Microgels are cross-linked polymers filled with water and they are in a spherical structure. Their size is similar to colloidal solutions. Depending on the properties of the polymers included in the microgel structure, they have different properties. There is a group of "smart" microgels that change their volume significantly in response to external stimuli. The most widely studied are pH-sensitive and thermosensitive microgels, but recently attention has been focused on electroresponsive microgels.

The project assumes obtaining an electrochemically controlled system for releasing active substances from the microgel. The first stage is to obtain a pH-sensitive microgel functionalized with electroactive groups and then anchor it on a conductive surface through the chemisorption process. After characterizing its properties, introduction a model substance with a positive charge that can electrostatically interact with the polymer network. Electrochemical oxidation of redox active functional groups and generation of a positive charge should translate into electrostatic repulsion of the model substance molecules. Additionally, conducting release profile in flow and checking effectiveness of the developed electrochemically controlled release system.

The project will consist of five stages:

1. Synthesis of monomers with electroactive molecules, then microgel synthesis.

2. Characterization of the obtained material - examination of size, morphology and electrochemical properties.

3. Modification of the surface of the gold electrode with a microgel in the chemisorption process and characterization of the obtained layer.

4. Monitoring the immobilization of the model substance in the microgel structure anchored on the gold electrode surface.

5. Studies on the preparation of an electrochemically controlled model substance release profile conducted under flow conditions.

Due to the specificity of the measurements performed, the project will use measurement methods like: dynamic light scattering, scanning/transmission electron microscopy, energy dispersive spectroscopy, quartz crystal microbalance with energy dissipation, cyclic voltammetry, chronoamperometry, UV-Vis spectroscopy. Such systems may in the future be used in the controlled delivery of drugs to the disease site from intrabody implants or transdermal patches.