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Effect of pulse electrical field on the mechanical properties of raw, blanched and fried potato strips

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French fry manufacturing involves a series of processes in which structural properties of potatoes are modified to produce crispy French fries which consumers enjoy. In addition to the traditional French fry manufacturing process, the industry is applying a relatively new process called Pulsed electrical field (PEF) to the whole potatoes. There is a wealth of information on the technical treatment conditions of PEF, however there is a lack of information about its effect on the structural properties that affect texture and its synergistic interactions with the other manufacturing steps of French fry production. The effect of PEF on ion content (K^+ , Ca^{2+} and Mg^{2+}) of Russet Burbank potato was determined by inductively coupled plasma optical emission spectrophotometry. Firmness and toughness of raw and blanched potatoes were determined in a uniaxial compression test. Moisture content was determined in a vacuum oven and oil content was measured using the soxhlet system with hexane. The final texture of the French fries – crispness – was determined using a three-bend point test. Triangle tests were conducted to determine if consumers could perceive sensory differences between French fries that were PEF treated and those without treatment. The concentration of K^+ , Ca^{2+} and Mg^{2+} decreased significantly in the raw potatoes after the PEF treatment as expected. The PEF treatment significantly increased modulus of elasticity, compression strain, compression force and toughness in the raw potato. The PEF-treated raw potato was firmer and stiffer, and its structure integrity held together longer, resisted higher force before fracture and stretched further than the untreated ones. PEF-treated potatoes had significantly lower oil content than the untreated French fries with the potatoes that received the Low/High blanching treatment exhibiting the lowest oil content. The PEF treatment did not have an overall significant effect on the moisture content and crispness of French fry. Most consumers could not detect a difference between French fries that received a PEF treatment from those that did not. The strain stress relationship exhibited by the PEF-treated raw potato and the lower oil content could be explained by an increase in cell connectivity between the potato tissue. PEF increases the Plasmalemma and tonoplast permeability allowing Ca^{2+} and Mg^{2+} cations to reach the cell wall and middle lamella, and be available for cross linking with the pectin molecule reducing the cellular intercellular space.

Biography

Maria Botero Uribe has completed her Bachelor's degree in Food Engineering; Master of Science in Cereal Chemistry and; Diploma in Agri Business. She is currently pursuing her PhD at University of Queensland. She has 15 years of experience in working through the grain supply and value chain from crop production through first and second stage processing.

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