**Mgr inż. Aleksandra Golonko**

## Dissertation abstract

**The influence of structural modifications on the physicochemical and biological properties of selected natural bioactive phenolic compounds significant in human nutrition**

This dissertation investigates the structural modifications of selected natural phenolic compounds, particularly flavonoids, to enhance their functionality in food technology and cancer therapy. The research focuses on compounds like resveratrol, quercetin, kaempferol, and chrysin, examining their potential to improve the therapeutic effects of anticancer drugs through redox activity. The study explores how these compounds can be optimized for use in functional foods, improving their bioavailability and antioxidant properties, thus supporting their integration into cancer-preventive diets. Key methodologies include quantum-mechanical calculations to determine molecular orbital energies (HOMO-LUMO) and energy gaps (eGAP), which highlight the enhanced redox potential of compounds like quercetin and kaempferol. These flavonoids, with lower eGAP values, demonstrated significant antioxidant activity, which supports their role in reducing oxidative stress and enhancing the efficacy of chemotherapy by promoting apoptosis in cancer cells.In addition, the study investigates flavonoid-metal complexes, particularly with zinc and copper, through spectrophotometric analysis (UV-Vis, FT-IR) and cytotoxicity assays on cancer cell lines (MCF-7 and MDA-MB-231). These complexes demonstrated increased stability and bioactivity, significantly improving their therapeutic potential in functional foods aimed at supporting cancer treatment. The research also emphasizes the challenge of bioavailability and investigates strategies such as structural modification to enhance the absorption and stability of these compounds. The findings suggest that functional foods enriched with modified flavonoids could act as valuable supplements, complementing traditional cancer therapies by reducing drug side effects and improving patient outcomes.

**Keywords:** *functional foods, dietotherapy, bioavailability, metal complexes, electron charge*