

Modeling, simulation and control of pink guava puree pasteurization process with fouling as disturbance

Abstract

Fouling is an unwanted deposit on a heat exchanger surface which may cause inefficiency to the heat exchanger's performance in maintaining the outlet product temperature during pasteurization. In order to deal with this problem, fouling must be handled by an efficient control strategy. In this study, an empirical model of fouling was successfully developed and used in a control system. The obtained model is represented by first order plus time delay model with $R^2 = 0.90$. Several proportional-integral-derivative (PID) controllers were then simulated on this model to determine the best control system. Simulation results showed that an ideal PID controller tuned by minimization of integral absolute error (IAE) method exhibited good performance in disturbance rejection of fouling with settling time reduced and robustness improved. This result provides insights to properly design a control strategy dealing with fouling during pasteurization. Pasteurization is one of the food preservation techniques which is commonly applied in beverage and food industries. The outlet product temperature from this process is a crucial parameter that must be controlled to satisfy the industrial standard. However, fouling deposit that occurs during pasteurization process hinders the temperature from reaching the desired value. Hence, a good controller should be designed in order to address this issue. In this study, a control strategy was investigated to deal with fouling problem by using simulation work. The simulation results obtained can be integrated in control strategy design for beverage and food industries. Furthermore, with an enhanced control strategy, product quality is ensured as well as improving efficiency in plant's energy consumption.

Keyword: Beverages; Computer simulation; Controllers; Energy utilization; Food preservation; Fouling; Heat exchangers; Industry; Pasteurization; Proportional control systems