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MODELING OF THE THERMO-PHYSICAL PROPERTIES OF LIQUIDS INVOLVED IN FOOD PROCESSING

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Abstract

Food processing industries are among the fewest industries that probably will last as long as humanity will survive.
Unlike the other process industries, the food industries' raw materials and products are easily degradable by external and internal factors, and most of them exhibit non-Newtonian behavior. Technologies and equipment for food processing have to be designed as a consequence of these facts. Rationally designed equipment needs a thoroughly knowledge of physical and thermo-dynamical properties (density, viscosity, thermal conductivity, thermal capacity and so on) of materials involved in food processing: raw materials, additives, intermediates, by-products and finished products.
Most of the data concerning the properties of fluids involved in food industry are presented in tabular or graphical form. In this form, experimental data are difficult to use in calculus where properties' values are often and repeatedly necessary at different temperatures: fluids flow, thermal balances and heat and mass transfer coefficients.
Our study aims to correlate experimental data previously published by different authors as tables and/or charts in order to obtain mathematical equations with the general form: $\Psi = f(T,x)$, where Ψ denotes the studied property (density, viscosity, thermal conductivity, etc.), T the temperature and x the concentration of the solution.
Using literature data concerning the variation of thermo-physical properties of sugar solutions in water with the temperature and sugar concentration, two to five equations for density, dynamic viscosity coefficient, thermal conductivity coefficient and thermal capacity have been established. The obtained equations meet two essential requirements: simplicity and sufficient accuracy for engineering calculations.

Key words: mathematical modeling, sugar solutions, thermo-physical properties

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