Optimizing the processing factor and formulation of oat-based cookie dough for enhancement in stickiness and moisture content using response surface methodology and superimposition

ABSTRACT

Despite the utilization of dusting flour and oil to reduce dough stickiness during the production process in food industry, they do not effectively help in eliminating the problem. Stickiness remains the bane of the production of bakery and confectionery products, including cookies. In addition, the high moisture content of cookie dough is unduly important to obtain a high breaking and compression strengths (cookies with high breaking tolerance). This study was conducted in light of insufficient research hitherto undertaken on the utilization of response surface methodology and superimposition to enhance the stickiness and moisture content of quick oat-based cookie dough. The study aims at optimizating, validating and superimposing the best combination of factors, to produce the lowest stickiness and highest moisture content in cookie dough. In addition, the effect of flour content and resting time on the stickiness and moisture content of cookie dough was also investigated, and microstructure analysis conducted. The central composite design (CCD) technique was employed and 39 runs were generated by CCD based on two factors with five levels, which comprised flour content (50, 55, 60, 65, and 70%), resting time (10, 20, 30, 40, and 50 min) and three replications. Results from ANOVA showed that all factors were statistically significant at $p < 0.05$. Flour content between 56% and 62%, and resting time within 27 and 50 min, resulted in dough with high stickiness. High-region moisture content was observed for flour content between 60% and 70%, and within 10 and 15 min of resting time. The optimized values for flour content (V1) = 67% and resting time (V2) = 10 min. The predicted model (regression coefficient model) was found to be accurate in predicting the optimum value of factors. The experimental validation showed the average relative deviation for stickiness and moisture content was 8.54% and 1.44%, respectively. The superimposition of the contour plots was successfully developed to identify the optimum region for the lowest stickiness and highest moisture content which were at 67–70% flour content and 10–15 min resting time.

Keyword: Dough stickiness; Moisture content; Response surface methodology; Optimization; Superimposition