Natural low molecular weight (LMW) compounds potentially have large application area in research as well as many beneficial properties for human health. Biologically active compounds will be analytes of interest in proposed project. Flavonoids, sugars and cyclitols are widely distributed in plants kingdom and they possess anticancer, antibacterial, antiviral, antioxidant and antidiabetic activities. Lipids comply many important functions in human body and recent studies suggest that the changes in lipidome can offer biomarkers of diseases. However, such applications of low molecular weight natural compounds require their determination in complex biological matrixes. Chromatographic methods coupled to mass spectrometry (MS) of analysis can separate them in mixture, but also have limitations such as: (a) non volatility of analytes for their analysis by gas chromatography (GC), thus requiring derivatization step that hard to control affecting accuracy of results, (b) comprehensive method development and laborious sample preparation in liquid chromatographic (LC) determination. Matrix-assisted laser desorption ionization technique (MALDI) coupled to time-of-flight mass spectrometry (TOF/TOF-MS), based on application of organic matrix assisting ionization of analytes, can offer analysis without separation and without complex sample preparation steps. Even though, detection of low molecular compounds by classical MALDI technique has limitations as: high background noise and suppression of analytes signals by organic matrix molecules. Thus, latest developments in this field offer to replace the matrix molecules to nanomaterials. Different kind of nanomaterials are applied for that purpose: nanoparticles, nanocomposites, metal organic frameworks, carbon-based nanomaterials. The field of **nanoassisted laser desorption ionization** (NALDI) is developing very fast and targets for detection of low molecular weight compounds are prepared based on *in-situ* synthesis of gold nanoparticles due to their unique properties as large surface area and strong chemical stability. This method proved to be effective in detection of LMW compounds, however it requires large volumes of organic solvents and precursor salts solutions as well as time (reaction takes in average 84 hours).

Therefore, the goal of proposed research project is to develop fast and simple method of preparation of NALDI targets cheaper than existing analogues based on metal and metal oxide nanoparticles. Application of metal and metal oxide nanoparticles also have reduced costs and time for preparation rather than nanocomposites. Zinc oxide, gold and silver nanoparticles will be chemically synthesized and deposited to classical MALDI targets and sheets of stainless steel cut to dimensions of the equipment and polished to mirror-like surface. Developed method will be used for screening of flavonoids, cyclitols and sugars in plants and search of potential biomarkers from lipid species distribution by analysis of urine extracts. Another emerging application of prepared target will be imaging of latent fingerprint (LFP) that is attractive for forensic science as well as for analytical chemists. "Chemical information" from fingerprint received from NALDI imaging has potential for biometric identification, forensic and anti-doping analysis.