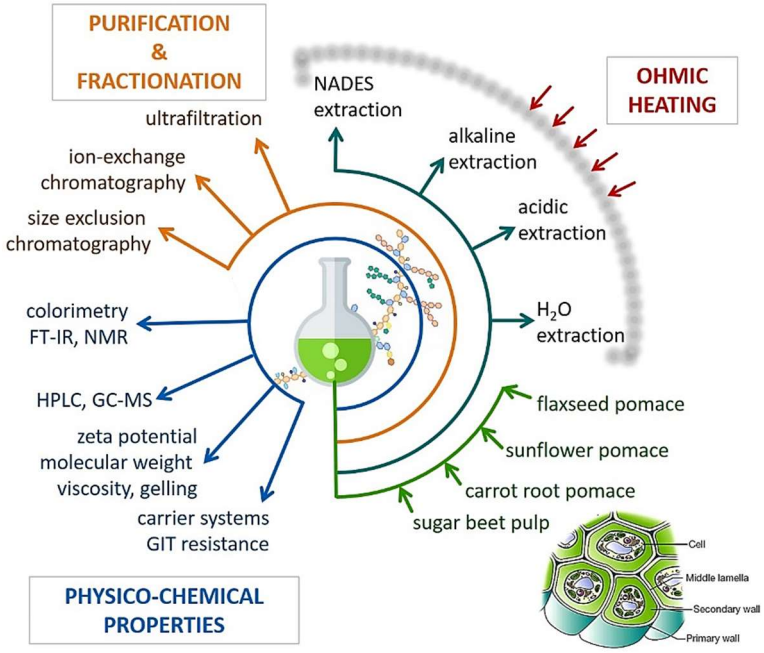
The main objective of the project is a research on the influence of extraction process parameters of obtaining polyanionic saccharides from native bio-waste, i.e. sugar beet pulp, carrot root pomace, sunflower pomace, and flaxseed pomace, residues from the agricultural and food processing industry very popular in Poland, still too poorly managed to obtain fine chemicals. The extraction process supported by Ohmic heating (*Ohmic heating-assisted extraction*, OHAE), used to extract plant biomass components, is an emerging technique and so far poorly explored by scientists around the world. Moreover, no one has ever tried to use it to extract pectin in environmentally safe solvents, such as natural deep eutectic solvents (NADES). The essence of the new knowledge discovered is the selection of appropriate conditions for the process, tailor-made not only to the isolated compounds, but also to the type of raw material used. The research idea proposed in the project indicates the need to determine the relationship between the selection of the extraction process parameters and the properties of saccharide polyanions extracted from biomass, both in terms of their chemical structure and physical properties, determining in the future their utility potential.

The main scientific objective of the project will be achieved through the implementation of the following tasks constituting specific objectives:



- Selection of OHAE process parameters for saccharide polyelectrolytes separation in: (i) water, (ii) the selected weak acidic, (iii) weak alkaline water solutions, (iv) and in some NADES, for each proposed raw plant material. All obtained extracts will be purified to collect water soluble polysaccharides. The influence of pH value and ionic strength on the OHAE process will be analysed, where several characteristics will be examined, i.e. the saccharides amount, especially the uronic acids presence, the degree of esterification of carboxylic functional groups of their structures, impurities of polyphenolics and proteins. Such an approach will allow characterizing a range of optimal extraction parameters for obtaining of the natural polyanionic saccharides (nPEs).
- Purification by chromatographic fractionation of the optimally obtained polyanionic products and the assessment of their homogeneity degree. Advanced chemical characteristics of the obtained fractions by spectroscopic and chromatographic methods will be executed.
- The physicochemical properties of pure polyelectrolytes fractions will be analysed in terms of viscosity and gelling capacity, zeta potential, and surface properties under the influence of selected factors, i.e. variable pH conditions, ionic strength, temperature, and multivalent ions. The behaviour of the most interesting saccharide polyelectrolytes will be evaluated in a four-stage model of the human gastrointestinal tract environment. The most interesting saccharide polyelectrolytes will be used as building materials for solid, semi-solid, and liquid carrier systems and the physicochemical properties of these systems, including their behaviour in the digestive system *in vitro*, will be studied.

The emerging Ohmic heating-assisted extraction technique for the separation of high-value chemicals such as pectins, performed in a suitable "green" extraction medium, is a promising, cheap, fast, and highly effective method. Electric current flowing through biomass, by converting electrical energy into thermal energy, results in a quick and uniform increase in temperature in the extraction system, which translates into time and energy savings. So far, Ohmic heating has been widely employed in food processing, including concentration, blanching, thawing, water extraction, and pasteurization. Therefore, the combination of OHAE with the still highly explored and not well-understood application of NADES will enable the identification of the synergy of the NADES extraction with Ohmic heating to obtain anionic polysaccharides, which are constantly obtained on an industrial scale under time-consuming, energy-intensive, and aggressive conditions, usually in the presence of mineral acids. In conclusion, combining Ohmic heating with extraction in NADES can significantly improve and promote the use of clean and sustainable methods in the extraction of fine chemicals.