

Title Detection of apple tissue fracturing mode by acoustic emission
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Abstract

Some of apples texture sensory descriptors depend on tissue fracturing modes during mastication. Crispness and crunchiness are attributes which relate to the sound generated during the first bite or tissue chewing, respectively. Juiciness and mealiness, the two contrary attributes, appear when cell walls fracture or cell-cell debonding are the dominant modes of fracturing, respectively. Therefore, the knowledge about the fracturing mode is crucial for a certain texture properties interpretation. Fracturing can be detected by the contact acoustic emission (AE) which was applied successfully as an instrumental way of the texture assessment of apples. Apple texture is very sensitive for a storage method. An enzymatic and non-enzymatic pectin degradation leads to the firmness decrease during storage. The goal of this paper is using the acoustic emission for detection of apple tissue fracturing mode. Three different apples cultivars were stored in different way, i.e. cold storage, shelf-life and control atmosphere storage. Finally, 10 different storage stages for the each cultivar were obtained. At the each stage, three mechanical tests with acoustic emission were applied: puncturing, texture profile analysis (TPA) and single edge notched bending (SENB). The results of acoustic emission measurements have allowed concluding that if the pectin degradation proceeds during storage, a number of acoustic emission events decreases as well. It is known, that in order to the sound generation a sudden energy release is necessary. Therefore, elastic cell walls can generate the AE signal in opposite to the plastic bonds between cells. It leads to a conclusion that the decrease of the number of the AE events would be associated with a decrease of a number of fractured cell walls. This result shows that the acoustic emission would be used for detection of apple tissue fracturing mode. Rough calculation of the number of fractured cell walls of the no-ripened apples, where the cell wall fracture mode is dominant, has agreed with the number of AE events recorded during mechanical deformation. This work was financed from national budget for science in years 2008-2010 as the project N R 12 0031 04