

# Detection of Counterfeit Antimalarial Drugs by SERS

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Substandard antimalarial drugs are a major problem to the health of citizens in developing countries, and it is likely that the problem persists due to the lack of means to detect substandard drugs. Various colorimetric techniques have been implemented to determine if a drug contains the stated active ingredient or not, but vibrational spectroscopies such as NIR and Raman can be used to more reliably quantify the amount of active ingredient. The use of Raman, however, has been limited by the presence of significant sample fluorescence that interferes with detection of the SERS signals of the active ingredients. Thus, we have started testing the ability of Surface-Enhanced Raman Spectroscopy (SERS) to detect and quantify ten common antimalarial drugs. We found that unique spectra for each of the compounds were able to be taken, and therefore SERS can be used to determine the active ingredient of many antimalarial drugs. To determine the quantification ability of SERS, two Partial Least Squares (PLS) based quantifiers were developed for drugs containing both of the active ingredients Artemether and Lumefantrine, the first of which attempted to predict the relative amounts of the two active ingredients at a concentration near the standard value, and the second, which attempted to predict the absolute amount of active ingredient given that the ratio between the two active ingredients was very close to the standard amount. The main objective of this research is to find out and show the possibility of using SERS in detecting and quantifying the amount of expected active ingredients in the antimalarial drugs that are available in markets of some developed and developing countries.