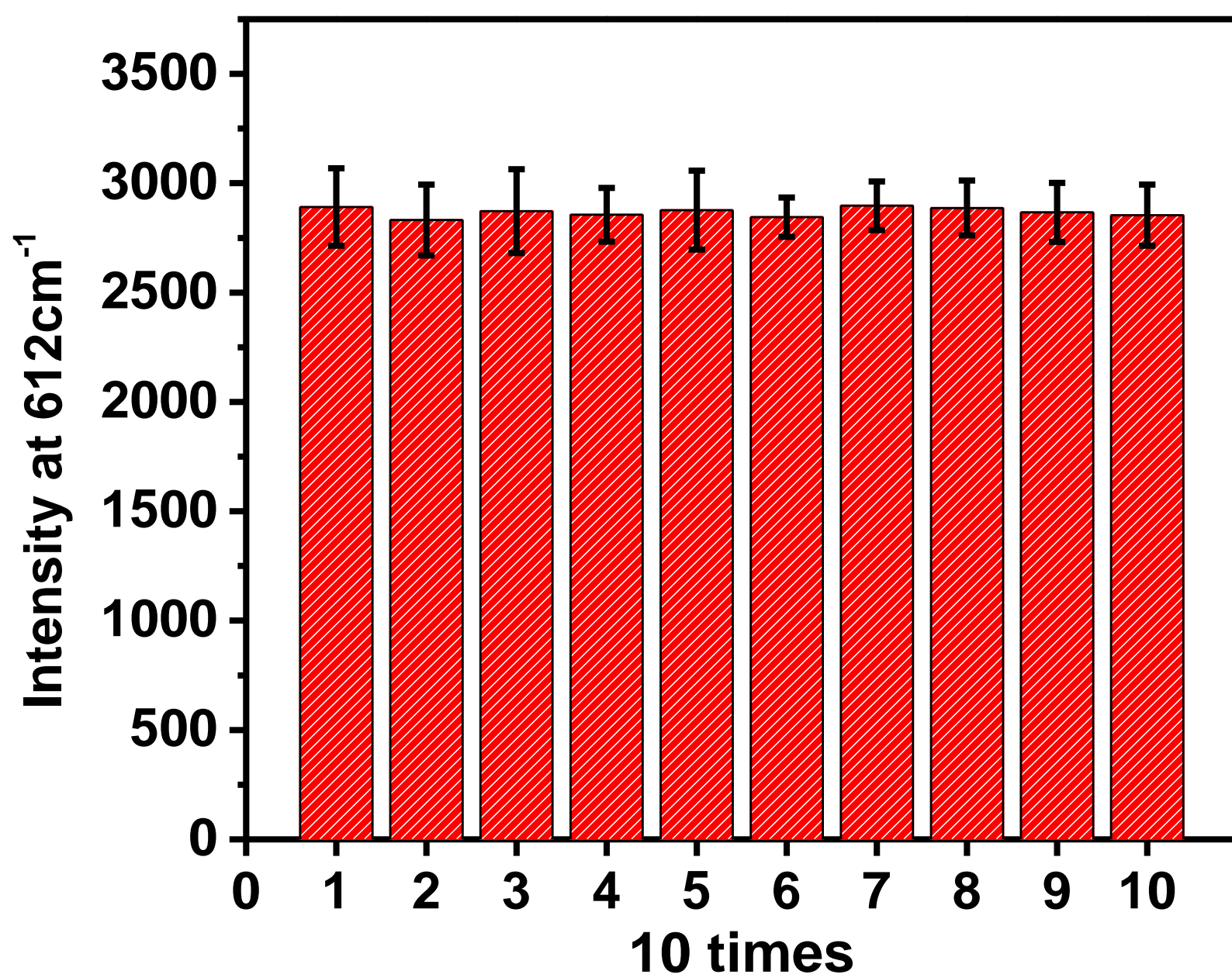
Detect EDS



Raman

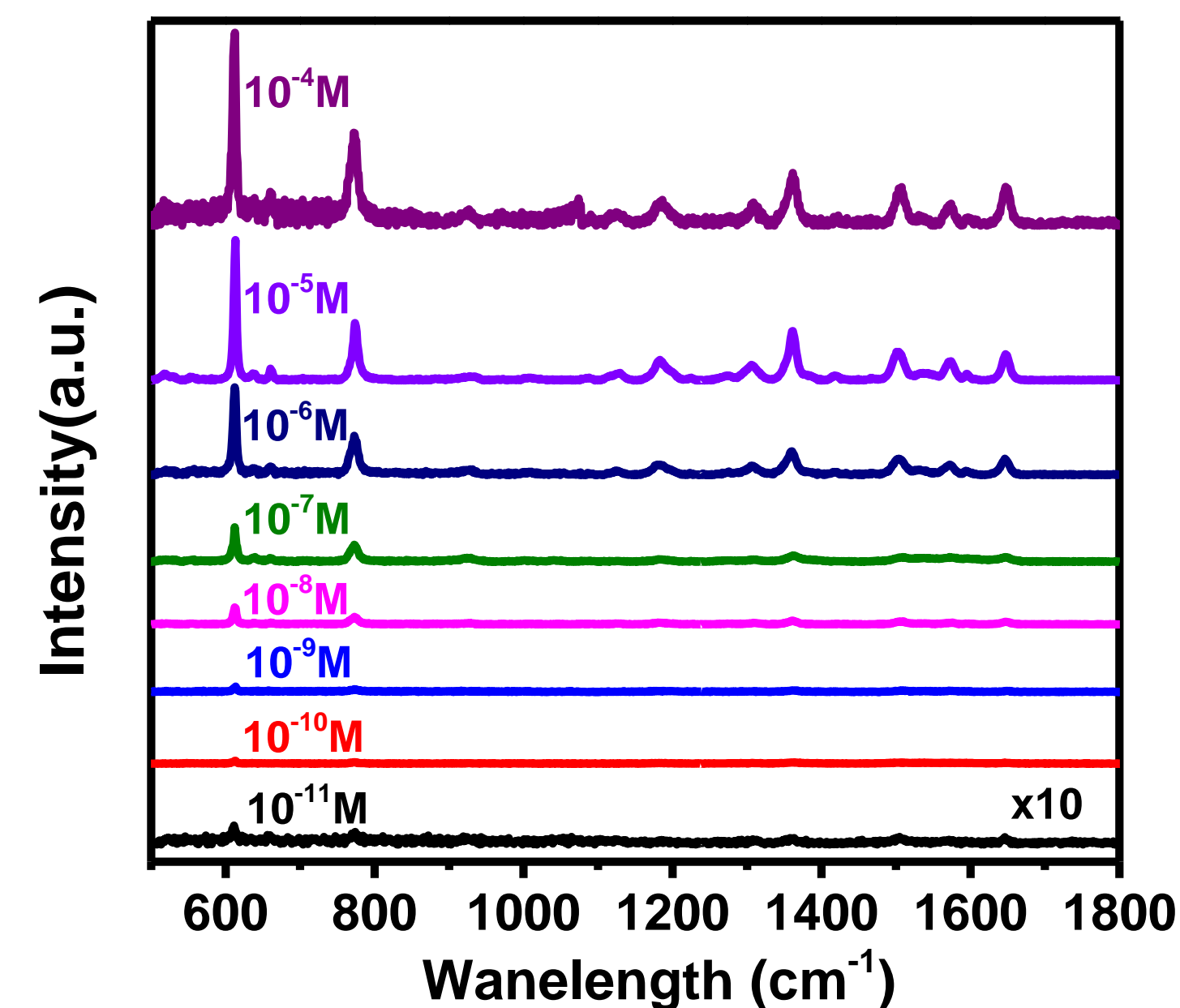
Detect RSD for 10 times

RSD is only 2.79%

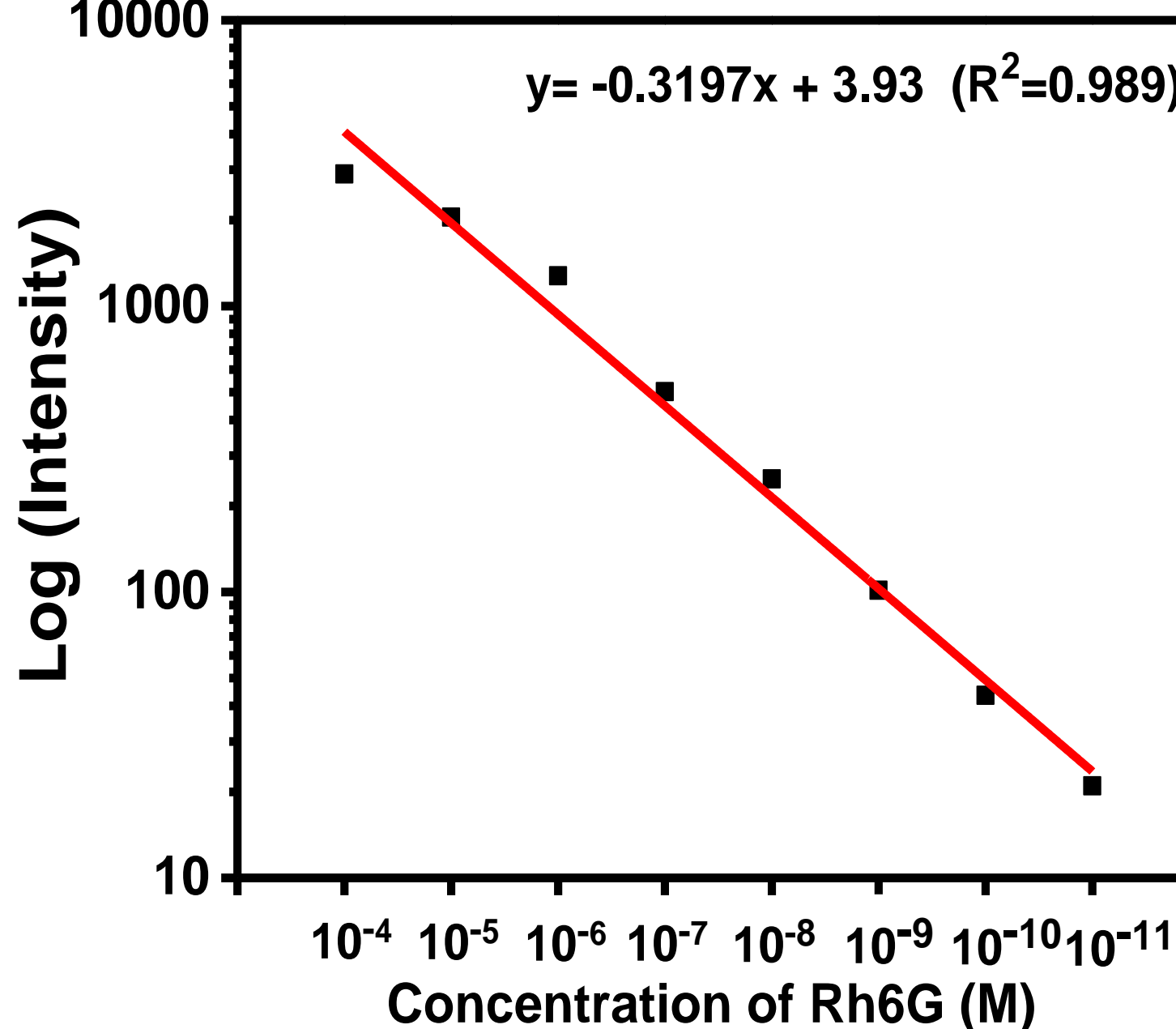


Detect Limit of detection

LOD down to 10⁻¹¹M

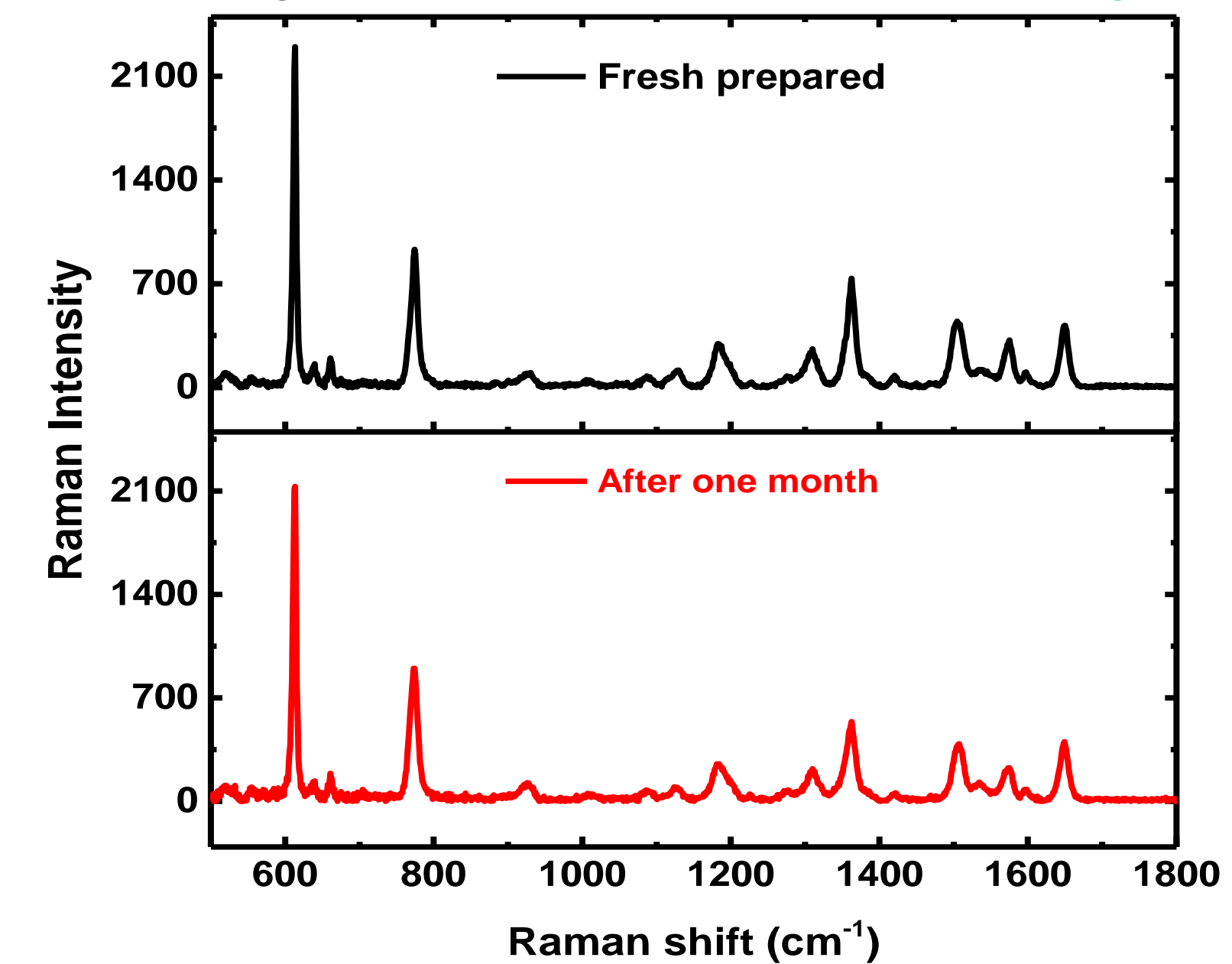


R-square = 0.99



Detect stability for a long time

Paper-based substrate stability



Conclusion

Future work

- One-step synthesis of AgNPs on disposable paper for SERS application.
- Paper-based plasmonic SERS substrate is cost-efficient and does not require complex methods.
- Exhibit excellent reproducibility (~2.79% RSD)
- Shows LOD of paper-base substrate is 10⁻¹¹M for Rh6G
- The wide range for Rh6G detection.
- Ideal substrate is stable for long periods of time.

SERS

Food safety, Waste water, Biomolecules

APPLICATION

