

The presented project is focused on the development of new violacein derivatives that could, in the future, serve as an alternative or complement to traditional treatment methods, such as chemotherapy or radiotherapy. Violacein is a natural compound with interesting and broad biological properties; however, it unfortunately exhibits relatively low selectivity and poor water solubility. The new derivatives have been designed to better meet the needs of melanoma therapy. With the proposed modifications, the compounds developed may not only act as standalone anticancer agents but also in combination with modern sonodynamic therapy (SDT), which is becoming an increasingly promising method for cancer treatment.

Sonodynamic therapy (SDT) is a modern cancer treatment method that combines traditional therapeutic approaches with cutting-edge technology. This therapy utilizes ultrasound, which, when combined with suitable sound-sensitive substances (known as sonosensitizers), can exhibit anticancer or antibacterial effects. Under the influence of ultrasound, these substances are activated, leading to their selective action on cancer cells without damaging healthy tissues or minimizing damage to a lesser extent. This approach allows for the effective elimination of cancer cells while minimizing the risk of damage to surrounding healthy tissues. As part of this project, violacein, a substance known for its anticancer properties, will be chemically modified to improve its effectiveness in sonodynamic therapy.

The first step in developing new violacein derivatives involves modifying its chemical structure to enable better interaction with cancer cells. To achieve this, the project will use classical chemical synthesis, including Suzuki coupling reactions, which will allow the creation of violacein derivatives containing different chemical groups. Changes in the structure may enhance the properties of the substance, such as its water solubility, which is crucial for therapeutic applications. Additionally, the project plans modifications that will enable the targeting of violacein derivatives directly to cancer cells, minimizing the risk of their effect on healthy cells. Cancers, including melanoma, exhibit characteristic metabolic changes known as the Warburg effect, which involves preferential use of glucose for energy production, even in the presence of oxygen. This metabolic process leads to increased glucose uptake by cancer cells and the production of lactic acid. As part of the project, we plan to modify violacein derivatives so that these substances can exploit this metabolic shift in cancer cells. Furthermore, the introduction of chemical groups such as glucose or folic acid will allow for more precise targeting of cancer cells, improving their selectivity.