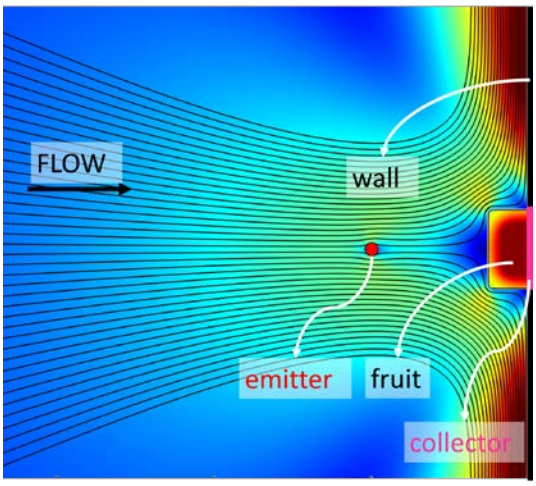
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Optimising electrohydrodynamic drying of cellular foods



The core of this project is the simulation-based design and subsequent fabrication of a lab-scale setup to investigate and optimise EHD drying of cellular food tissue.

Keywords

Ionic wind, corona discharge, cellular foods, convective drying, fluid flow

Labels

Master Thesis

Description

The principle behind electrohydrodynamic (EHD) drying is that airflow is generated by means of corona discharge, so-called ionic wind. This ionic wind enhances heat and mass transfer from any wet material that is placed in this airflow field. As electrohydrodynamic drying is a non-thermal technology, it is particularly attractive to dehydrate heat-sensitive products, such as cellular foods (e.g. fruit). Compared to conventional convective drying, it has been reported to reduce drying time, reduce product shrinkage, increase rehydration capacity, improve (soften) texture, and preserve color and flavor better. It is also found to preserve better the nutritional content (vitamin C).

Goals and tasks

The first aim of this project is to increase our insight in EHD drying using multiphysics modelling of the electrostatics, the resulting EHD-generated airflow and the food drying process. The second aim of this project is to design and build a lab-scale experimental setup for EHD drying of fruit. The tasks include:

- Multiphysics modelling of EHD drying, including electrostatics, heat and mass transfer processes and food quality decay (an existing model in COMSOL is already available to start off with).
- Parametric analysis using the model to find the optimal voltage, electrode distance and fruit size.
- Designing a lab-scale prototype EHD tunnel.
- Constructing and testing the prototype tunnel, including wind speed and electrical power measurements.

The work will be performed at the experimental facilities of Empa (Dübendorf). The ideal candidate has knowledge in convective heat and mass transfer, food processing or wind tunnel testing.

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Topics

Engineering and Technology, Fluid dynamics