Poland is a country where over 2,000 m^3 of municipal and industrial wastewater, in which dangerous compounds known as micropollutants are present, are discharged annually into water or soil. These are substances whose concentration is not too high, but they can still pose a direct threat to humans, animals and the environment. The efficiency of removing these pollutants depends primarily on the technological solutions used in wastewater treatment systems. Pharmaceuticals are among the most dangerous pollutants present in wastewater, and they are not fully eliminated in conventional treatment systems when they reach municipal wastewater treatment plants. The content of pharmaceuticals in treated wastewater discharged to natural reservoirs directly threatens the life and health of humans and animals. In addition, the presence of antibiotics in surface waters contributes to the acquisition of resistance by bacteria, which results in the selection of drug-resistant bacteria. Another important problem is microplastic, the presence of which in waters poses a real threat to aquatic organisms. During the treatment of raw wastewater, about 90% of microplastics are removed, the remaining part introduced to surface waters poses a serious threat to the environment, e.g. due to the sorbing of organic micropollutants on the microplastic surface. Wastewater is also a living environment for numerous microorganisms, including pathogenic microorganisms, in which the phenomenon of gene transfer, including antibiotic resistance, is common.

Currently, it is not possible to remove all pollutants using a single process at a wastewater treatment plant. Existing wastewater treatment plants are not adapted to remove micropollutants, which requires the use of additional treatment methods. The law in force in Poland does not regulate the concentration of these compounds in treated wastewater, but there is already a draft of a new wastewater directive, which will require more stringent compliance with the presence of hazardous substances discharged with wastewater to natural slow receivers. In recent years, there has been an increasing interest in low-temperature plasma for wastewater treatment. This technology is already used in sterilization processes and disinfection. It also has numerous advantages, the most important of which are the lack of by-products, harmful to the environment, waste products, the possibility of conducting plasma treatment at atmospheric pressure and at ambient temperature.

The aim of the project is to determine the effectiveness of removing selected micropollutants from wastewater in the so-called III degree of purification. The research carried out as part of the project puts emphasis on understanding the mechanism of decomposition of selected pharmaceuticals, microplastics and the impact on pathogenic microorganisms. Understanding the reaction mechanism will help to select the most favorable reaction conditions, at which the reduction of impurities will be as large as possible. It is very important to evaluate the process in terms of costs and energy input. The treated wastewater will be reused to irrigate selected crops. This step aims to assess the suitability of the use of treated wastewater in the agricultural sector. Tests with cultivated plants will be carried out on a small laboratory scale in special climatic chambers. Thanks to this, it will be possible to assess the method of irrigation (type of irrigator), and not changes due to e.g. changes in temperature or humidity.

The innovative nature of the research assumed in the project will consist in the use of an innovative method of wastewater treatment from selected micropollutants and pathogenic microorganisms, and then their reuse for irrigation of plants and monitoring of environmental risk.