EXPERIMENTAL VALIDATION OF THE DYNAMIC MODELING OF A HTST PASTEURIZATION PROCESS WITH PLATE HEAT EXCHANGERS

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Pasteurization is a thermal processing of liquid foods that target the inactivation of microorganisms and enzymes that compromise food safety and product shelf life. The main objective of a mathematical model of a dynamic process is to be able to describe it as accurately as possible in order to allow the process evaluation and optimization and to study operational conditions and control strategies. The purpose of this work was the experimental validation of a dynamic modeling of a HTST pasteurization process that comprises three plate heat exchangers (heating, cooling and heat regeneration), a holding tube and tubular connections. The model consisted of differential equations of thermal energy balance and boundary conditions for all channels of the exchangers and tubes. The experimental study was conducted using an Armfield FT43 laboratory plate pasteurizer and software gPROMS (PSE) was used to solve the corresponding model. Experimental tests were first performed at steady state in order to determine the convective heat transfer coefficients in the exchangers and to determine the overall heat transfer coefficients between the tubes and the environment. The flow rates were between 10 and 40 L/h for the product (distilled water) and between 24 and 60 L/h for the service fluids. Experimental tests were performed in transient state to study the process behavior during sudden changes in flow rates and inlet temperatures. Through the comparison of experimental and simulated results, it was verified that the predictions from the model were in good agreement with experimental data under various operating conditions.