Mathematical model describing the behavior of biomass, acidity, and viscosity as a function of temperature in the shelf life of yogurt

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Abstract. A right store temperature can prevent spore germination and influence the quality of the shelf-life of yogurt. In this research, the main objective was to determine a set of first-order ordinary differential equations (ODEs) that reproduce the behavior of the physicochemical and microbiological parameters that describe the kinetics of biomass (B), acidity (A), and viscosity (V) as a function of temperature. The data set of these variables was extracted from Zhi et al. 2018 [*Development of a dynamic prediction model for shelf-life evaluation of yogurt by using physicochemical, microbiological and sensory parameters*] which analyzes the evaluation of the shelf-life of yogurt through the use of physicochemical, microbiological, and sensory parameters at different temperatures. The data was extracted for B, A, and V at 5°C with the WebPlotDigitizer 4.5 software. Further, through the Eureqa software we were able to formulate a set of three first-order ODEs and numerical simulations were performed for the three variables. The coefficient of determination indicates that our mathematical model accurately reproduces the experimental data with values of R^2=0.976 for Biomass, R^2=0.995 for Viscosity, and R^2=0.988 for Acidity. In silico experimentations for 30 days indicate that the behavior of the data obtained when comparing them with the literature shows that the measured parameters carry an expected behavior. Additional work is focused on analyzing the shelf-life for different temperatures.

Keywords. *In silico*, Microbiological parameters, Nonlinear systems, ODEs, Shelf-life.