Improving the selectivity and performance of Surface-Enhanced Raman Spectroscopy (SERS) substrates for nitrite detection

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Surface-Enhanced Raman Spectroscopy (SERS) is a well-known spectroscopic technique that enhances the rather weak Raman signal by using nanostructured, metallic substrates that provide enhancement through electromagnetic, and chemical factors. With this enhancement, SERS has been shown to have high sensitivity, even detecting to single molecules. Being a vibrational spectroscopy technique, SERS is also selective to the chemical bonds of the molecules of interest and a SERS spectrum can be useful in identifying unknown samples. In seawater, nitrites are an important nutrient that supports algae and aquatic plant growth, which are vital in the aquatic food chain, as the main food source for fish and other aquatic organisms. Large amounts of nitrite from human-made processes like wastewater treatment, agricultural runoffs and industrial processes can cause algae to grow much faster than normal, disrupting the coastal ecosystem. Through our work with C-AIM, we are hoping to use SERS to help in the detection of nitrite levels in seawater. Currently, a colorimetric reaction known as the Griess reaction, is used for the determination of nitrite in a sample. The higher the concentration of nitrite, the more vibrant the color of the Griess reaction becomes. By combining this reaction with SERS through surface chemistry, we hope to be able to detect nitrite when no color change is observed, due to SERS high sensitivity. Along the way, we've developed methods to help with the detection of nitrite including the nanofabrication of in-house SERS substrates, and a pre-treatment method to improve the enhancement of SERS substrates.