Supporting Information

Rapid Detection of Carbapenemase-Producing Enterobacteriacae Based on Surface-Enhanced Raman Spectroscopy with Gold Nanostars

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Number of pages = 3

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Number of Tables = 1

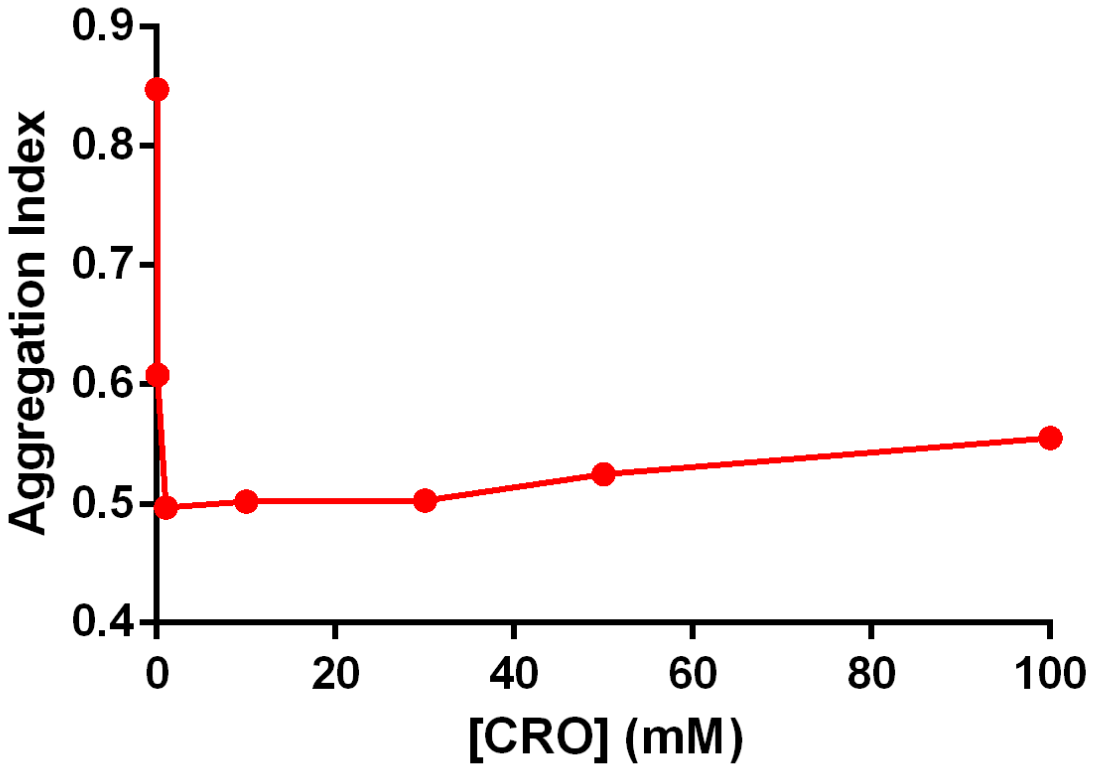
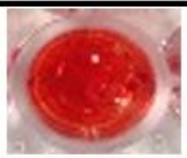
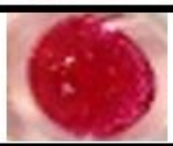


Figure S1. Determination of the minimum protective amount (MPA) of CRO needed to stably protect the gold nanostars against salt-induced aggregation from 0.5X PBS. Based on the UV-Vis spectra in Figure 2D, we utilized a quantitative method based on the aggregation index (AI = A_{500nm}/A_{700nm}) of gold nanostars to determine the colloidal stability of AuNS-CRO at various CRO concentrations in the presence of 0.5X PBS salt to induce aggregation. The MPA was the minimum CRO concentration where the AI remained low. Here the A_{700nm} reduced in the presence of aggregation (Figure 2D) while normalizing this to A_{500nm} would remove concentration-dependent change in the absorbance. From our study, we obtained a minimum AI of ~0.5 between 1 and 30 mM of CRO added to AuNS in 0.5X PBS. Any concentration of CRO outside of this range would result in AuNS aggregation at concentrations < 1 mM or slightly higher AI for concentrations > 30 mM. Hence, we chose 1 mM of CRO as our MPA.

Incubation time (min)	Control	NDM producing E. coli	Non-NDM producing E. coli
1			
10			
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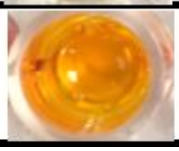
45			

Figure S2. Modified Carba NP test was used to validate the effectiveness of the SERS assay. The Carba NP test is a commercially available test used clinically to probe for carbapenemase activity qualitatively through a color change from red to yellow. The reaction medium consisted of phenol red, which changed from red to yellow-orange at lower pH. Here, the presence of NDM+ *E. Coli* caused a color change from red to yellow (middle column) due to the hydrolysis of the β-lactam ring, which resulted in the release of H^+ ions and acidification. This was not observed in NDM- *E. Coli* (right column). It was also important to note that the solutions were all maintained as red initially to rule out any possible pH effects from the two different *E. Coli* strains.

Table S1. Detailed assignment of peaks in the SERS spectra that are associated with changes in the SERS intensity due to the hydrolysis of CRO.

SERS Peak (cm^{-1})	Assignment
620, 1000, 1031	Polystyrene Cuvettes
722	Lactam Ring Breathing Vibration
1358	CH_2 Bending
1495	CH_3 Deformation Vibration