

# EFFECT OF FLOUR BLENDS AND BAKING CONDITIONS ON THE QUALITY OF ORANGE FLESHED SWEET POTATO-PUMPKIN-WHEAT COMPOSITE BREADS DURING STORAGE

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## INTRODUCTION

- Changes in moisture content and textural properties of bakery products during storage may be detrimental to the products' eating qualities and shelf-life.
- An increase or decrease in the moisture content of bread during storage can adversely affect the texture, eating quality and shelf- life of bread.
- Incorporation of gluten-free flour and baking operations may help to minimize post baking changes in bread.
- This study investigated the effect of wheat, orange-fleshed sweet potato (OFSP) and pumpkin flour blends, and baking operation conditions on the moisture content, water activity, textural profile, and the rate of staling in composite bread crumb using the response surface methodology (RSM).

## MATERIALS & METHODS

- I-optimal (combined) design of RSM of the Design-Expert software version 11 (Stat-Ease Inc., Minneapolis, United States) was used for experimental design.
- A total of 27 experimental runs were created.
- wheat flour (A) was replaced with OFSP (B) and pumpkin flour (C) within the rate of 10-50% and 10-40% respectively.
- Six levels of baking temperature (150-200 °C) and time (15-25 min) were used for bread preparation.
- The bread was prepared following the International Association for Cereal Science and Technology (ICC) standard method 131.

### Bread Storage

- Freshly baked bread loaves were cooled for 2 h and stored in a climatic chamber (model VCL 400, Voetsch Industrietechnik GmbH, Germany) at 25 °C and 85 % relative humidity for five days.

### Bread Quality Measurements

- Crumb moisture content and water activity were measured at 2 h after cooling and 24 h interval of five days of storage.
- Textural profile analysis (TPA) was performed on crumbs for the first three days storage at 24 h interval using a texture analyzer (model TA.XT plus, Stable Micro Systems Ltd, Godalming, UK).
- Mold growth on bread slices was assessed during the five days of storage.

## RESULTS AND DISCUSSION

- Crumb moisture content and water activity decreased with storage time.
- The percentage loss in the moisture of crumbs ranged between 5.5 – 34.7 %.
- Bread crumb hardness and chewiness increased while cohesiveness, springiness and resilience decreased during storage.
- However, increasing pumpkin and OFSP flour rates slowed moisture loss and staling (Fig. 1).
- Moreover, bread crumbs that contained pumpkin flour above 10 % had more stable cohesion, springiness and resilience during storage.

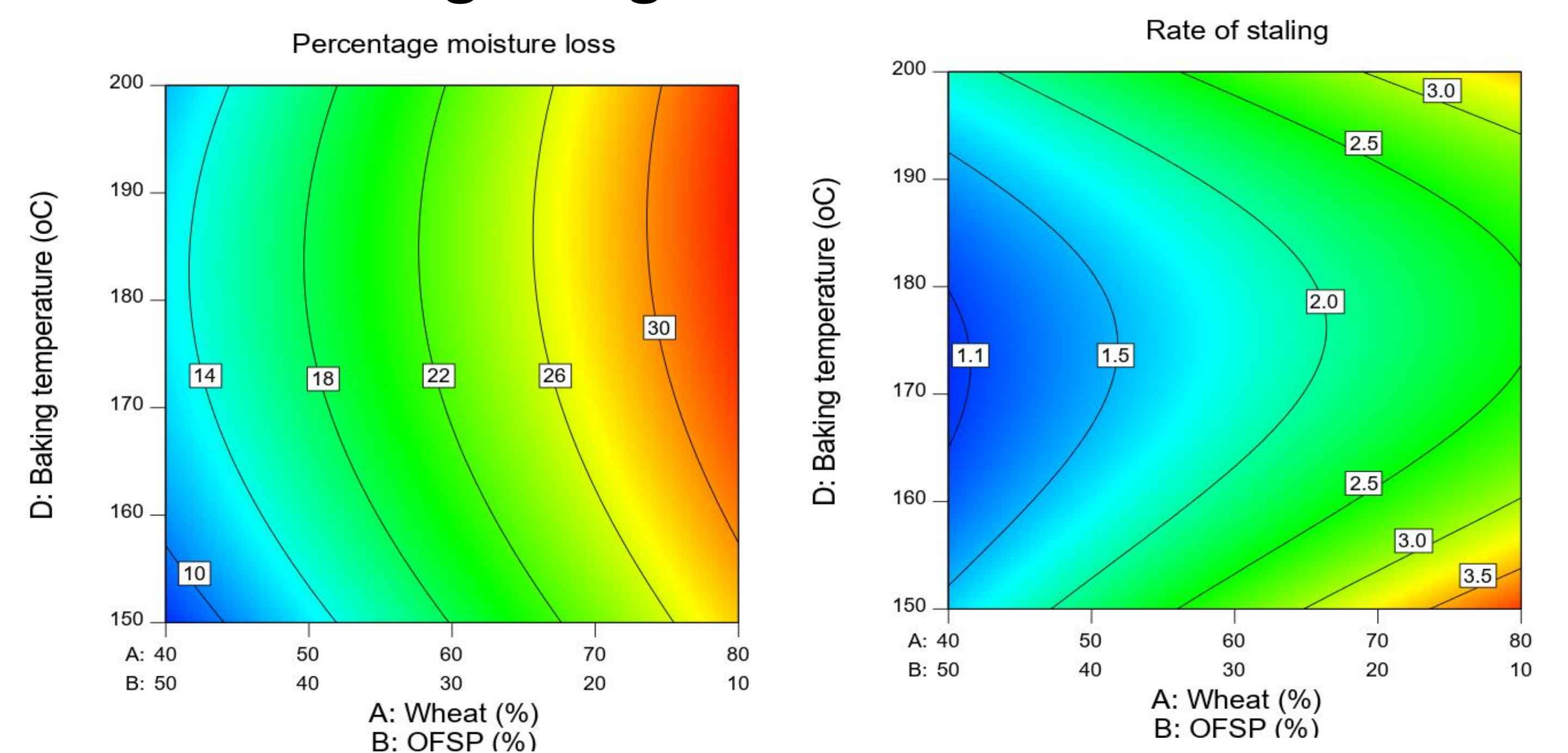


Fig. 1. Response surface plot of the effect of wheat & OFSP flour proportions, pumpkin flour (10 %), baking temperature and baking time (15 min) on percentage moisture loss and rate of staling in bread crumbs during storage.

- Bread containing higher proportion of wheat flour and baked at lower temperature (150-160 °C) and higher (190-200 °C) had high staling rate.
- Bread prepared from wheat flour (>70%) and baked at lower temperature (150 °C) for shorter time (15-19 min) had mold growth on the fourth day of storage.

## CONCLUSION

- The incorporation of OFSP flour ( $\leq 33\%$ ) and pumpkin ( $\leq 12\%$ ) baking at 170-180 °C for 17-19 min could be applied to enhance bread crumb quality properties and shelf-life during storage.

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