Sutida Netipunya 2006: Development of Bread Stick from Rice Flour. Master of Science (Agro-Industrial Product Development), Major Field: Agro-Industrial Product Development, Department of Product Development. Thesis Advisor: Assistant Professor Nantawan Therdthai, Ph.D. 106 pages.
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Bread stick is the soft-tough bread typically produced from wheat flour. To reduce importing wheat flour as well as increase value of rice, this study was aimed to develop a rice-flour based bread stick. To improve quality of the rice-flour based bread stick, effect of some major ingredients including water, fat, hydroxypropylmethyl cellulose (HPMC) and xanthan gum on the product quality was studied by using the central composite design (CCD). According to the experimental data, empirical models were established to express the relationship between the ingredients and quality factors including hardness (N), springiness index, specific volume (cm^3/g), crust color (L*-value) and crumb color (L*-value). Model performance was evaluated by using correlation coefficient (r) between actual values and modeled values and mean square error (MSE). Rs of hardness, springiness index, specific volume, crust color and crumb color models were 0.9937, 0.8072, 0.9786, 0.9109 and 0.9046 respectively. MSEs were 11.6000, 0.0011, 0.0037, 3.4028 and 0.8300 respectively. For validation, additional experiments were conducted. According to the results during modeling and validation, the model performance was reasonably good. Therefore, the developed models were used for optimization using least square criterion. In order to minimize raw material cost and keep the quality similar to the commercial wheat-flour bread stick, the optimal rice-flour based bread stick formula should be composed of 59.64% water, 11.09% fat, 2.01% HPMC, 1.65% xanthan gum, 12.89% sugar, 2.03% salt, 3.61% yeast and 33.33% eggs, based on flour content (flour consisted of 72.92% rice flour, 12.50% tapioca flour and 14.58% potato flour). After that the optimized formula was used to study dough mixing time. It was found that the mixing time should be 7 minutes. Based on the developed formula with 7 minutes mixing time, hardness and springiness index of the optimized bread stick were 6.33 N and 0.87 respectively. The specific volume was 2.20 cm^3/g. L*-value of crust color and crumb color were 59.47 and 75.46 respectively. The estimated raw material cost was 10.91 baht per 250g dough. According to consumer test, likeness values of the rice-flour based bread stick appearance, softness and overall were moderate and 89.73 % of consumers accepted the product. Therefore rice flour could be used for substituting wheat flour in breadstick, in order to reduce importing wheat flour and increase rice value.

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