42. Friction at bread cutting by a disk knife

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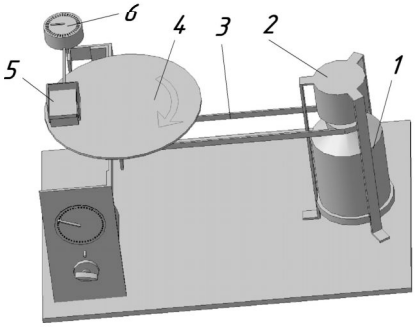
Introduction. Circular shears blades are applied for cutting meat articles, cheese, bread at small capacity. As the exception, at cutting long grain articles is used the equipment with circular shears blades, capacity to 600 pieces of bread for a minute. The known manufacturer - HD Georg Hartmann Maschinenbau. The basic problem of circular shears blades - the big surface of a friction. It negatively influences quality of products.

It is examined, as efforts of a friction between bread and a circular shears blade surface vary at keeping of bread and as it influences quality of a surface of a cut.

Materials and methods. It are examined bread «Loaf Niva», from a premium flour, with adding of 1 % vegetable oil, it is fabricated by a classical mode, two-phasic test preparation. Time of self-control after baking changed from 0 till 24 hours.

The friction fact examined on installation (fig. 1). The friction surface is executed as a reverse disk which receives movement from the drive through pass transmission. A disk material - a steel, a surface roughness - 0.8. Rate of slippage in a place of contact to bread varies from 0.5 to 7.5 *m/s*. On a disk surface in a header place a piece of bread in the size 4x4x2 *mm*. At disk rotation between bread and a disk there is a friction force which is registered a dynamometer. The specific load on a friction surface varies with weights.



The coefficient of friction f is defined as a ratio of friction force F to normal load Q of a product on a friction surface $f = F/Q$, *N*.

Experimental researches were executed according to the central composite orthogonal plan of the second order.

Results and discussions. From the previous probes it is known that efforts of a friction depends on rate of slippage V, specific load N on a surface of a friction and time of keeping of bread τ. Considering dependence of a coefficient of friction on a specific load and rate, it is expedient to define instead of a coefficient of friction tension G of a friction as dependence of effort of a friction to the area of a surface of friction S: $G_{sp} = F / S$, N/m^2.

The equation for definition of tension of friction G_{sp} crumb on a metal surface:

At $0 < \tau < 240$ *min*:

$$G_{sp} = 133 + 0.003 \cdot \tau^{2} - 0{,}97 \cdot \tau - 4.1 \cdot 10^{-5} \cdot N^2 + 0.447 \cdot N - 0.00104 \cdot \tau \cdot N + 12.4 \cdot V,$$

At $\tau > 240$ *min*:

$$G_{sp} = 129.2 - 0.000041 \cdot N^2 + 0.447 \cdot N - 0.00104 \cdot \tau \cdot N + 12.4 \cdot V,$$

The equation for definition of tension of friction G_{sp} crust on a contact area with a blade:

$$G_{sp} = 98.56 - 0.0015\tau^2 + 0.60\,\tau + 0.14P + 31.9V,$$

The equation adequately describe process at a significance level 0.05, and within

factors: specific load N = 400-2500 Pa, rates of slippage V = 0.5 - 8 m / s, time of self-control of bread τ = 0 - 48 *hour*. For pulp at increase in a specific load friction tension increases. Tension of a friction of directly proportional rate of slippage within 0.5-8 m / s. The greatest influence on friction tension has time of keeping of bread before cutting. At increase in time of self-control of bread after a batch from 0 to 240 minutes friction tension is diminished in 2 - 2.5 times. The further increase in time of self-control influences friction tension a little.

For a crust tension of a friction more low. It increases with increasing holding time, proportional to the specific tension and sliding velocity.

Conclusion. Friction negatively influences quality of a cutting. The bread structure fails, occurs spalling, bread adheres to a knife. Through the big surface of a friction to circular shears blades probably to cut bread after refrigeration and holding time 3-4 hours. In the future actually to define modes of lowering of friction forces at a cuting and securities of cutting of fresh bread by a disk knife.

References

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