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A moving boundary model for food isothermal drying and shrinkage: General setting

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8 **Abstract**

A moving-boundary model is proposed for describing food isothermal drying. The model takes into account volume reduction of food materials and it is capable to predict sample shrinkage and surface deformation during the drying process. It can be applied to any sample geometry (discoid, cylindrical, cubic, parallelepiped) and to any food material since it can take into account that sample volume can decrease of a quantity that can be smaller, equal or larger than the corresponding volume of removed water.

The core of the present model is the adoption of a pointwise shrinkage velocity equal (and opposite in sign) to the water diffusive flux times a shrinkage factor $\alpha(\phi)$ depending on the pointwise water volume fraction $\phi(\mathbf{x})$. The shrinkage factor $\alpha(\phi)$ can be assumed a priori or directly derived from experimental data of the rescaled volume V/V_0 vs the rescaled moisture content X/X_0 . For ideal shrinkage $\alpha(\phi) = 1$.

The model provides good results in terms of prediction of volume reduction, surface deformation and effective water diffusivity for potato strips air-drying.

9 *Keywords:* Dehydration, Shrinkage, Moving boundary model, Diffusion

10 **1. Introduction**

11 Drying is one of the most widespread processes for food preservation and
 12 storage (Arvanitoyannis et al., 2005; Albanese et al., 2006). Process conditions

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