Development of an LSPR-based SARS-CoV-2 Screening Test in Saliva

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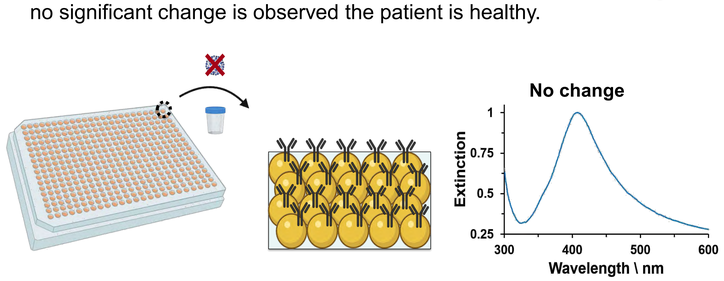
Introduction

As of February 02, 2022, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has reached 376.5 million confirmed cases with 5.7 million deaths worldwide.[1] This work addresses the need for a rapid, cheap, and easily scalable screening for SARS-CoV-2.

Previous studies have demonstrated that saliva testing can have as high as 90% rate of accordance with nasopharyngeal specimens for respiratory viruses. [2]

The Localized Surface Plasmon Resonance, or LSPR biosensing is based on the sensitivity of the plasmon frequency to local refractive index changes at the nanoparticle surface. In this sensor, a silver nanoparticle film is built on top of plastic wells and is subsequently modified with self assemble monolayers in which SARS-CoV-2 antibodies against the S2 subunit are covalently linked.

The maximum of the extinction spectra of the sensor is assessed before and after the contact with the patient's saliva. If a redshift of the maxima is observed, the patient should be referred to further testing. If no significant change is observed the patient is healthy.

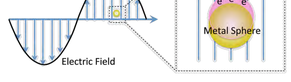


Theory

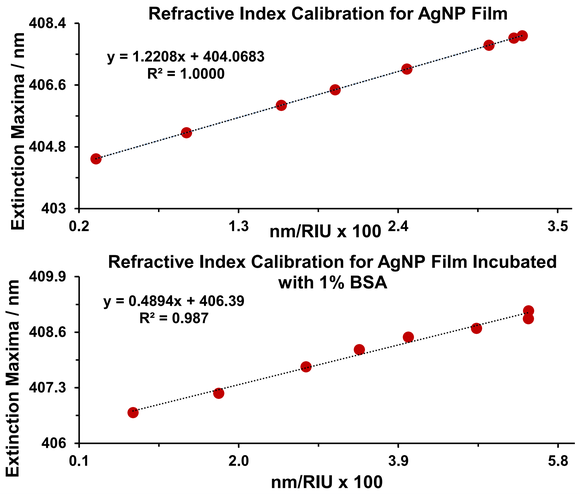
$$|Ep(h)| = E,max,l * \left(1 + \frac{h}{r}\right)^{-(p+2)}$$

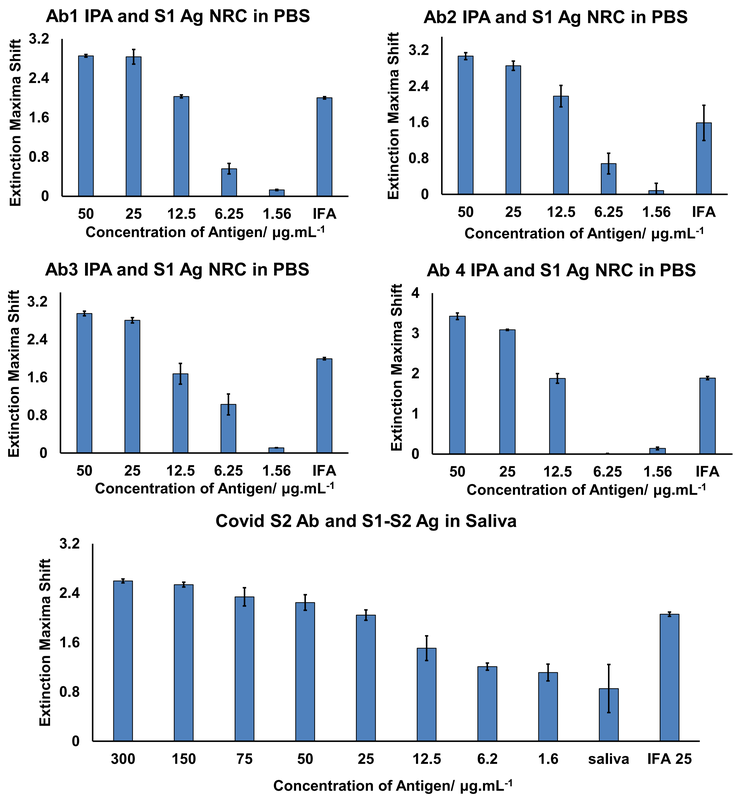
$$\Delta n\ eff(d,nl,nb) \equiv \frac{\Delta\lambda res}{Sb,l}[\text{RIU}]$$

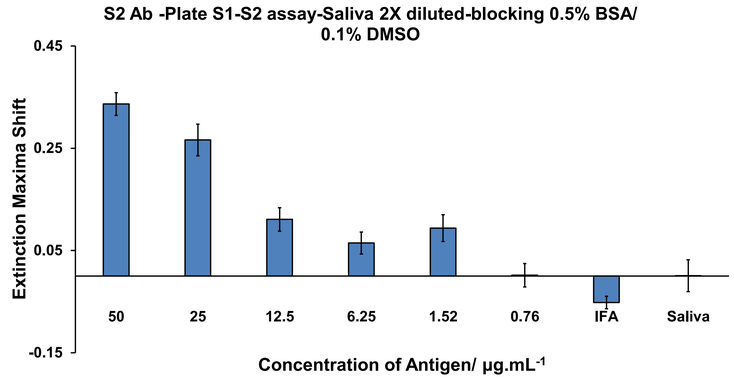
$$\Delta n\ eff = (nl - nb) * (1 - \left(1 + \frac{d}{r}\right)^{-(2p+1)}$$

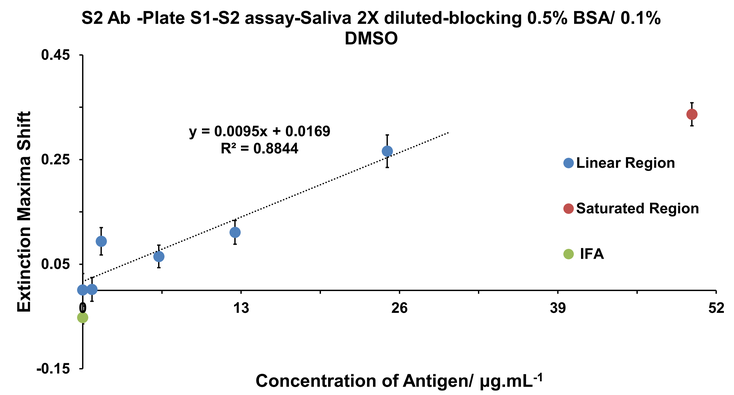


Results









Future work

Test the sensor in patient samples with a partnership with the Hospitalier de L'Université de Montréal Research Center in Montréal, Québec

References

(1) who.int/health-topics/coronavirus, accessed 02/02/2022
(2) *Nanoscale Adv.*, 2021,**3**,1588-1596

Acknowledgements

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