Exploiting the interaction between live *E. coli* and citrate Au nanoparticles to form a label-free diagnostic test for bacterial contamination

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There is a need for sensitive and robust label-free detection of bacteria in food and environmental samples.[1] Here we show how colloidal gold nanoparticles can be combined with the spontaneous multiplication of live *Escherichia coli* bacteria in a growth medium to produce an enhanced optical signal that is sensitive down to ca. 10 CFU/mL of live bacteria. The assay exploits the insight that an *in situ* suspension of nanoparticles in a growth solution amplifies the optical changes caused by multiplication of the bacteria. The method relies upon the change in optical spectrum as gold nanoparticles aggregate onto the cell walls of a proliferating population of planktonic bacteria. The sensitivity is comparable to that of many state-of-the-art techniques used in the field. The method does not detect dead or inactive bacteria. Since there is no need for an expensive and heat-sensitive antibody, the technique that we describe may offer some advantages for testing in the field.

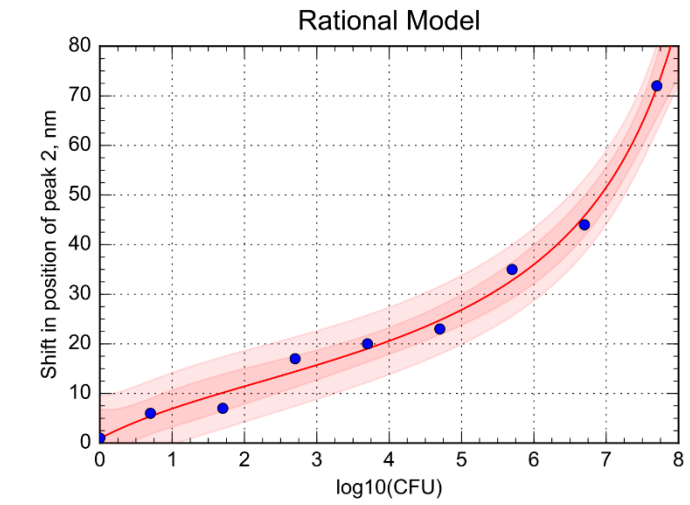

Figure 1: Rational model (R^2 = 0.9927) of the proposed AuNP sensor whereby the dark pink regions show the 95% confidence interval for the average log10(CFU/mL) of the bacterial test solution and the light pink regions show the 95% prediction interval for any individual future calculation as a function of the shift in the position of the second plasmon peak in nm.

References:

1. Pissuwan, D.; Gazzana, C.; Mongkolsuk, S.; Cortie, M. B., Single and multiple detections of foodborne pathogens by gold nanoparticle assays. *Wiley Interdisciplinary Reviews: Nanomedicine and Nanobiotechnology* **2020,** *12* (1), e1584.