

Warachai Poparisut 2011: Optimization and Mathematical Modeling of Water Loss and Oil Uptake during Microwave Frying of Frozen Potato Slices. Master of Science (Food Engineering), Major Field: Food Engineering, Department of Food Science and Technology.  
Thesis Advisor: Mr. Sirichai Songsermpong, Ph.D. 107 pages.

Conventional deep fat frying is the well known food preparation method due to this method is simple and convenient but has disadvantage in respect of large oil uptake. In this research, microwave frying was considered as a new method for improving the quality of the fried food and frozen potato slices were used. The first objective of this investigation was to study the effect of microwave power level and frying time on the quality of fried potato slices (moisture content, oil content, texture and color). It was found that moisture content tends to decrease, for oil content, hardness and  $\Delta E$  values tends to increase when fried with high microwave power level and frying time. The second objective of this investigation was to study the equations to describe the various quality changes of potato slices during microwave frying at power level of 85, 425 and 850 watt with initial oil temperature at  $140^{\circ}\text{C}$  in comparison with conventional deep fat frying with initial oil temperature at  $180^{\circ}\text{C}$ . It was found that the most appropriate model to describe water loss was Page's law and to describe oil uptake was Fick's second law model. For the equation to explain the change in texture and color during frying was Pedreschi and Moyano's model (2005) and first order kinetics model respectively. It was found that the equations can predict both qualities very well. The values of the predictions were in agreement with experiment values. When comparing the rate of change for various qualities of 2 methods, it was found that potato slices fried with microwave power level 850 watt had rate of water evaporation ( $k_m$ ) and effective moisture diffusivity, rate for softening of the potato tissue ( $k_s$ ), rate for crust hardening ( $k_h$ ) and rate for color change ( $k_e$ ) during frying higher than conventional deep fat frying but rate of oil uptake and effective oil diffusivity was lower than. Therefore, fried potato slices with microwave at 850 watt decreased frying time and oil uptake. The last objective of this investigation was to study the optimum condition of microwave frying of potato slices by response surface methodology. It was found that using high microwave power level for short time (700 watt 130 seconds) and low microwave power level for long time (425 watt 200 seconds) cause moisture content and oil content in the range lower than United States Standard for fried potatoes, the fried potato slices has high hardness and golden brown color. In addition, both conditions have qualities better than potato slices fried with conventional deep fat frying in the range of 180-210 seconds due to the moisture content and  $\Delta E$  values are equal but have lower oil content and more hardness than conventional method. Therefore, the potato slices with initial oil temperature  $140^{\circ}\text{C}$  then fried by microwave at optimum conditions were the way to replace conventional deep fat frying at  $180^{\circ}\text{C}$  in order to reduce the oil absorption and better quality.

---

Student's signature

Thesis Advisor's signature