Inversion of a numerical model to predict the effective moisture diffusivity of fruits during drying as a function of temperature and moisture content

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Drying is one of the most important fruit and vegetable preservation method useful to remove water from fresh materials. This permits to avoid growth of bacteria, yeasts or molds. To better understand the heat and mass transfer process that take place during drying, numerical models can be used. The effective diffusivity determination is a crucial aspect for the development of drying models. The diffusivity is affected by the product temperature and moisture content. The aim of this study was to develop a method, based on the inversion of a finite element model, to estimate the moisture diffusivity of fruits during drying as a simultaneous function of temperature and moisture content.

The research work was divided in three phases: i) experimental determination of the moisture concentration versus time in various fruits during the drying process; ii) development of a numerical heat and mass transfer model for the determination of moisture content versus time; iii) parameter estimation of moisture diffusivity as a function of temperature and moisture content, by minimizing the distance between numerical model and experimental results using a feasible optimization algorithm.

The estimated moisture diffusivity coefficients are close to those reported in literature for the same fruits, but obtained by others approaches. The experimental and calculated moisture contents are in good agreement showing a determination coefficient $R^2 > 0.96$.