Surface-Enhanced Raman Spectroscopy on Silver Nanoparticles

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Introduction

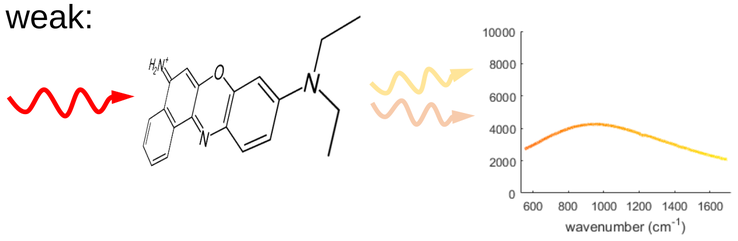
Surface-enhanced Raman spectroscopy (SERS) is arguably the ultimate analytical technique, and promises to allow for single-molecule detection.
→ This has many potential applications, such as:

Forensic science

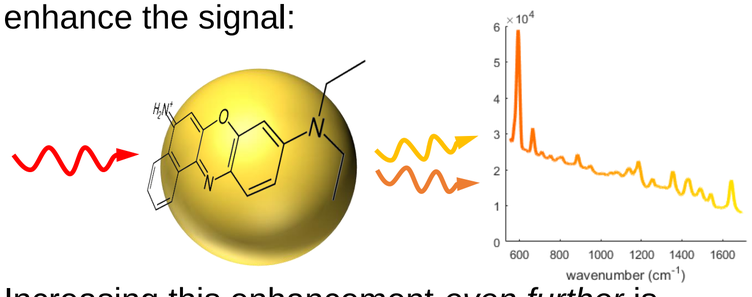
Cancer screening

What's Special about SERS?

Normal Raman Spectroscopy is usually very weak:



SERS is much stronger since the dyes are absorbed onto silver nanoparticles, which enhance the signal:



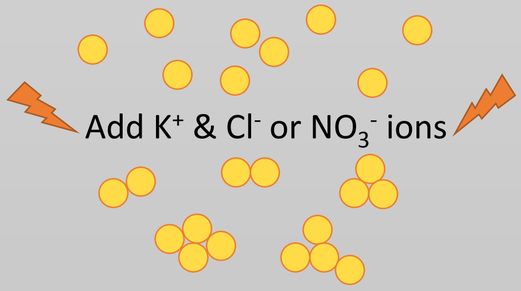
Increasing this enhancement *even further* is essential for developing real-world applications

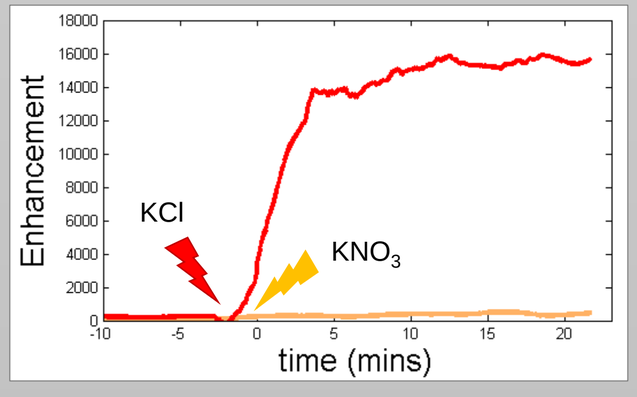
Objective

Increase SERS signal enhancement & understand *why* it increases

Results of Aggregation:

Adding charged ions to colloids induces aggregation, which is known to enhance SERS further:

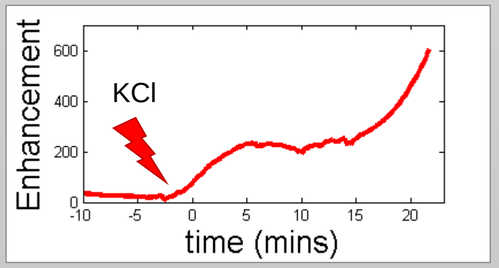




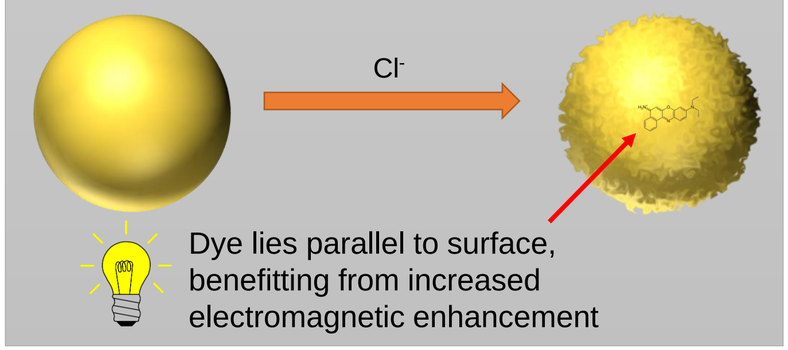
→ Large enhancement with KCl, but not KNO_3
→ Aggregation model isn't accurate!

Roughening Effect = Larger Factor

Even when we add too few Cl^- ions to induce aggregation, we still get an increase:



Proposed explanation: KCl *roughens* surface



Dye lies parallel to surface, benefitting from increased electromagnetic enhancement

Conclusion

→ Aggregation of nanoparticles does lead to increased enhancement in SERS
→ The chemical effects of Cl^- are of greater importance however, roughening the surface for greater SERS enhancement

Acknowledgements

Special thanks to the Victoria Scholarship Office and the Raman Research team for funding this summer project, to my supervisor, Eric Le Ru, and also to Brendan Darby, Aleksa Djorovic, Peter Hauer, and Matthias Meyer for their generous assistance throughout the project.