Abstract of the doctoral thesis of Anna Topolewska, MSc. entitled “Development of the uniform method for extraction, purification and determination of steroidal glycoalkaloids in plant material and in food.”

Steroidal glycoalkaloids, heterocyclic nitrogen compounds, are the main defense chemicals produced by plants of solanaceous family, including potato (*Solanum tuberosum*), tomato (*S. lycopersicum*) and eggplant (*S. melongena*). They are characterized by significant biological activity and display certain toxicity towards mammals. Hence, it is important to monitor the content of these compounds in food products. In turn, analysis of glycoalkaloids in different parts of the plants allows to estimate the plant’s ability to defend itself against insect feeding and infections.

Therefore, the main objective of the work was to design a uniform method for the determination of steroid glycoalkaloids in plant material: both in the vegetative organs and in the edible parts of the plant, that would enable both the standardized control of their content in commercially available food products and the assessment of crop plant’s resistance to adverse effects caused by biological factors.

Studies on the selection of reaction conditions for derivatization of glycoalkaloid aglycones, a step required for gas chromatography-based analyses showed that trifluoroacetic anhydride (TFAA) was the most suitable agent for the acylation reaction. Among the techniques used for the analysis of glycoalkaloids (HPLC-UV/Vis, LC-MS/MS, GC-FID, GC-MS), the techniques coupled with mass spectrometry (LC-MS/MS and GC-MS) proved to be the most useful. However, the results obtained did not confirm the superiority of any of them, and the choice of a specific one should depend on the availability of equipment and the specific goal of the research. Detailed examination of the results obtained by the GC-MS technique revealed the presence of a new glycoalkaloid in the tomato plant, which was a combination of solasodine aglycone and lycotetraose saccharide component, and was named dehydrofilotomatine. The use of the Response Surface Methodology (RSM) allowed to optimize the conditions of glycoalkaloid extraction from matrices of different composition and structure. The designed extraction method was characterized by much higher efficiency than the official AOAC method (997.13). The analysis of glycoalkaloids in wild and domesticated tomatoes showed that the content and composition of these compounds is strictly dependent on the plant species. In turn, the glycoalkaloid content control in commercially available food products showed that although most products are safe, consumption of unripe green tomatoes may cause certain toxic effects.

The uniform methodology designed for the extraction and determination of glycoalkaloids in biological material of various origin may become a useful tool for the routine monitoring of their presence in food.