



# Surface-Enhanced Raman Scattering (SERS) and Finite Difference Time Domain (FDTD) Investigations of Plasmonic and Flexible Filter Papers for the Detection of the Molecular Vibrations of Amoxicillin

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## Abstract

Amoxicillin, an antibacterial drug commonly used in food production, requires rapid and accurate detection due to its illegal usage and potential health risks. This study focuses on the development of surface-enhanced Raman scattering (SERS) biosensors using filter paper substrates coated with silver nanoparticles (Ag NPs) for the detection of amoxicillin. The Ag NPs were prepared by employing a chemical method, and their characteristics were analyzed through various techniques. The SERS substrates exhibited an impressive limit of detection (LOD) of  $10^{-12}$  M for amoxicillin, with a mean relative standard deviation (RSD) of 6.63% for repeated measurements. The experimental and simulated enhancement factors were determined as  $4.044 \times 10^4$  and  $2.996 \times 10^4$ , respectively. These disposable, reproducible, and chemically stable substrates demonstrate great potential for SERS-based research and the development of highly sensitive biosensors.