RESEARCH OF TECHNOLOGICAL PROPERTIES OF CORN GROATS

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Rezumat: În lucrare se prezintă cercetările proprietăţilor tehnologice ale crupelor de porumb. Ne–am propus să urmărim extracţia de crupe la măcinarea hibridului de porumb "Porumbeni–351" din subspecia Zea Mays Indurata, conţinutul de proteine, precum şi proprietăţile tehnologice ale crupelor obţinute prin gradul de fierbere şi creşterea de volum la fierbere. Analizând rezultatele obţinute în urma cercetărilor se poate de concluzionat, că proprietăţile tehnologice ale crupelor de porumb se pot corela perfect cu conţinutul stratului sticlos în endospermul bobului şi sunt influenţate direct de dimensiunile granulometrice ale particulelor.

Key words: corn grain, groats, boiling degree.

Using corn groats in various forms contributes to the dietary diversification of the population and its enrichment with nutrients. Groats production volume depends on the capacity of the consumption market.

At the production of corn groats used for different purposes (directly in food, manufacture of flakes, alcoholic and soft drinks, etc.) is used corn from "indurate", "semiidentata" and "identata" subspecies, which must comply with the requirements of the ГОСТ 13634–90 standard. To be mentioned that for the production of groats and flour will be used recently harvested corn, because at the increasing of storage length of crops the endosperm becomes breakable and the quality of groats extraction is reduced.

In order to obtain a technologically effective and economically profitable production process of the groats, the corn has to possess highest vitrescence and must be intended for food use. The weak point of the grinding corn process lies in the small extraction rate, because of the secondary products and wastes resulted from the production process, requiring market. For example, the total extraction rate of the corn groats is about 40% while the extraction rate of buckwheat grains is – 70 ... 72%. Therefore, the processing of corn requires high investments in order to use all products from processing. Only in this case finished products can be obtained at minimal cost.

Corn groats are cracked particles from the endosperm of various shapes, obtained from the separation of the embryo and shell, polished, rounded edges. Corn groats come predominantly from glassy areas of the endosperm. After groats polishing, flour areas (of white shade) turn into flour. Assortment and quality standards of the corn groats must correspond to the ГОСТ 6002–69 standard. In Russia for the corn groats type "Euro", produced by separating germs in volume of 100% is used ТУ У 15.6–30344016–001:2010 standard.

Assortment of corn groats:

- ⇨ Corn groats divided into 5 numbers;
- ⇨ Big groats for flakes, of dimensions not exceeding 3,5 mm;
- ⇨ Small groats for puffs, of dimensions not exceeding 3,5 mm.

Technological properties of corn grains depend on several factors, of which the most significant are: the species and variety of the grains, their hardness, the content of endosperm, the content of glassy area and grain size. Unlike the structure of the wheat grain, the corn grain is separated in two areas – the glass and flour zones, which possess different structural and mechanical properties (hardness, specific weight).

In the present study we intend to follow the extraction of groats after grinding process of the hybrid corn "Porumbeni–351" of the subspecies *Zea Mays Indurata,* protein content extraction as well as the technological properties of groats obtained by the boiling degree and volume increase at boiling.

The grinding of the grain samples was performed in the laboratory, based on particular experimental technological schemes. Initial level of grain humidity was 11.7%. Before the grinding, the samples were soaked in water at 200C, up to 15% humidity. The resting time chosen was 45 minutes. Extracted groats are classified into 5 numbers depending on granulosity, according to the industry standards.

The protein content in the analyzed groats samples was determined by NIR analyzer with near–infrared reflectance.

The boiling degree of the groats was determined by boiling 25 g of the sample to be analyzed, arranged in a gauze bag and placed in a beaker filled with distilled water. The boiling of the samples was performed by repeated weighing up to constant mass. The boiling degree (G_f) was established by calculating the ratio:

$$\boldsymbol{G_F = \frac{m_2}{m_2}}$$

where: m_1 – the initial mass of the sample, g;
m_2 – the final mass of the sample, g.

Volume increase of the groats at boiling was established by the measurement of 25 g sample product and 0,3 g of salt. The mixture was placed in a gauze bag, which has been submitted to boiling in a container with distilled water. Boiling was performed until obtaining of constant mass, shape changing and appearance of the particles. Volume growth index at boiling was calculated with the following relation:

$$C_V = \frac{V_1}{V_2}$$

where: V_1 – initial volume of the sample, cm3;
V_2 – final volume of the sample, cm3.

The investigations performed at corn grinding have emphasized the fact that the biggest extraction have groats 1, 2 and 3 (Fig. 1), from glassy endosperm areas and while the extraction of groats 4 and 5 is small. Groats 4 and 5 reveal an orange color with white shades, which proves that they come from farinaceous areas and less glassy. The content of protein in groats is at 11 ... 14% and increases in groats nr.5, which is determined by the presence of embryo particles.

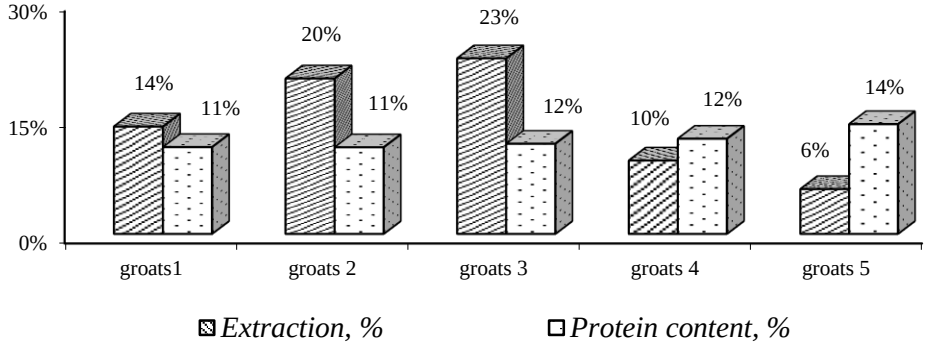

Fig.1. Extraction and protein content in corn groats

Following the boiling degree values and the index of volume increase at boiling (Fig. 2), we observe that these technological indicators increase as granularity of groats decreases. At the same time, these two indicators are influenced by the structure of the corn endosperm, as hygroscopicity of floury endosperm is much higher than that of the glass.

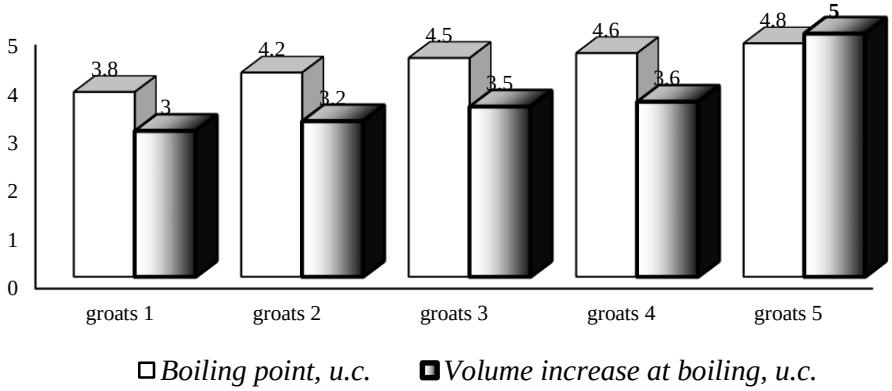

Fig.2. Boiling degree and volume rate increase of the groats at boiling

Also must be mentioned the fact that, groats nr. 5 have a higher volume growth than other groats, which have a larger granulosity. Swelling of the big groats is more difficult than for the small groats, in which the water access is easier.

Therefore, analyzing the results of research it can be concluded that the technological properties of the corn groats correlate perfectly with the content of glassy layer in the endosperm of the grain and are directly influenced by the granular dimensions of the particles.

Bibliographic references:

1. Recomandări privind cultivarea porumbului în Moldova. – Paşcani, Institutul de cercetări ştiinţifice pentru porumb şi sorg din Republica Moldova, 2001, 50 pag.;
2. Registrul soiurilor de plante al Republicii Moldova pentru anul 2011. – Chişinău, Comisia de Stat pentru testarea soiurilor de plante, Ediţie oficială, 2011, 124 pag.;
3. Moraru Ş. Cultura porumbului. – Chişinău, "Tipografia Centrală", 1998, 100 pag.;
4. Moraru C., Râpeanu R. Tehnologia industrializării porumbului, Bucureşti, Editura Tehnică, 1972, 296 pag.;
5. George W. Dickerson Nutritional Analysis of New Mexico Blue Corn and dent Corn kernels. – Cooperative Extension Service, College of Agriculture and Home Economics, New Mexico State University, 2003.