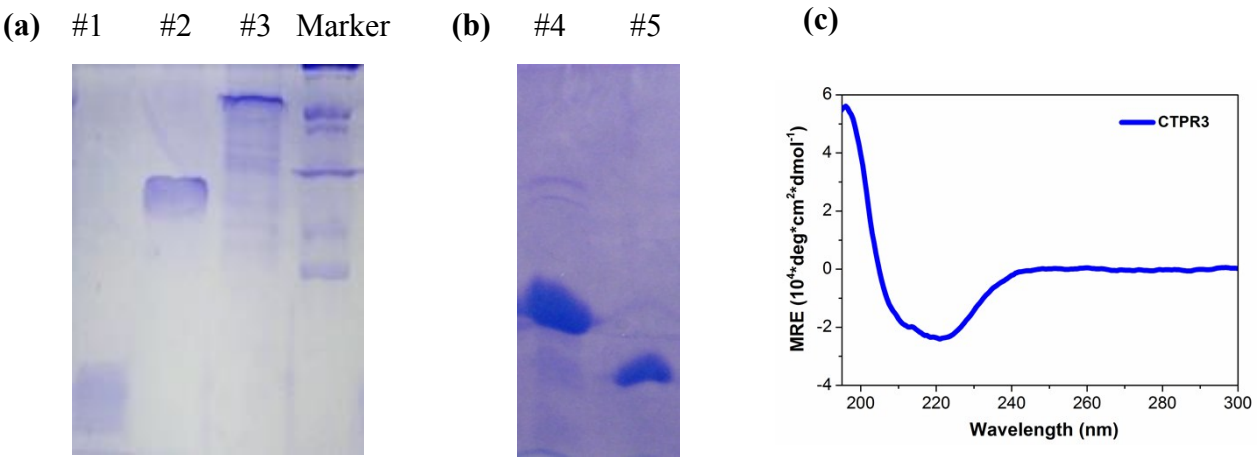
Supporting inforamtion:



AEAWYNLGNAYYKQGDYQKAIEYYQKALELDPNN

Figure S1. (a) 15% SDS-PAGE gel of CTPR3 (lane 1), CTPR6 (lane 2), CTPR18 (lane 3), MW marker (lane 4). (b) 15% SDS-PEGE gel of CTPR3-cys (lane 1) and CTPR3 without (His)6-tag (lane 2). (c) Circular dichroism (CD) spectrum of CTPR3 protein (MRE: The mean residue ellipticity). Bottom: Single letter amino acid sequence of the CTPR repeat. CTPRn proteins are created by repeating this sequence n times (n=3,6,18).

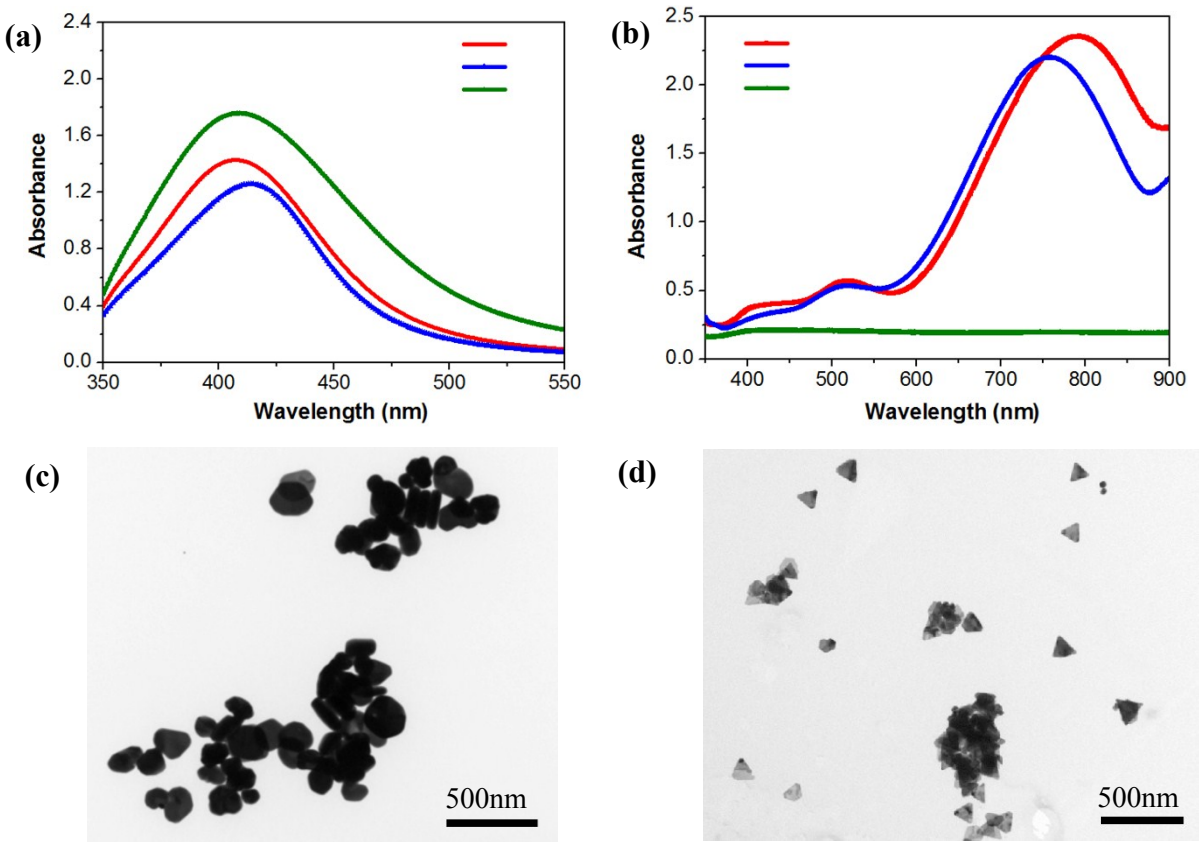


Figure S2. (a) UV-Vis spectra of freshly made Ag seed (red), seed stored at r.t in the dark for 2 weeks (blue), and seed prepared in the absence of citrate (green). (b) UV-Vis of nanoparticles prepared using freshly made Ag seed (red), seed stored at r.t in the dark for 2 weeks (blue), and seed prepared in the absence of citrate (green). (c,d) TEM images of Ag NPs prepared using 20µl seed prepared in the absence of citrate (left), and seed stored at r.t in the dark for 2 weeks (rigth).

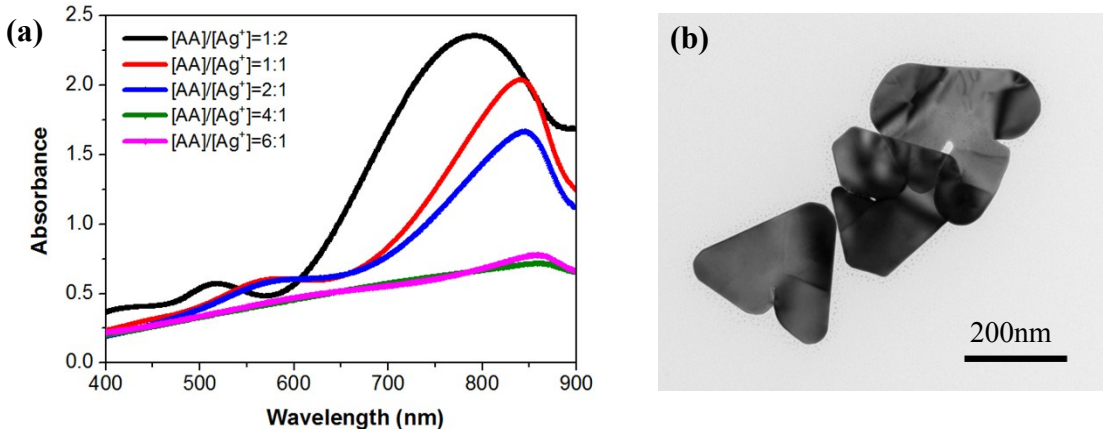


Figure S3. (a) UV-Vis spectra of Ag NPs prepared using 20µl CTPR3-Ag seed with the increasing ratio of ascorbic acid [AA]/[Ag^+]. (b) TEM images of Ag NPs prepared using [AA]:[Ag^+]=4:1.

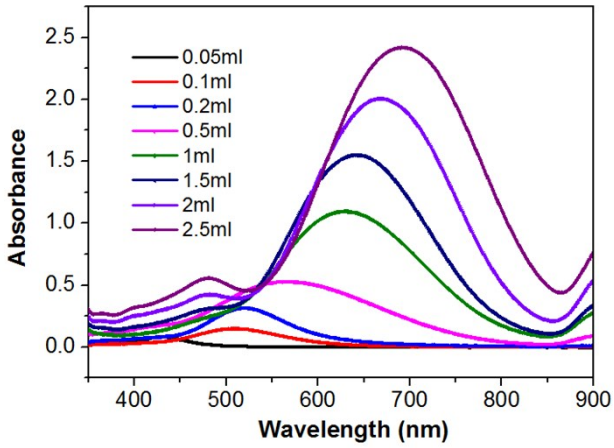


Figure S4. UV-vis of Ag NPs prepared with the increasing volume of 0.5mM $AgNO_3$ aqueous solution

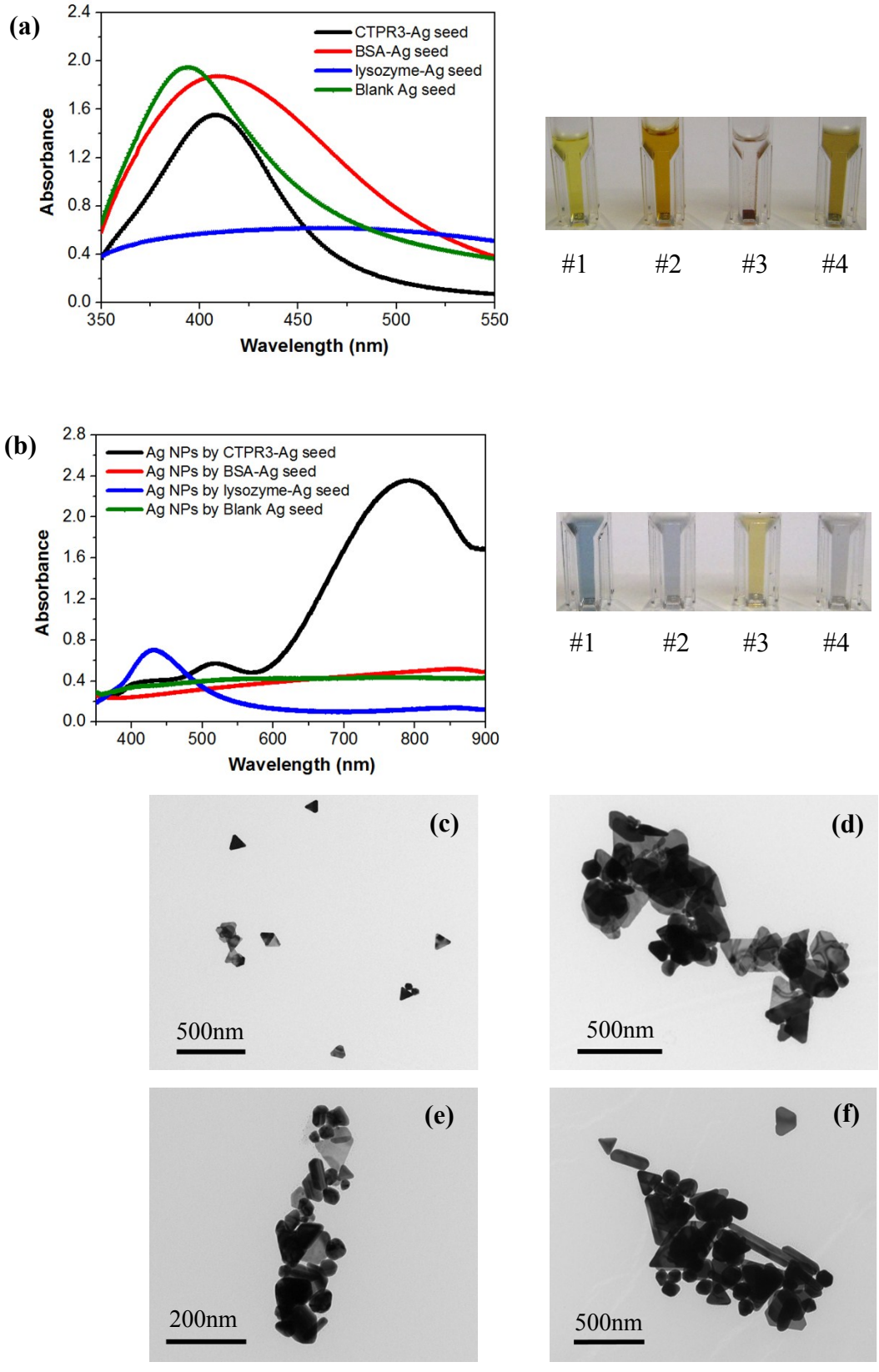


Figure S5. (a) UV-vis spectra and photgraphic images of Ag seeds solutions prepared in the absence of protein (green, #4), in the presence of CTPR3 (black, #1), BSA (red, #2), and

lysozyme (blue, #3). (b) UV-vis spectra and photographic images of Ag NPs soluitons synthesized using 20µl different types of seeds (color scheme and numbering same as in a). (c-f) TEM images of Ag NPs synthesized using 20µl seeds #1-#4, respectively.

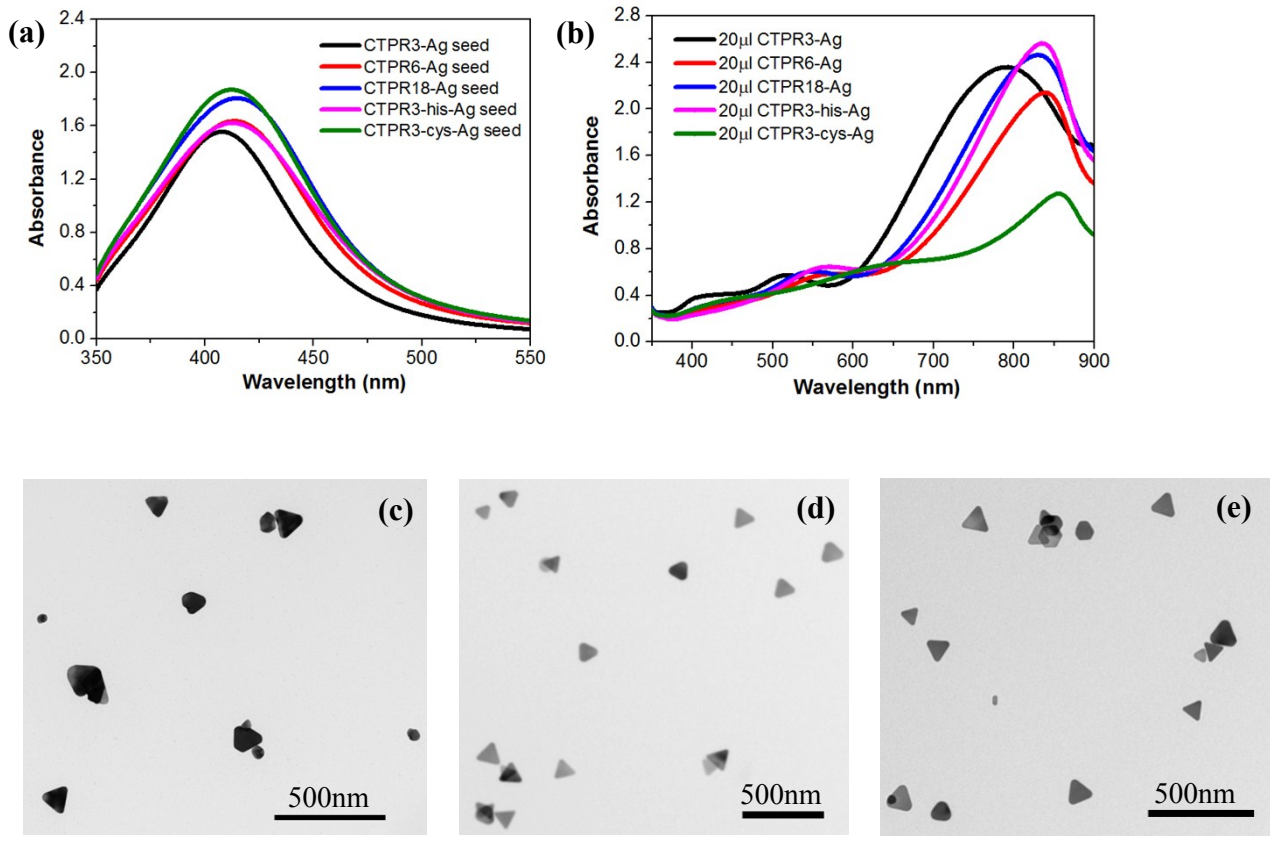


Figure S6. (a)UV-Vis spectra of Ag-seeds prepared in the presence of CTPR3 (black), CTPR6 (red), CTPR18 (blue), CTPR3-his (magenta), and CTPR3-cys (green). (b) UV-Vis spectra of Ag nanoprisms prepared using 20ul of the corresponding seeds (coloring same as in a). (c-e) TEM images of Ag nanoprisms prepared using CTPR3-cys, CTPR3-his and CTPR18 respectively.

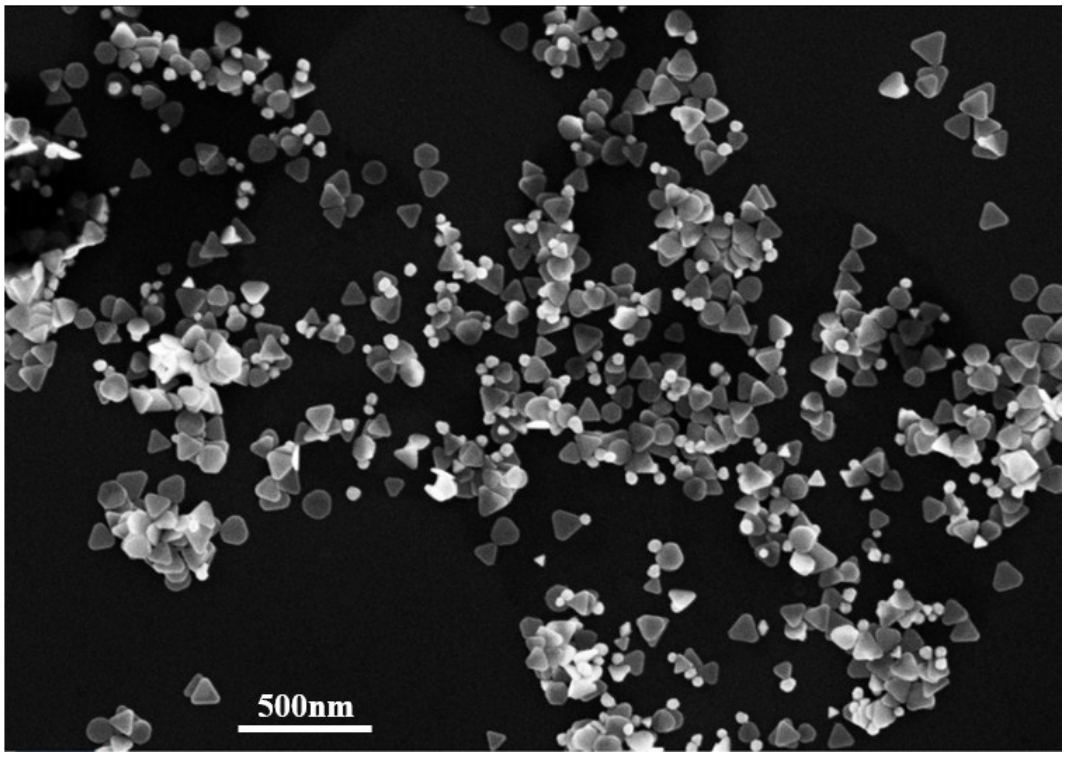


Figure S7. SEM image of Ag NTs-based SERS substrate.

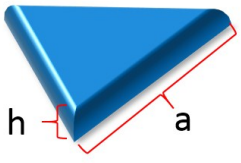
EF is calculated as follows:

For Ag nanoprisms in the solutions:

$$EF = (I_{SERS}/I_{Sol}) \times (C_{Sol}/C_{SERS})$$

Where I_{SERS} and I_{Sol} are the peak intensities of 1078cm^{-1} for the 4MBA@Ag solution and 0.5M 4MBA solution in 1M NaOH, C_{SERS} and C_{Sol} are the concentration of 4MBA on Ag nanoprisms and in solution.

The volume of one Ag NT can be calculated by



$V_{NT} = \sqrt{3}a^2h/4$, a=102.8nm, h=8.8nm, ρ_{Ag}= 10.5g/cm^3

Molecular weight of Ag= 107.87g/mol

V_{NT} = 40269nm^2,

The surface area of one Ag NT can be calculated by

$$S_{NT} = \frac{\sqrt{3}a^2}{2} + 3ah$$ =1.187*10^4 nm^2

The weight of one silver NT: $W_{NT} = V_{NT} * \rho_{Ag} = 4.23 * 10^{-16}$ g

The weight of Ag NTs in the growth solution W_{total}= 0.5mM * 107.87g/mol * 3ml = $1.618 * 10^{-4}$ g

Since 1ml of the Ag NTs solution was used for the SERS measurement, the concentration of Ag NTs

C_{total}= 1ml/V_{total}* W_{total} / W_{NT} = 1ml/(5ml + 3ml + 0.075ml +0.02ml) * $1.618 * 10^{-4}$g/$4.23 * 10^{-16}$ g

$$C_{total} = \frac{1ml * W_{total}}{V_{total} * W_{NT} * N_A} = \frac{1ml * 1.618 * 10^{-4} g}{(5 + 3 + 0.075 + 0.02)ml * 4.23 * 10^{-16} g * 6.0} \\ 10^{-11} M$$

$$C_{SERS} = C_{total} * \frac{S_{NT}}{0.54\ nm^2} = 7.85 * 10^{-11}\ M * \frac{1.187 * 10^4}{0.54} = 1.73 * 10^{-6}\ M$$

Accumulation time was 1s for both condition and we assumed the 4-MBA with footprint of 0.54nm^2 was adsorbed as monolayer, then

$$EF = \left(\frac{I_{SERS}}{I_{Sol}}\right) \times \left(\frac{C_{Sol}}{C_{SERS}}\right) = \left(\frac{448}{192}\right) \times \left(\frac{0.25\ M}{1.73 * 10^{-6}\ M}\right) = 3.4 * 10^5$$

For Ag nanoprisms as SERS substrate:

$$EF = \left(\frac{I_{SERS}}{I_{Bulk}}\right) \times \left(\frac{N_{Bulk}}{N_{SERS}}\right) = \left(\frac{I_{SERS}}{I_{Bulk}}\right) \times \left(\frac{\delta_S * A}{\rho_S * f * A}\right)$$

Where δ_S and ρ_S is the surface density of molecules on the regular substrate and Ag NTs SERS substrate, A is laser focal area, f is the occupied factor which is approximate to be 0.5.

10μl of 2M 4MBA suspension was deposited onto the Si wafer to form a thin film with the diameter of approximately 4mm, thus

$$\delta_S = \frac{V_{4MBA} * M_{4MBA} * N_A}{\pi d^2/4} = \frac{10\mu l * 2\ M * \ 6.02 * 10^{23}/mol}{3.14 * (4mm)^2/4} = 9.60 * 10^{23}\ m^{-2}$$

V_{4MBA} =10 μl, M_{4MBA} =2 mol/L, M_{4MBA}= molecular weight of 4MBA,

$$\rho_S = \frac{1}{0.54nm^2} = 1.85 * 10^{18}\, m^{-2}$$

$$EF = \left(\frac{I_{SERS}}{I_{Sol}}\right) \times \left(\frac{N_{Bulk}}{N_{SERS}}\right) = \left(\frac{1240}{470}\right) \times \left(\frac{9.6 * 10^{23}\, m^{-2}}{0.5 * 1.85 * 10^{18}\, m^{-2}}\right) = 2.8 * 10^{6}$$