EVALUATION OF ULTRAVIOLET RADIATION (UV-C) AND HIGH HYDROSTATIC PRESSURE (HHP) ON TOTAL BACTERIAL COUNT IN MINAS FRESCAL CHEESE

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Introduction

Consumer demand for healthy, natural and additive-free food, with greater stability during storage has encouraged food companies and industries to work with alternative technologies to ensure microbiological safety, without negatively affecting nutritional components (KHAN et al., 2017). Minas frescal cheese (MFC) is a fresh cheese with very high humidity (BRASIL, 2004) and high water activity, that is, these characteristics give this product a reduced shelf life. The quality of the raw material, hygiene during production, transport and storage are essential to guarantee the microbiological safety of this product (MATERA et al., 2018). MFC has been associated with the transmission of several pathogenic bacteria, such as *Enterococcus* spp., *Staphylococcus* spp. (SPANU et al., 2014; GONZALEZ et al., 2017), diarrheagenic *Escherichia coli* (DEC), *Listeria monocytogenes* and *Salmonella* spp. (LIMA et al., 2015). The use of new processing technologies like ultraviolet radiation (UV-C) and high hydrostatic pressure (HHP) can influence MFC's microbiological stability, increasing its shelf life and controlling the potential microbiological hazards in this product (CEBRIÁN et al., 2016).

This study aimed to evaluate the inactivation of total aerobic bacteria (TAB), present in the natural microbiota of MFC, through the application of different doses of UV-C and HHP.

Method

MFC was produced in the Food Technology Laboratory of MBO/UFF, as described by Gouvea et al. (2019), using good manufacturing practices, under controlled conditions, to reduce the variability between samples. A Central Composite Rotatable Design (CCRD), 2^2+ (2.2) +3, was used in a total of 11 assays carried out in random order, to evaluate the individual and combined effects of the different doses of UV-C (0.097 to 0.392 J/cm².s^{-1}) and HHP (100 to 400 MPa, for 10 min), on the inactivation of TAB present in the natural microbiota of MFC. The entire experiment was carried out with three independent repetitions. The TAB count was performed as described in the ISO 4833-1/2013. The Statistica® 7 software was used to elaborate the experimental design and to obtain the polynomial model that describes the effect of independent variables (UV-C and HHP) on TAB inactivation, through multiple regression analysis (BARANYI et al., 1999; OSCAR, 2005).

Results / Discussion

The individual effect of the UV-C and HHP treatments provided a greater decimal reduction (DR) of TAB than the combined effects of the treatments. The individual effect of UV-C with the highest mean DR of TAB (-0.32 ± 0.03 log CFU/g) was at the dose of 0.152 J/cm^2.s^{-1}, while the individual effect of HHP with the highest DR mean (-0.43 ± 0.06 log CFU/g) was at a dose of 175 MPa for 10 min. The highest mean DR of TAB was -0.18 ± 0.44 log CFU/g of MFC, when submitted to the combined doses of 0.152 J/cm^2/s^{-1} and 400 MPa. The model's lack of fit was not statistically significant (p = 0.318557),

indicating its adequacy. Model adjustment was also observed through the value of R^2 = 0.94 (94% adjustment) and R^2ajs = 0.87 (87% adjustment). Only the linear effect of HHP significantly influenced (p = 0.011579) in the inactivation of TAB in MFC. In this study, the pressure of 400 MPa/10 min with a 0.152 J/cm^2.s^{-1}dose of UV-C obtained the best interaction, being evidenced by the lowest TAB count. The Shapiro-Wilk test was used to verify the normality of the data and it was demonstrated that the residual values have a normal distribution, with a value of p = 0.963. The importance of validating a mathematical model is to ensure that the results obtained are reliable and this validation is achieved.
The predicted and observed values of the prediction model used in this study resulted in values of *Af* = 1.03; *Bf* = 1.00; % D = 3.12; % B = 0.00; and ER ranging from -0.01 to 0.01. These results indicate that there is a perfect correlation between predicted and observed, mainly due to the *Bf* value (1.00), which allows us to say that the model is fail-safe. Therefore, all model performance indexes indicate the model's suitability to predict TAB inactivation under the individual and combined effect of UV-C and HHP.

Conclusion

HHP and UV-C are promising technologies with potential action to reduce microorganisms in MFC. The results presented in this study encourage future studies to optimize the combined use of UV-C and HHP in MFC.

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