Urinalysis by Surface-Enhanced Raman Spectroscopy on Gold Nanoparticles for Different Disease

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Abstract : In our Life Science Research Center of the University Simon Bolivar (LSRC), one of the focuses is the diagnosis and prognosis of different diseases; we have been implementing the use of gold nanoparticles (Au-NPs) for various biomedical applications. In this case, Au-NPs were used for Surface-Enhanced Raman Spectroscopy (SERS) in different diseases' diagnostics, such as Lupus Nephritis (LN), hypertension (H), preeclampsia (PC), and others. This methodology is proposed for the diagnosis of each disease. First, good signals of the different metabolites by SERS were obtained through a mixture of urine samples and Au-NPs. Second, PLS-DA models based on SERS spectra to discriminate each disease were able to differentiate between sick and healthy patients with different diseases. Finally, the sensibility and specificity for the different models were determined in the order of 0.9. On the other hand, a second methodology was developed using machine learning models from all data of the different diseases, and, as a result, a discriminant spectral map of the diseases was generated. These studies were possible thanks to joint research between two university research centers and two health sector entities, and the patient samples were treated with ethical rigor and their consent.

Keywords : SERS, Raman, PLS-DA, diseases

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