Nowadays, one of the major problems is to provide for a constantly growing human population on Earth safe food products of adequate nutritional values as well as of an extended shelf-life. The longer freshness of food products would reduce food losses due to food spoilage.

The main aim of this proposal is to develop new processes for manufacturing mycotoxins-free, safe-to-consume plant drinks of prolonged shelf-life and improved nutritional properties with the aid of cold atmospheric plasma (CAP, Fig. 1). The second goal of the project is to develop innovative, cheap, and efficient new sterilization methods for plant drinks as an alternative to the currently applied ineffective or energy-consuming processes. The CAP used to achieve this goal will be generated in contact with the flowing plant drink in a highly efficient plasma system (up to 240 L h^{-1}). The plasma will be initiated in the form of a direct current atmospheric pressure glow discharge in contact with a plant drink, acting as an anode (FLA-dc-APGD) or cathode (FLC-dc-APGD). The effect of the operating conditions of plasma systems, *i.e.* the flow rate of introducing the plant drink into the plasma system, the discharge current in the system, discharge voltage, the rotation speed of the metallic electrode, the distance between the electrode and the plant drink, on the contents of: mycotoxins, vitamin C, nitrite ions, fat, and also fiber - depending on the type of the analyzed plant drink. On the basis of the obtained data, statistical models will be proposed and analyzed, making it possible to determine the optimal conditions for the production of plant drinks with the use of CAP. The obtained plant drinks will be analyzed in order to determine their shelf-life, cytotoxicity, as well as the selected nutritional and physicochemical properties. Moreover, the digestion process of the plasma-treated beverages in the stomach will be simulated. Moreover, by inoculating fresh plant drinks with the selected microorganisms responsible for their spoilage, it will be possible to prove potency and applicability of the herein developed innovative method for sterilization of plant drinks. Due to the analyses of reactive oxygen and nitrogen species, generated in the gas and liquid phases during the CAP treatment of plant drinks, the mechanisms and the processes leading to production of functional beverages of defined properties will be proposed.

The assumptions of the proposed interdisciplinary research project were developed on the basis of long-term and extremely effective cooperation between scientists from the Department of Analytical Chemistry and Chemical Metallurgy, Faculty of Chemistry, Wroclaw University of Science and Technology (Project's Leader) and the University of Gdansk (Project's Partner). The implementation of the research project results will contribute to ensuring food security for people around the world, and will also lead to broadening knowledge in several scientific disciplines, *i.e.*, chemical sciences, biological sciences, chemical engineering, process engineering, and electrical engineering.

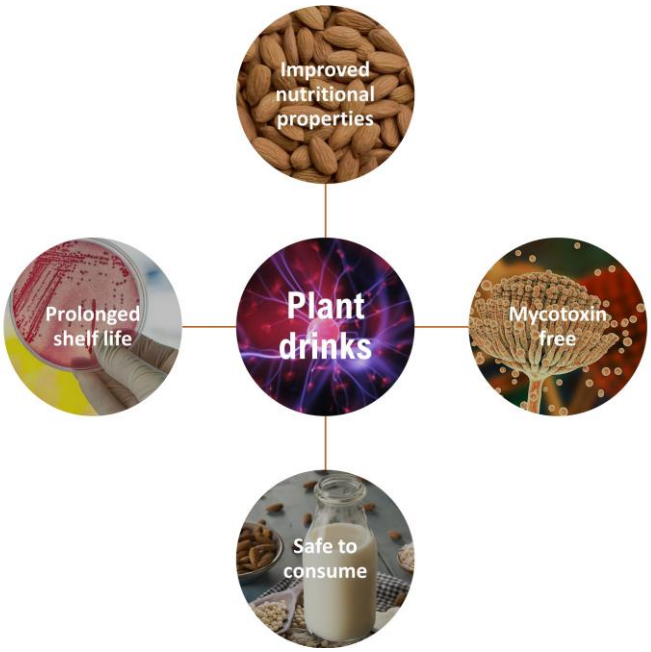

Fig. 1. The selected improved properties of the plant drinks functionalized with the aid of cold atmospheric plasma.