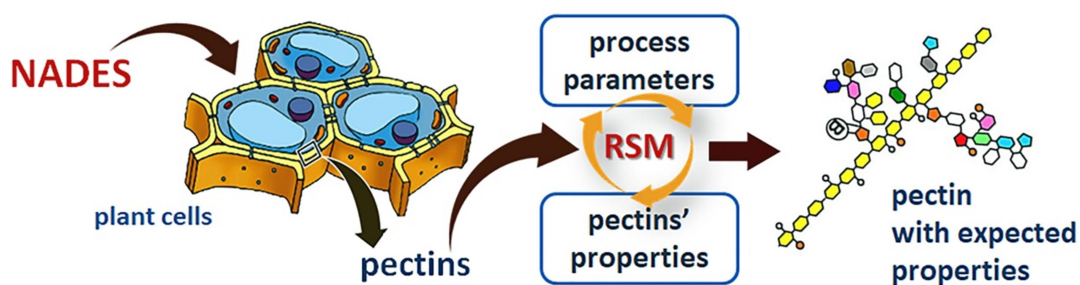


Multiscale analysis of the influence of technological parameters of the natural deep eutectic solvents extraction process on the properties of the fruit pomace pectin

The aim of the project is to conduct a multi-scale analysis of the impact of technological parameters of pectin extraction from plant biomass - fruit pomace, which is waste of the domestic food industry. The use of natural deep eutectic solvents (NADES) as a substitute for the traditionally used strong inorganic acids opens up a new perspective for the use of environmentally friendly technologies that transform natural resources from renewable sources into useful products. The technological solution proposed in the project makes it necessary to determine the relationship between the selection of NADES components, their mutual proportions, the amount of water influencing the viscosity of the mixture, temperature and duration of the process and the properties of pectins extracted from the biomass, both in terms of their chemical nature and physical properties that will be determine their utility potential. The main scientific goal of the project will be achieved through the implementation of research tasks:

- **Extraction of pectin from fruit pomace in selected NADES systems with the use of experimental planning methods.** NADES can be obtained by mixing substances of natural origin, such as simple sugars, low molecular weight organic acids, choline chloride and / or urea. The obtained mixtures have attractive physicochemical properties. The mixtures proposed in the project will be used to extract pectins from fruit pomace in a multi-variant way, with different proportions of their ingredients, taking into account the NADES ratio to plant dry matter, process duration and temperature.
- **Initial physicochemical characteristics of the obtained plant biomass extraction products.** The obtained extraction products will be analyzed taking into account the pH, solubility, gelling capacity, sugar content in the product, including uronic acids, the amount of polyphenols and proteins, indicating the degree of purification of the product.
- **Multiscale analysis of the influence of technological parameters of extraction processes on the obtained pectins using the response surface methodology (RSM).** The technological parameters of the extraction process will be correlated with the data describing the physicochemical nature of the obtained pectins. The dependence of the data describing the properties of the obtained pectins on the applied process parameters will allow to describe the trends and propose optimal extraction conditions with the use of NADES.
- **Chemical characterization of pectins extracted using optimal technological parameters of NADES extraction.** Advanced chromatographic and spectroscopic methods will be used for this purpose. Characterization of selected pectins obtained in optimal process conditions will be performed using imaging techniques.



Pectins, as heteropolysaccharides present in plant cell walls, consist mainly of D-galacturonic acid linked by α -(1,4) bonds. However, their molecular weight, degree of esterification (DE) of D-galacturonic acid, degree of branching of the main chain, type of sugar subunits in the main chain and side chains will depend not only on the type of plant material, but also on the conditions technological process of their separation from biomass. Traditional methods of obtaining pectins using strong inorganic acids increase the susceptibility of these substances to degradation, accelerate equipment corrosion and pose an environmental problem. The use of NADES for pectin extraction is an under-researched process, so far little described in the scientific literature. There is no systemic description of the related technological parameters on this subject. Understanding the dependence of the parameters of the pectin extraction process with the use of NADES on their properties will be of great importance for the better use of clean technologies based on the use of deeply eutectic mixtures based on ingredients of natural origin.