CARPATHIAN JOURNAL OF FOOD SCIENCE AND TECHNOLOGY

Journal home page: **http://chimie-biologie.ubm.ro/carpathian_journal/index.html**

MATHEMATICAL SIMULATION OF DEFORMATION FRICTION FORCE DURING FOOD MATERIAL CUTTING

Oleg Vjatcheslavovich Ageev[1]✉, Marek Jakubowski[2], Liviu Giurgiulescu[3],

[1]Kaliningrad State Technical University, Department of Food and Refrigeration Machines
[2]Koszalin University of Technology, Department of Food Processes and Facilities
[3]North Universitary Center of Baia Mare, Technical University of Cluj Napoca, Chemistry-Biology Department
✉oleg.ageev@klgtu.ru

https://doi.org/10.34302/crpjfst/2020.12.4.1

Article history:
Received:
28 April 2020
Accepted:
25 September 2020

Keywords:
Food cutting;
Friction force;
Knife edge;
Rheology;
Viscoelasticity

ABSTRACT

The process of friction when cutting food materials has been investigated theoretically. The muscle tissue of the raw material has been described by the Maxwell-Thomson rheological model. When choosing an analytical description of a regular microrelief of food processing equipment knives, taking into account technological formative factors, a physical-technological theory of surface roughness has been used. A mathematical description of the profile of the knife rough surface in the form of a dimensionless periodic one-parameter function has been obtained. By solving the differential equation of viscoelastic material state in a dimensionless form, the law of distribution of dimensionless normal contact pressures over the microprotrusions of the edge rough surface has been obtained. An expression for the dimensionless deformation friction force has been obtained. It is established that at speeds tending to zero or infinity, this force tends to zero. The magnitude of the force increases monotonically with the increase in the measure of the material elasticity and the increase in the dimensionless length of the knife edge. The dimensionless width of the contact area of microprotrusion is monotonously depends on the measure of material elasticity and non-monotonously depends on the dimensionless sliding speed with a pronounced minimum.