

## II. Streszczenie w języku angielskim

This doctoral dissertation presents the topic of mass spectrometry with laser ablation for the study of biological and synthetic materials. The presented series of publications concerns both the development of new MS laser methods and their application.

The doctoral thesis presents the results of imaging sections of human kidney tissues with normal and cancer parts using the innovative LARESI MSI method. The compounds contained on the surface of the tested object were identified by measuring in the SRM/MRM mode.

The next presented results were ion images generated for imprints of human bladder tissue fragments obtained as a result of mass spectrometry imaging with laser desorption/ionization. Silver-109 nanoparticles sputtered onto the test object, produced by chemical reduction, were used for the measurement.

A solution to the problems arising from the use of nanoparticles produced by chemical reduction in mass spectrometry by developing a new method for generating NPs is presented. The method of synthesis by laser ablation in a solution with the use of a pulsed fiber laser with a 2D galvanometric scanner head for the production of chemically pure nanoparticles from the surface of a metal plate is discussed. The characteristics of the obtained  $^{109}\text{Ag}$ NPs and AuNPs are also presented with the results of LDI MS experiments performed for several low molecular weight compounds. The LDI MSI results of the fingerprint covered with  $^{109}\text{Ag}$  nanoparticles produced by the LASIS method additionally confirmed the usefulness of the obtained nanoparticles for the analysis of both simple and complex objects.

The last part presents the use of laser-generated silver-109 nanoparticles for the qualitative and quantitative analysis of chemical compounds using manual LDI measurements and semi-automatic LDI MSI. Both aqueous solutions and biological material - human blood serum - were used for the study. For the obtained results, a regression analysis was performed using various types of functions. Based on the performed experiments, the advantage of the LDI MSI method over the manual LDI MS measurements was demonstrated.

In addition, the gold and monoisotopic silver nanoparticles were used to identify metabolites in the blood serum of patients with bladder cancer using the LDI MS method.