Thesis Title	Heat and Mass Transfer of Frying in Vacuum Fryer
Thesis Credits	12
Candidate	Miss Jarinya Jirojkul
Supervisors	Assoc. Prof. Dr. Sakarindr Bhumiratana
	Mr. Suvit Siriwattanayothin
Degree of Study	Master of Engineering
Department	Food Engineering
Academic Year	1998

Abstract

This research studied heat and mass transfer in deep-fat frying and the effects of factors such as oil temperature, pressure, frying time and dimension of food on the transfer process and on the product quality.

The study found that oil temperature affected the temperature and moisture content of the products. High-temperature frying enhanced heat and mass transfer rate. Pressure during frying affected the moisture content of the products. Lowering pressure caused decreasing boiling point of liquid within the products. Therefore, the moisture content of the products fried under vacuum frying decreased at a faster rate than that of atmospheric frying. The shape of the food also affected the rate and amount of oil absorption. Cubed potatoes which possessed the high ratio of crust/core absorbed more oil than slab potatoes where the crust/core ratio was lower.

This research also presented the development of mathematical equations used for modeling heat and mass transfer in atmospheric frying and vacuum frying. Deep-fat frying was viewed as a non-moving boundary problem because the thickness of crust layer was considered very thin.

Heat transfer in the core region was controlled by conduction. Effective thermal diffusivity of the potato products fried between 120°C -160°C under atmospheric frying was 1.61×10^{-7} - 3.36×10^{-7} m^2/s and for the same product under vacuum frying, the value was 4.17×10^{-7} - 6.34×10^{-7} m^2/s. Mass transfer in the core region was a result of concentration gradient. Effective mass diffusivity of potato between 120°C-160°C under atmospheric frying process was 2.23×10^{-9}-1.09×10^{-8} and under the vacuum frying was 5.83×10^{-9}-1.49×10^{-8} m^2/s. Conclusively, the effective thermal diffusivity and effective mass diffusivity of the products fried under vacuum frying were higher than atmospheric frying.

In the crust region, crust layer was very thin(0.5-0.8 mm) and most of the oil absorbed was within the crust. Therefore, oil accumulation within the crust can be used to estimate the crust thickness and the crust formation rate. It was concluded that crust forming rate was linearly dependent on the oil temperature. The crust formation rate of the products fried under vacuum frying was higher than that under atmospheric frying.

Keywords : Deep-Fat Frying / Vacuum Frying / Fryer / Potato / Oil Absorption / Diffusion / Heat Conduction