10th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2006, Barcelona-Lloret de Mar, Spain, 11-15 September, 2006

RESPECT CONCERNING DETERMINATION OF ENERGY CONSUMPTION AT GRINDING TO VEGETABLE PRODUCTS TROUGH TEXTURE ANALYSIS

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ABSTRACT
In which regarding the grinding process, have to mentioned that in time of this operations the form of products herself changed they are solicitation mechanic and thermal. The knowledge of phenomena's and factors which interfere in grinding operation lead to obtaining energy consumptions reduced.
Keywords: grinding, energy consumption, texture analysis

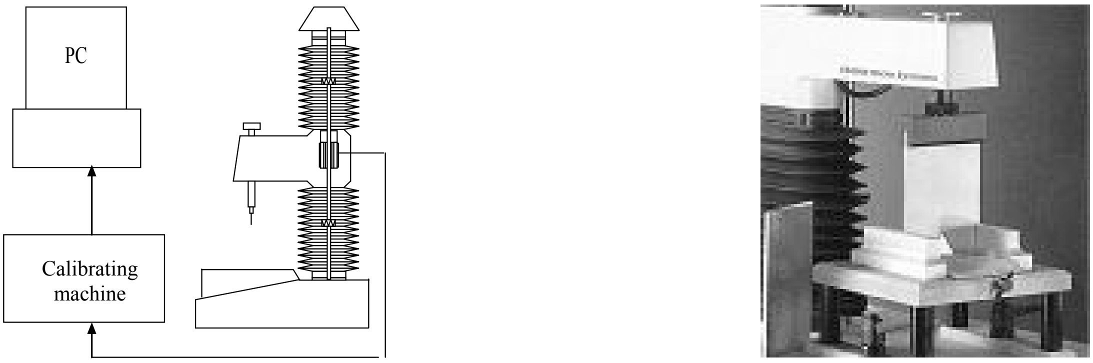
1. INTRODUCTION

Because are ascertainment the tendencies of development and diversification of agricultural production worldwide and in our country, this requires a development of processing sector at this production. Frequently the basic materials are of different forms, too big to be used as such and in consequence must grinding. Through grinding is persued size reduction of solid particles as the consequence of one mechanical force action. [1]
Grinding by cutting process it is complicated thing which are explained through the fact that grinding action are submit particles inhomogeneous as size and with difference in physical characteristics of different parts. In the selection of a certain grinding process, must be taken into account the fact that through grinding operation must result a superior qualitative product with reduced energy consumption.

2. EXPERIMENTAL TECHNIQUES

Study of grinding process from cutting, respectively determination of energy consumption, are referred in principal to determination of grinding force. In order to determine the grinding force is used of experimental methods the texture analysis. [2, 3]
Texture represents reologic characteristic one food product and she refer to property which confer this resistance of action an exterior forces (compression, shearing, cutting, strain). In function of texture, from each food product, to compression and broken forces opuses itself elasticity, fibrousness etc., property which have un important role in estimation product quality. Texture is appreciated through qualifying: soft, firm, hard, brittle, crisp, rubble, fibrous etc. Texture importance as general factor to acceptability at one special group to food products may differ very much from case to case. [1]
Products of vegetable origin present un specter of variation at texture more big than in case of product to animal origin due to the variety to fruit and legume sorts fated consumption, but and the fact that a big part from this are used under shape to fresh products. Maintenances of qualitative characteristic to form similar fresh product are in many cases un important aspect in food industry.Texture profile analysis (TPA) is based on the recognition of texture as a multi-parameter attribute. For research purpose, a texture profile in terms of several parameters determined on a small homogeneous sample

may be desirable. The test consists of compressing a bite-size piece of food two times in a reciprocating motion that imitates the action of the jaw and extracting from the resulting force-time curve a number of textural parameters that correlate well with sensory evaluation of those parameters. In this mean can be used meter “Texture Analyser – TA-XT2i” (fig. 1), witch supply a complete three-dimensional analyses for force, knife snap and time. These meters are characterized to a stalwart structure and o resolution at 0,025% for maintaining always accuracy.



a) *b)*

Figure 1. Texture Analyser – TA-XT2i
a) technological scheme of apparatus; b) meter image.

Can be used together with “Texture Expert” program, for to different specimen’s type at which can be determines: cohesion, elasticity, strength of broken, strength of penetration, adhesively, etc. Meter TA-XT2i work, through thermo resistant cell in one field of temperature witch varied in interval (50-200)^{0}C.The meter TA-XT2i results are processed to program of dates acquisition “Texture Expert”, who together formative analyzer of structure. For reliable and reproducible results some basic rules are taken into consideration: storage, specimen morphology, moisture content, temperature, and speed at which is deformed (strain rate), dimension and products form. To realize the experiments the following species and sorts of fruits and vegetables (root crop) were chosen, so we represent a more large scale of vegetable products with texture variable (table 1). [2]

Table 1.Species and sorts at products analyzed.

No. crt.	*Specie*	*Sort*	*Maturity*	*Observations*
1.	Apple	Idared	Complete	Crusted
2.	Apple	Golden delicios	Complete	Crusted
3.	Apple	Jonangold	Complete	Crusted
4.	Potato	Désirée	Complete	Crusted
5.	Potato	Sante	Complete	Crusted

The property of particles studied variation in function of specie and sort; in table 2 are presented the values of medium humidity and medium density at sorts analyzed.

Table 2. Medium density and humidity of products analyzed.

No. crt.	Specie	Density, kg/m^3	Humidity, %
1.	Apple	846	87,5
		920	84,1
		930	83,5
2.	Potato	1010	82,3
		1050	74,5
		1060	79,6

In laboratory was determined the cutting force with the help of texture analyzer TA-XT2i. For cutting force determination the experiences was perform for products processed in table 1÷2. In time of experience for determine the cutting force was varied cutting velocity in interval (0, 0045 ÷ 0, 0085) m/sec. The variation mode of cutting force in function at cutting velocity from different products humidity are processed in figure 2 and 3.

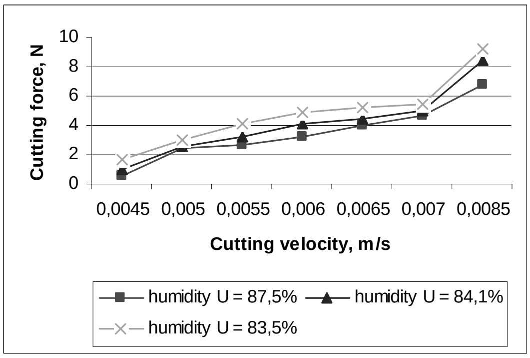


Figure 2. Cutting force variation in function at cutting velocity for apples crusted to different humidity.

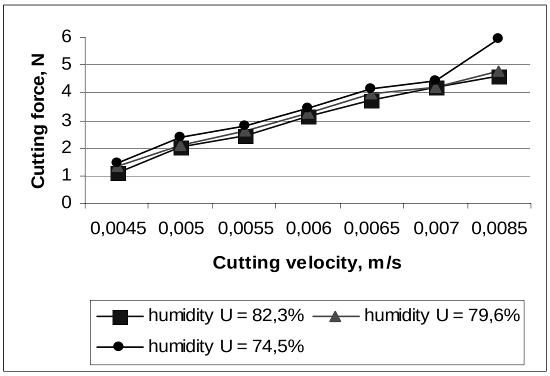


Figure 3. Cutting force variation in function at cutting velocity for potatoes crusted to different humidity.

Energy consumption was calculated with the help of Rittinger relation, for sorts processed in table 1-2. Considering that Rittinger assumes in his theory that the energy necessary to grinding is directly proportional with the new created surface in grinding process and not with variation of particle dimension, namely the theory that which takes into account all grinding stages, we have:

$$E_R = k_R\left(\frac{1}{d} - \frac{1}{D}\right) \quad (1)$$

in which:
k_R - represents the Rittinger constant;
d – the dimension of particle after the grinding process;
D – the dimension of particle before the grinding process;
The Rittinger constant depends on of texture material sort which is going to be grind. If we consider the Rittinger constant:

$$k_R = F_m \cdot S_n \quad (2)$$

in which:
F_m - represents the grinding force, N;
S_n –new created surface, m^2.

The new created surface is given by the formula:

$$S_n = S_f - S_i \tag{3}$$

In figures 4 - 5 is showed the grinding energy variation calculated using the Rittinger method for the cutting force values which are determined with texture analyzer TA-XT2i.

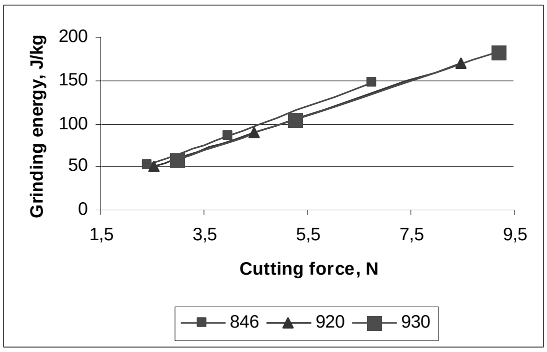


Figure 4. Grinding energy variation function at cutting force for apples crusted with different density values.

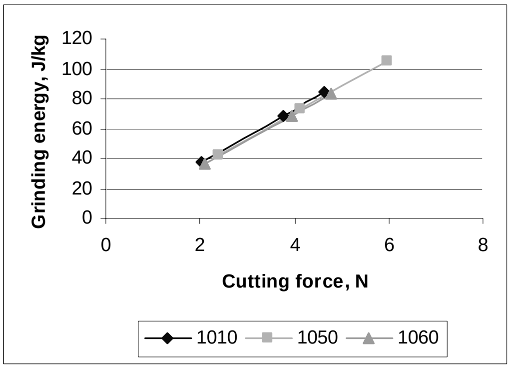


Figure 5. Grinding energy variation function at cutting force for potatoes crusted with different density values

3. CONCLUSION

Texture analyses following cutting force determination in function to cutting velocity. From analyses of results obtained are observed in grinding time have place variable deformation in particle, to distinguish thus elastic behavior of particle submissive deformation.

Can be observed that: the cutting force varying inverse proportionally with humidity particles, big values of cutting force being canned for products with small humidity; cutting force are influenced to particle density having a differentiated in function at product texture.

The grinding energy determinate with the help of cutting force and with the help of shearing force, by Rittinger law show considerable differences, thing which are explaining through variety of textural characteristics of products analyzed and of strains at which are submissive working elements.

4. REFERENCES

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