ABSTRACT

During ultra high temperature (UHT) treatment of milk, deposits, known as fouling, are formed on the heating surface, which adversely affect both the fluid flow and the heat transfer. This in turn may impair the product quality and reduces plant-operating time, leading to higher processing costs. Milk fouling is only partially understood due to its very complex nature and it cannot be completely eliminated but strategies to reduce it are of special interest. Experiments on actual sterilizers are very expensive due to large amount of milk required and hence are not feasible particularly when fouling of different types of milk under various conditions are to be studied. A laboratory scale static heat exchanger (SHE) was, therefore, designed and investigations were carried out to study the effects of different types of milk and conditions on the fouling behaviour. Skim milk was also sterilized in a helical triple tube heat exchanger (HTTHE) and milk-fouling study was done. The milk fouling data of HTTHE was developed from the observations of SHE experiments. A model based on hydrodynamics and heat balance, to simulate the fouling behaviour is described in this work, which can predict the fouling, milk outlet temperature and pressure drops etc. It was implemented on an existing helical triple tube UHT milk sterilizer and results were validated with the actual measured data. A steam controller algorithm is also suggested to offset the drop in milk outlet temperature due to fouling. This can prolong the processing time, improve the product quality and bring down the extra costs due to fouling. The developed model can be very useful tool for predicting the long-term behaviour of tubular UHT milk sterilizers and has a potential to be modified further so that it can be adopted in processing of milk in a commercial milk sterilizer.

Keywords: UHT, Milk, Fouling, Sterilizer, Modeling.