Numerical simulations of the hydrodynamic behaviour of a continuous ohmic heater operating with Newtonian and Non-Newtonian fluids

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A pilot ohmic heater was tested for the continuous aseptic processing of strawberry pulp. The fluid mechanics and the fluid residence time distribution (RTD), in the whole volume of the vessel and exclusively in the heating zone (between the electrodes), have been numerically simulated using Computational Fluid Dynamics (Fluent^{TM}) for a Newtonian (water) and a non-Newtonian fluid (strawberry pulp). These simulations were performed at different mass flow rates (from 0.5 to 2 kg/min.) and different inlet temperatures (from 40 to 90 ºC). RTDs were determined defining a unit scalar at the inlet and monitoring its value at the outlet. These results allowed the construction of *F*-diagrams and the calculation of the hold back (*H*) and segregation (*S*). The simulations showed that for 0.5 kg/min water induces the formation of more shortcuts (10 % higher *H*) then pulp. However, for 2 kg/min both fluids display a similar behaviour (less than 3 % difference between *H* values). Furthermore, RTD is affected by the inlet mass flow rate but not so significantly by process temperature. The values of *S* calculated for water show that the reactor approaches plug flow behaviour. The RTD determinations in the heating zone allowed the establishment of an equation for the prediction of the outlet temperature of the fluid, allowing setting criteria for the aseptic processing of fluids thus guaranteeing the microbiological safety of the products.