

# ANTIBACTERIAL, PLASMONIC, AND TOXIC PROPERTIES OF ENGINEERED NANOPARTICLES

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## ABSTRACT

This dissertation is a comprehensive study involving multiple projects about using various nanomaterials and nanotechnologies to improve food safety. First, a simple, fast, and efficient method was developed to fabricate new SERS substrates by coating an AuNR-decorated graphene sheet on Si substrate. These results demonstrate that there is a great potential to use graphene and gold materials for food safety applications.

Second, the feasibility of SERS method was evaluated by measuring Ag NPs in four dietary supplements and one nasal spray with a minimum sample preparation. These results demonstrate that there is a great potential to use SERS for food safety applications.

Third, we investigated the antibacterial properties of GO against human intestinal bacteria (*E. coli* K-12, *L. acidophilus* ADH, and *B. animalis* Bif-6). This study suggests that GO is biocompatible and has a potential to be used in agriculture and food science.

Last, we studied the antibacterial properties of Se NPs against four important foodborne pathogens (*E. coli* O157:H7, *S. aureus*, *Salmonella*, and *L. monocytogenes*). The cytotoxicity of Se NPs was also studied in vitro using the Caco-2 cell line. The results demonstrate that Se NPs can be used as an antimicrobial agent to inhibit the growth of *S. aureus*, and can potentially be used in food safety and biomedical applications.