

STUDY OF THE INFLUENCE OF THE ADDITION OF INGREDIENTS IN BAKERY PRODUCTS ON RHEOLOGICAL PROPERTIES OF FLOUR

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Objectives

In order to improve the nutritional quality of breads, the mixture of malt bagasse to wheat flour can affect the rheological properties of doughs and products. In this case, farinography can predict the effects of malt bagasse on the mixing properties and suitability of wheat flour, by determining operational parameters such as water absorption, mixing time, stability and tolerance index to the mixture, important indicators of the bread making process. In this sense, we evaluated the farinographic effects of replacing 10% of wheat flour with ground dry residual malt from Baltic Porter beer.

Materials and Methods

Duplicate portions of 300 g of refined wheat flour Suprema (Bunge, SP, Brazil) (control) and wheat flour with 10% residual dry malt (beer Baltic Porter-Brewery Casa Avós, SP, Brazil) were evaluated in a farinograph adjusted to 500 farinographic units (UF) of consistency, to determine the farinographic parameters, water absorption and stability. The results were statistically evaluated using ANOVA analysis of variance and application of the Tukey test at a 95% significance level, with the Minitab statistical package (USA), to verify the effects of malt bagasse on the rheological properties of the dough.

Results

The mean values of water absorption and stability, as farinography analysis, results are shown in Table 1.

Table 1. Farinography analysis of the samples.

Treatment	Water absorption (%)	Stability (min)
Control	63.1±0,06 ^A	38.4±0,42 ^A
Malt bagasse BP	65.2±0,36 ^B	12.6±1,41 ^B

Same letter in the same column indicates that there is no significant difference ($p < 0.05$)
BP- Baltic Porter

The study of rheology is of vital importance in the area of food, since the knowledge of these rheological properties helps in industrial processes, such as equipment design, quality control and determination of the product's shelf-life [CAUVAIN, YOUNG, 2009; LANNES, 2017].

One of the most abundant ingredients in baked products is flour, and the addition of different ingredients in the dough can influence the rheology of flour. And the malt bagasse is a residue from the manufacture of beer, which contains, on a dry basis, proteins and fibers ranging, respectively, from 19 to 30% and from 42 to 78% [LYNCH et. al, 2016].

There are 3 equipment that help in this study: alveograph, extensograph and farinograph [AQUINO, 2012].

The alveograph is a tool that relies on the injection of air into a portion of mass until the formation of a bubble, thus simulating the release and retention of gases, so one of the evaluated properties is the Gluten Strength (W): Whereas gluten is a protein that acts as a "glue", the strength of gluten is given by the energy required for mass deformation, since its expansion and wall rupture, therefore it is a property that is related to the carbon dioxide retention capacity of the mass and the cooking performance of a flour. [CARCEA et al., 2020; CAUVAIN, YOUNG, 2009]. The extensograph is an instrument that measures the strength of the mass in length. The property obtained called Resistance to Extension or Elasticity (R) is related to the capacity of the dough to retain the carbon dioxide that is generated during fermentation [YAMANI, 2015, DELCOUR, HOSENEY, 2010]. The farinograph is an apparatus that measures the resistance of the dough during the mixture of ingredients, thus evaluates several parameters, mainly the absorption of water in the body [YAMANI, 2015].

In recent literature, there are 2 interesting studies on the addition of ingredients and the influence on farinograph properties. In CARCEA et al, 2020, it was studied how the addition of Sodium Chloride to bread doughs influences the water absorption and stability. It was observed that the addition of salt decreased the absorption of water, but increased the stability. In PASQUALONE, ANGELIS et al, 2019, farinograph was used to evaluate the influence of the addition of chickpea flour in the dough of durum breads, with this analysis it can be concluded that the water absorption increased, while the dough stability decreased with the addition of chickpea flour.

Conclusions

The replacement of 10% of wheat flour by dry crushed malt bagasse significantly affected the parameters of water absorption and stability, when compared to the control treatment, causing an increase of 2.76% in water absorption, and a reduction of 67.18% in stability. These effects can be explained by the high water absorption capacity of the malt

bagasse fibers, and by their interference in the formation, cohesion and stability of the gluten network, must be taken into account when preparing and developing the dough.

References

- AQUINO, V. C. Estudo da estrutura de massas de pães elaboradas a partir de diferentes processos fermentativos. 2012. 87f. Dissertação (mestrado) – Departamento de Tecnologia Bioquímico-farmacêutica, Universidade de São Paulo, 2012.
- CARCEA, M.; NARDUCCI, V.; TURFANI, V.; MELLARA, F. A Comprehensive Study on the Influence of Sodium Chloride on the Technological Quality Parameters of Soft Wheat Dough. *Foods*, v. 9, Issue 7, 2020.
- CAUVAIN, S.P.; YOUNG, L. S. Tecnologia da panificação. São Paulo: Manole. 2 ed. 2009. 418p.
- DELCOUR, J.A., HOSENEY, R. C. *Principles of Cereal Science and Technology*. 3rd Ed. AACC International, Minnesota, USA 2010, 222 p.
- LANNES, S. C. S. Rheology as a Tool for Food Development. In: Maria Dolores Torres Pérez. (Org.). *Advances in rheology research*. 1 ed. Hauppauge - USA: Nova Science Publishers, 2017, v. 1, p. 289-308.
- LYNCH, K. M.; STEFFEN, E. J.; ARENDT, E. K. Brewers' spent grain: a review with an emphasis on food and health. *Journal Of The Institute Of Brewing*, v. 122, n. 4, p. 553-568. 2016.
- PASQUALONE, A.; ANGELIS, D.; SQUEO, G.; DIFONZO, G.; CAPONIO, F.; SUMMO, C. The Effect of the Addition of Apulian black Chickpea Flour on the Nutritional and Qualitative Properties of Durum Wheat-Based Bakery Products. *Foods*, v. 8, issue 10, 2019.
- YAMANI, B. V. Substituição parcial de farinha de trigo por farinha de amaranto (*Amaranthus cruentus* L.), quinoa (*Chenopodium quinoa* W.) e maca (*Lepidium meyenii* W.) na elaboração de panetone. 2015. 237p. Tese (doutorado) – Faculdade de Ciências Farmacêuticas, Universidade de São Paulo, São Paulo, 2015.