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SERS-based study supported by chemometric methods for the differential diagnosis of vaginal infections

Vaginal infections (vaginitis) are among the most common and problematic disorders that affect almost 70% of women during their whole lifetime at least once – the most prevalent are bacterial vaginosis (BV) and vulvovaginal candidiasis (VVC). Vaginitis is associated with the feeling of discomfort and can cause many severe diseases and complications *e.g.* premature rupture of membranes. The accurate diagnosis and implementation of appropriate medicines is an inherent element in successful treatment and provides protection against recurrence of infection. The whole situation is complicated by the fact that vaginal discharge may be altered due to physiological and pathological conditions such as desquamative inflammatory vaginitis (DIV), vulval dermatoses, or allergic irritation - not caused by biological agents. All this makes the differential diagnosis of vaginal infections of the utmost [1][2]. Surface-Enhanced Raman Spectroscopy (SERS) is based on the inelastic scattering of incident light by molecules adsorbed onto a roughened metal substrate (SERS substrate). SERS has been proved as a beneficial method due to its ultra-sensitivity and non-destructive nature that reveals specific fingerprint-like information down to the molecular level. This technique was utilized to study many biological systems such as: human tissues, cells, body fluids [3]. In this study for the first time, we used SERS and chemometric method - Partial Least Squares Regression (PLSR) to track the spectral response of vaginal fluids caused by different types of infections. We proved that the biochemical alterations that result from infections can be translated into a specific spectral image that is unique for each infection and hence their differentiation is possible at high level of explained information by PLSR. The integration of SERS-based sensors with a small, portable Raman spectrometer leads to the development of a handheld point-of-care device.

References

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