



PepsiCo Global Snacks R&D

Analysis of shear forces during mash disk formation

This problem relates to the production of chips in a particular process. A potato composite composed of multiple mashed ingredients and small particles is fed through a spreading manifold. This forces the mash into a cylindrical mould (forming process) on a rotating drum to produce mouth sized disk pieces, which then continue to a drying process.

During the forming process a scraper is used across the top of the mould to leave the mash flush with the top of the mould. This shearing process may affect the surface of the mash disk (as illustrated in the diagram below).

What is the effect of this shear on the material properties and structure of the mash disks and how can it be controlled? This will affect the texture of the final chip products, an important product attribute for consumers.

How would operating parameters and mould design affect the shear forces on the disk? This could impact scale up limitations and product design.

The key parameters are the composition of the mash, the pressure with which it is pushed into the former, the rotational speed of the drum, the shape / design of the scraper blade, force that pushes the scraper blade against the drum and the mould design. It is possible to attempt bulk rheology measurements on the mash.

Mathematical Challenge

Formulate a mathematical model of the scraping process and its effects on the surface of the disk and use this model to understand the dependence of the effects on the parameters that are available.

