

# Modeling the Effect of Headspace Steam on Microwave Heating of Mashed Potato

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## Abstract

**Introduction:** Domestic microwave ovens are widely used to heat food products, because of rapid and convenient heating. Nonuniform heating is the biggest issue in microwave heating process, which also causes food quality and safety issues. Microwave heating models are promising tools to assist in developing food products that deliver uniform heating. Due to intensive heating, moisture evaporation leading to drying and splattering of food is often observed in microwave heating. A plastic film covered on the top of the tray can be used to reduce the moisture loss and improve heating uniformity. A microwave heat-mass transfer model incorporating the effect of headspace steam is needed to assist in microwave food product development.

**Use of COMSOL Multiphysics®:** A geometric model was developed for a domestic microwave oven (Model no: NN-SD9675; Panasonic Corporation, Shanghai, China) rated at 1250 W and a tray of 550 g mashed potato. A plastic film was covered on the top of the tray with a leaking edge for releasing moisture. The model physics includes electromagnetic, heat and mass transfer, phase change of water during evaporation, and laminar flow. A custom routine was developed to interface COMSOL Multiphysics® software with MATLAB® to simulate microwave heating of rotating mashed potato on the turntable. The effect of headspace steam on heating uniformity and moisture loss was evaluated for 3 minutes of microwave heating.

**Results and Conclusion:** Without covering the plastic film on the top, vapor leaved the food tray freely with total moisture loss of 25 g. The plastic film reduced the total moisture loss and improved the heating uniformity of the whole food product.