

The pulsed electric field (PEF) is a nonthermal technology of food processing, that finds more and more applications in the food industry. The main action of the PEF is based on interfering with the cellular structure. As a result of electroporation, pores are formed in the cell membrane, and then they can expand, aggregate, and even reseal. To assess the degree of destruction of the tissue subjected to pulsed electric field treatment, for example, measurements of electrical conductivity, microscopic analysis and time-domain nuclear magnetic resonance are used. Each of these methods requires some interference in the tissue. Mechanical damage to a plant immediately affects its visual quality, however over the long term it causes metabolic changes, the effects of which, in the form of broadly understood changes in quality, are detected after some time. Each applied process causes stress to the plants, which as a consequence induces physiological and metabolic changes. A full understanding of the mechanism of stress-induced changes would enable developing a method that allows to reduce its effects. The pulsed electric field may act as an abiotic stressor, influencing the metabolism of the treated tissue. Considering that the treatment with pulsed electric field, as well as all the above-mentioned methods of assessing the effects of electroporation, are based on the necessity to interfere with the treated tissue, a method of measuring the obtained effects in a non-invasive manner is essential, so that the obtained result actually relates to only one, specific process. The determination of biospeckle activity may prove to be such a method.

The aim of this study will be assessment of the effect of a pulsed electric field with variable energy supplied to the treated apples and carrots on their metabolic activity measured over time. Moreover, an attempt to use biospeckle activity and respiratory activity as potential non-invasive methods for quantifying electroporation will be made. Obtained results can provide a more accurate description for the mechanism of affecting plant tissues by pulsed electric field.

This project will focus on a modern technique of food processing, which is the pulsed electric field (PEF). Taking into account its not fully recognized potential, the lack of data on the impact of this nonthermal technique on biospeckle activity, and additionally its ambiguous effect on the respiratory activity of some fruits and vegetables, conducting research in this field is considered justified. The effect of PEF on the strength of the cell wall of plant materials has not been studied so far. Furthermore, the innovative aspect of this work will also result from the fact of using an advanced and modern method to determine the state of the water, which is the time-domain nuclear magnetic resonance. An attempt will also be made to correlate the biospeckle activity with remaining parameters, which are the subject of the research in this project. Taking all of the above into consideration, this work will contribute to expanding the basic knowledge about the direct (measured in a non-invasive way) effect of the pulsed electric field on plant tissue in terms of, first and foremost, the nature of metabolic and physiological changes of the treated material.