Microwave-assisted pasteurization of mango pulp and nectar: thermo-physical, electrical and dielectric properties and inactivation kinetics of pectin methylesterase

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Continuous flow microwave heating has proven to be an important option to heat exchangers in the thermal processing of liquid foods because of the fast volumetric heating, low wall temperatures, high energy efficiency and use of electricity from renewable sources. The aim of this study was the microwave-assisted pasteurization of mango puree and nectar (Palmer variety). To support process design and operation, the thermos-physical, electrical and dielectric properties were determined and successfully correlated with temperature: density (pycnometry) thermal conductivity (concentric cylinders), heat capacity (DSC), rheology (parallel plates, coaxial cylinders), electrical conductivity (conductivity meter), relative electrical permittivity and dialectic loss factor (coaxial probe). Ionic contribution to microwave hearting varied between 20 and 70% at 915 MHz and between 5 and 50 % at 2,450 MHz, with a favorable increasing penetration depth only at 2,450 MHz. Samples was thermally processed at different time-temperature combinations (2 to 100 s, 50 to 85 °C) using conventional heating (water bath) and microwave heating (focused mw reactor at 2,450 MHz) recording the temperature history with a fiber optic sensor. Conditions were selected to obtained a residual activity of enzyme pectin methylesterase (PME) between 3 and 97 %, assessed by the titration method. The first-order with two fractions kinetic model was well adjusted to the data, with lethality integration for each treatment, suggesting the presence of two fractions with very different thermal resistances, as is usual for PME. Negligible difference in inactivation rate was observed under microwave heating (only thermal effects). Support: FAPESP 2013/07914-8, CNPq 169888/2017-7, 316388/2021-1.