Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

# Research of Change in Humidity of Local and Other Varieties of Soya Seeds at Various Storage Modes

**Tursunova Nargiza Nigmatovna,** Bukhara Engineering Technological Institute, Republic of Uzbekistan
**Bahriddinova Nasiba Muradovna,** Bukhara Engineering Technological Institute, Republic of Uzbekistan
**Ergasheva Husnirabo Bobonazarovna,** Bukhara Engineering Technological Institute, Republic of Uzbekistan
**Ashurova Muxabbat Zoirovna,** Bukhara Engineering Technological Institute, Republic of Uzbekistan
**Axmedova Mexriniso Baxronovna,** Bukhara Engineering Technological Institute, Republic of Uzbekistan
e-mail: **gaxa8004@mail.ru**

**Annotation.**In this paper, we studied the effect of various storage conditions on moisture changes in local and foreign soybean seed varieties processed at the enterprises of the oil and fat industry in Uzbekistan.

The nature of changes in the moisture content of soybean seeds of various varieties, depending on the duration of storage under various temperature conditions, is revealed. The curves of changes in the moisture content of soybean seeds depending on storage conditions in production conditions.

Optimum temperature conditions are recommended that affect the change in humidity of soybean seeds during storage.

**Key words:** soybean seeds, soybean varieties, humidity, oil content, storage temperature, storage duration, modes, oxidation, micro flora, experimental design.

**Introduction.** Currently, in the Republic of Uzbekistan great attention is paid to increasing the volume of cultivation of local soybean varieties, as well as their processing.

To ensure sustainable agriculture in the context of global climate change and land degradation, the search for alternative ways of growing crops and applying innovative developments to increase the production of high-quality crop products is an acute issue [1].

Soya is the most widespread leguminous and oilseed crop of our planet, which is cultivated by more than 90 countries on five continents in the temperate, subtropical and tropical zones. The world leaders in the production of grain soybeans are the USA, Argentina, China, India. In developed countries, legumes, including vegetable soybeans, occupy 12-13% of the field crop rotation. Soybeans and meal are the best raw materials in the food industry; meal is a protein, nutritious food in animal husbandry, poultry farming and fishing. About 35% of all vegetable oil in the world comes from soybeans. Soybeans contain 40-43% protein and 21-23% fat, which does not contain harmful substances to humans. More than 400 different products are obtained from soybeans. In addition to soybean oil, soy milk, soy protein, soybean meal and an increased grain yield are of great scientific and practical importance [2].

Although soybeans are of high enough quality, that is, they are rich in protein and fat, today they are grown in small quantities in agriculture in Uzbekistan. Its various varieties contain up to

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

57% dietary protein, easily digestible unsaturated fats and up to 30% carbohydrates (mainly mono- and disaccharides), which contain biologically active substances and vitamins: A1, B1, B2, B3, B6, E, C, D, K, PP, etc., as well as trace elements such as Mn, Mo, Mg, B, Fe. All of them are important for the human body and animal nutrition [3].

Soybeans is the leading unique culture of world agriculture, the pinnacle of excellence and universality throughout the plant world, which is central to solving the protein problem and quite profitable.

The main condition for the safe storage of soybean grain is to reduce the moisture content in it to an allowed level, which depends on the duration of storage and the ambient temperature. So just can prevent the harmful effects of microorganisms and fungi, as well as reduce gas exchange of grain [6].

In 2019, the area of soybeans in all regions exceeded 19,500 ha. The main goal is to focus on scientific work on the planting of new soybean varieties adapted to various soil and climatic conditions of the republic, high yield, selection of varieties grown on this basis, the study of physiological processes and biochemistry in developmental ontogenesis.

In the oil and fat industry enterprises that process soybean seeds, oil is extracted from soybeans in all regions, and meal is used for poultry and livestock as protein feed.

**Literature review.**

The value of oilseeds is not limited to the high content of fat and digestible protein substances in them. It is also determined by the fact that their proteins contain a relatively large amount of essential amino acids, i.e. lysine, leucine isoleucine, methionine, phenylalanine, tryptophan, valine, trionin, histidine, arginine, which are not synthesized by the human body and many animals and must be introduced with food or food.

The content of valuable natural substances in soybean seeds is associated with varietal characteristics, conditions of growth and maturation in certain years, the degree of maturity of the seeds and the completeness of post-harvest ripening [7].

In the published article on the topic “Change in the quality indicators of soybean seeds under various storage conditions” [8], the effect of various storage modes on changes in biochemical and microbiological indicators of the quality of soybean seeds was studied ”, the researchers studied and selected conditions that contribute to a decrease in the intensity of oxidative processes and a slowdown in vital processes all living components of soybean seeds grown in Ukraine. Regularities are established that allow predicting the permissible dates and seed resistance under certain storage conditions.

The author of [9] carried out comprehensive studies of soybean varieties included in the State Register for CCR. The influence of the gas environment and physical effects on the biochemical composition of soybean seeds during long-term storage is revealed. New types of bakery products with the addition of soy flour have been developed.

The author [4] studied the kinetic characteristics of biochemical processes during storage of cotton seeds. The main factors determining the long-term storage of oilseeds using various methods and technological modes are the biochemical changes that occur in the composition of the cell of oilseeds. The moisture content of the seeds during storage did not exceed 8.0%, the analyzed samples were completely cleaned of weed and oil impurities.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

For untreated batches, the most significant indicators are the biochemical activity of seeds: the activity of enzymes — lipoxygenases, lipases, and seed moisture. At the same time, the characteristics that evaluated the products of lipolytic reactions — hydrolysis and oxidation, acid and peroxide numbers (Table 1) were the most significant for the processed batches.

**Table 1.**

**Statistical characteristics of the biochemical parameters of cotton seeds (108-F) with various processing methods**

| Indicators | Without treatment in EMF | | With processing in EMF with a strength of 1.6 A / m | |
|---|---|---|---|---|
| | Mean | The coefficient of variation | Mean | The coefficient of variation |
| Seed germination, % (Sg) | 55,7 | 69,9 | 56,8 | 85,6 |
| Enzyme activity:<br>Lipase (Ao) $\frac{(mk \cdot mol \cdot C)}{kg \cdot min}$ 18: 1Lip | 140,3<br><br>61,2 | 76,3<br><br>34,6 | 52,1<br><br>39,9 | 42,4<br><br>38,3 |
| Mass fraction of lipids,% (Ms) | 23,5 | 3,1 | 23,7 | 4,6 |
| Acid number of oil in seeds, (a.n.) mg KOH / g | 2,6 | 51,0 | 1,8 | 90,3 |
| Peroxide value of oil in seeds, (P.v.) % (J) | 0,20 | 130,0 | 0,08 | 32,5 |

The object of the study was cotton seeds grown in the dry climatic conditions of Uzbekistan, the author proposed an improved storage technology for low-grade cotton seeds.

The study of humidity changes under various storage conditions, changing the parameters of local and imported soybean varieties in Uzbekistan is an urgent problem.

**The goals and objectives of the study** are to study changes in the moisture content of seeds of local and other varieties grown in the natural conditions of Uzbekistan and imported soybean varieties under various storage conditions, as well as develop recommendations on the duration of storage of soybean seeds depending on temperature conditions.

**Materials and methods.** To study the change in humidity of various soybean varieties, the following varieties of soybean seeds were selected with the following basic indicators:

**Table 2**

**The basic indicators of the studied soybean seeds processed at LLC “Evrosnar” in the Republic of Uzbekistan**

| Soybean Seed Variety | Basic indicators | | |
|---|---|---|---|
| | Weed admixture, % | Humidity, % | Oiliness, % |
| «Evrika-357» (Kazakhstan) | 3,1 | 9,17 | 19,45 |
| «Nafis»(Uzbekistan) | 4,25 | 10,46 | 18,35 |
| «Dustlik» (Uzbekistan) | 7,85 | 7,0 | 19,04 |
| «Parvoz» (Uzbekistan) | 1,2 | 7,18 | 19,43 |

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

«Evrika-357» is a medium-ripened variety of soybeans imported from Kazakhstan. The weight of 1000 seeds is 147 grams. The grain contains 19-21% fat and 34.8-38.4% protein. The average yield can be up to 39.2 c / grain.

Variety «Nafis» is medium-ripened. The weight of 1000 seeds is 134 grams. Beans do not crack during cooking. The grain contains 19-19.5% fat and 36.2-42.5% protein. A good feature of this variety is that if the planting period is delayed, it shortens the growing season. The average yield can be up to 30.7 c / grain [2].

The «Dustlik» variety is medium ripened. The weight of 1000 seeds is 136-138 grams. Beans do not crack during cooking. The grain contains 19-20% fat and 36-38% protein. A good feature of this variety is that when the sowing period is delayed, the growing period is reduced, and the grain yield is 31.3 centners.

Variety «Parvoz» was developed at the Uzbek Scientific Research Institute of Rice. The type of variety is medium. The mass of 1000 seeds is 141-143 g, the grain yield is 37.4 c / ha, the grain contains 38-40% protein and 20-22% fat.

To study changes in humidity during storage at various temperature conditions of the above soybean varieties, the following methods were selected: acceptance rules and sampling methods (GOST 10852-86 Interstate Standard. Oilseeds. Acceptance rules and sampling methods); method for determining weeds (GOST 10854-88 Methods for the determination of weed, oilseed and specially considered impurities); method for determining moisture (GOST 10856-96 Interstate standard. Oilseeds. Method for determining moisture) [10-12].

To study the change in the moisture content of seeds of various soybean varieties depending on the temperature of the stored medium $X_1$ ($^0$C) and the duration of storage $X_2$ (day), an experimental plan [5] is developed, which is given in Table. 3.

**Table 3.**

**Planning matrix and experiment results for changing soybean seed moisture**

| Experience number | Factors | | | | Experiment Results | | | |
|---|---|---|---|---|---|---|---|---|
| | Coded | | Natural | | Soybean seed moisture, % | | | |
| | $x_1$ | $x_2$ | Storage temperature $X_1$, $^0$C | Storage duration $X_2$, days | $y^1_1$ | $y^2_1$ | $y^3_1$ | $\bar{y}_1$ |
| 1 | -1 | -1 | 15,0 | 10 | 9,13 | 9,44 | 7,38 | 8,65 |
| 2 | +1 | -1 | 35,0 | 10 | 5,90 | 5,27 | 6,33 | 5,83 |
| 3 | -1 | +1 | 15,0 | 30 | 7,43 | 6,94 | 6,87 | 7,08 |
| 4 | +1 | +1 | 35,0 | 30 | 4,98 | 5,11 | 5,31 | 5,13 |

As a result of the approximation of discrete data, the following regression equations were obtained that adequately describe the dependence of the studied changes in the humidity of various soybean seed varieties depending on the duration of storage and the temperature of the stored medium:

$$y_1 = 6,67 - 1,19 \cdot x_1 - 0,57\ x_2.$$

The statistical reliability of the obtained regression equations was evaluated by the general Fisher criterion, which checks the null hypothesis of the statistical insignificance of the parameters of

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

the regression equation and the correlation dependence index. The calculated value of this criterion (Fc) for the resulting equation is, respectively, $Fc_1 = 1.39$. Comparison of these values with the table value of the criterion (Ft = 5,32) for a given significance level q = 0.01 and the number of degrees of freedom fy = N (n-1) = 9 (2-1) = 9 showed that Fc<Ft (1,39 <5.32), therefore, the null hypothesis is rejected and the statistical significance of the parameters of the regression equations is recognized [5].

On the basis of this experimental design, experiments were carried out in which the main influencing parameters for changes in the moisture content of soybean seeds were the temperature of the stored medium and the duration of storage.

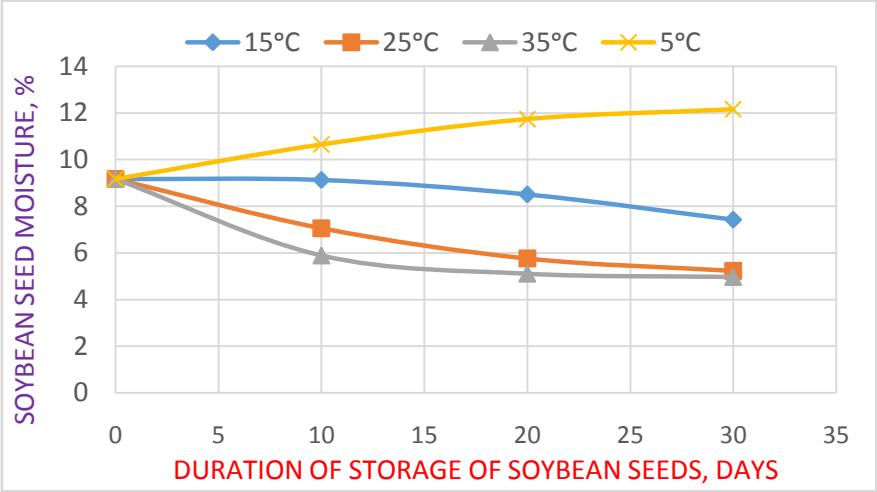


**Fig. 1. Change in moisture content of soybean seeds of the «Evrika-357» variety (Kazakhstan) at various temperature conditions**

During the entire storage period of seeds of soybean varieties «Evrika-357» imported from the Republic of Kazakhstan, at various temperature conditions, the condition of the seeds was constantly monitored, its indicators affecting the quality of the stored raw materials, such as humidity, oil content, acid number, were monitored appearance, discoloration, smell.

As can be seen from the graph shown in Fig. 1, according to the results of experimental studies of changes in the moisture content of this soybean variety, it was revealed that from 10 to 30 days of storage at a temperature of $5^0$C, the moisture content of soybean seeds increases to 12%, at $15^0$C there is a slight decrease in humidity by 1 %, and at a temperature of 25-$35^0$C a sharp decrease in humidity during 10-15 days to 5-6%, after which the moisture content of soybean seeds goes into equilibrium.

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

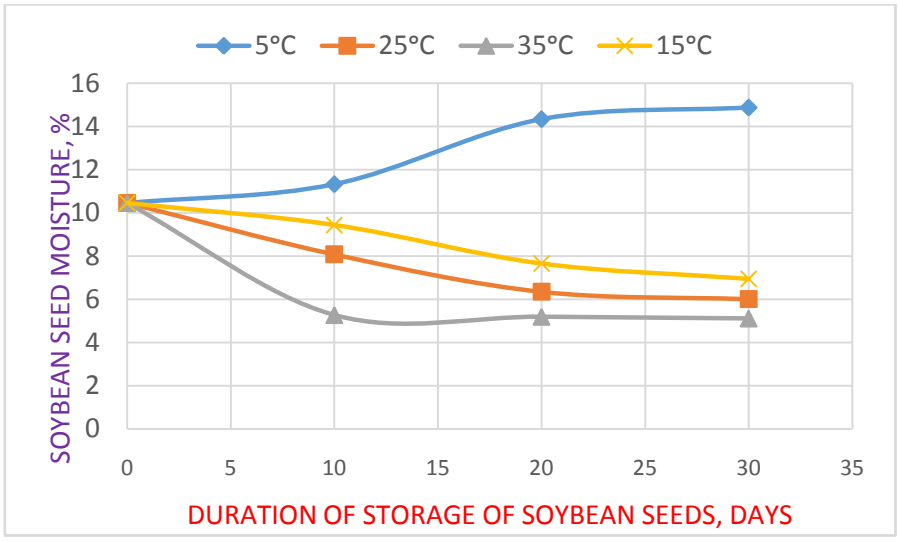


**Fig. 2. Change in moisture content of soybean seeds of the Nafis variety (Uzbeksitan) at various temperature conditions**

When storing seeds of the local «Nafis» soybean variety, at various temperature conditions, humidity changes were observed, the curves shown in Fig. 2. In the course of research, it was found that within 20 days at a storage temperature of $5^0$C, the moisture content of soybean seeds increases by 5%, at a temperature of $15^0$C for 20 days there is a slight decrease in humidity by 2%, and at a temperature of 25-$35^0$C a decrease in humidity during 10-15 days reached 6%, after which the moisture content of soybean seeds goes into equilibrium.

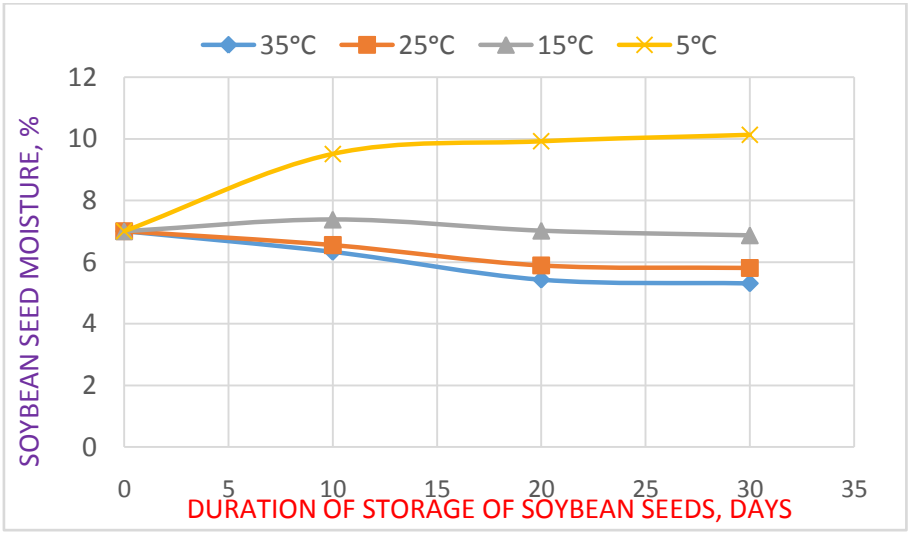


**Fig. 3. Change in humidity of soybean seeds of the Dustlik variety (Uzbekistan) at different temperature conditions**

In fig. Figure 3 shows the moisture variation curves of the local «Dustlik» soybean variety at various storage temperatures.

As shown in this figure, at a low storage temperature ($5^0$C), the moisture content of soybean seeds above this variety within 15 days reaches 10% of the initial 7%, and with the rest of the studied temperature regimes it slightly increases, after which it goes into equilibrium. A longer storage of

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 3, 2021, Pages. 7039 - 7047
Received 16 February 2021; Accepted 08 March 2021.

seeds at high temperature conditions is accompanied by a decrease in humidity by 1%.

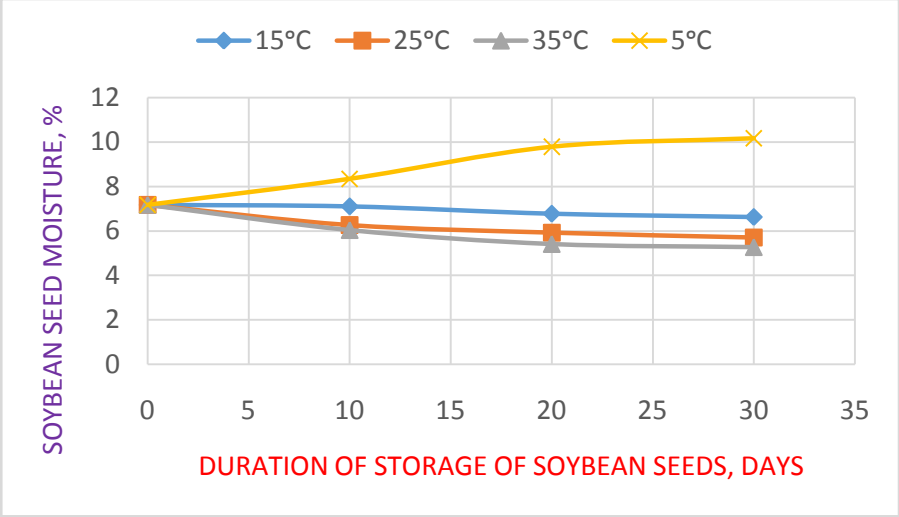


**Fig. 4. Change in humidity of soybean seeds of the «Parvoz» variety (Uzbekistan) at various temperature conditions**

The results of the study of changes in the moisture content of soybean seeds of the «Parvoz» variety at different temperature conditions are shown in the form of curves in Fig. 4, in which there is an increase in the moisture content of soybean seeds up to 10% for 20 days at a storage temperature of $5^0$C, at a temperature of $15^0$C there is a slight decrease in humidity by 0.5%, and at a temperature of 25-$35^0$C, a decrease in humidity over 10-15 days to 6%. Under all storage conditions after 20 days, these soybean seeds go into equilibrium.

**Testing of research results.** The results of the study of moisture changes in local and other varieties of soybean seeds under various storage conditions can be implemented at oilseed processing plants in Uzbekistan.

The introduction of the identified optimal soybean storage regimes into production will allow preserving the grown products with minimal losses and costs, ensuring maximum yields of soybean seed products.

**Findings.** Based on the studies of changes in humidity of local and other varieties of soybean seeds «Evrika-357», «Nafis», «Dustlik», «Parvoz» under various storage conditions revealed that, the temperature of the stored medium below $5^0$C contributes to an intensive change in grain moisture from 7% to 15%, which negatively affects oiliness and acid number. It is recommended that the shelf life of these soybean seed varieties be reduced to a minimum. When storing these soybean varieties at temperatures from 15 to $35^0$C, it helps to reduce moisture, which positively affects the change in oil content and acid number of soybean seeds. Under these conditions, long-term storage of the above mentioned soybean seeds for processing is recommended. These measures help preserve local and importing soybean varieties and get high-quality soy products from it.[13-27]

Since qualitative changes in the fat of soybean seeds during storage are caused by enzymes and exposure to atmospheric oxygen. Under the action of enzymes, an increase in acidity and acid number occurs. Storage temperature significantly affects the rate of rise, both acidity and acid number

of fat. Lowering the storage temperature inhibits the accumulation of free fatty acids, i.e. leads to a decrease in oil content of soybean seeds. In our further studies, the influence of temperature and storage time on the change in oil content and acid number of soybean seeds of local and imported varieties will be revealed.

**LIST OF USED LITERATURE:**

1. Tursunova N.N. The value of soybean grain in ensuring food safety // Materials of the international scientific conference "Innovative solutions of engineering and technological problems of modern production", 3 Volume, Bukhara, 2019. P. 97-99.
2. Tursunova N.N. Comparison of the chemical composition of local and foreign soybean varieties // Materials of the international scientific conference "Innovative solutions of engineering and technological problems of modern production", 3 Volume, Bukhara, 2019. P. 113-114.
3. Narziev M.S., Tursunova N.N. Systematic approach to the analysis of storage of soybean seeds. // Development of science and technology: scientific and technical journal. № 5/2019. P. 300-304.
4. Salomov B.Kh., Tursunova N.N. Main features of biochemical and enzymatic processes during storage of oilseeds. // Development of science and technology: scientific and technical journal. №. 3/2020.
5. Grachev Yu.P., Plaksin Yu.M. Mathematical methods of planning an experiment. M.: De Lee Print, 2005
6. Tursunova N.N. Influence of factors on soybean grain storage. Materials of the XIII International scientific and technical conference «Technique and technology of food production», Mogilev, 2020. Volume 1. P. 145-146.
7. Tursunova N.N. Change in the quality of soybean oil and oilcake under the influence of heat treatment. Materials of the XIII International scientific and technical conference «Technique and technology of food production», Mogilev, 2020. Volume 1. P. 286-287.
8. Egorova A.V., Trufkati L.V., Evdokimova G.I., Shpyrko T.V. Change in the quality indicators of soybean seeds under various storage conditions. // Odessa National Academy of Food Technologies: Наукові праці, Issue 48, 2015. Odessa.
9. Kalashnikova S.V.«The study of the quality and preservation of seeds of soybean varieties in the conditions of the Central Black Forest steppe», abstract, 2001y.
10. GOST 10852-86 Interstate standard. Oilseeds. Acceptance rules and sampling methods.
11. GOST 10854-88 Methods for the determination of weed, oilseed and especially considered impurities.
12. GOST 10856-96 Interstate standard. Oilseeds. Method for determining humidity.
13. K.S.Rakhmonov. Influence of leavens of spontaneous fermentation and phytoadditives on the provision of microbiological safety of bread // T. I. Atamuratova, N. R. Djuraeva, I. B. Isabaev, L. N. Haydar-Zade//Journal of Critical Reviews //2020, Vol.7, Issue 5, pp. 850-860.
14. S.K. Jabborova.Application of products of processing mulberries and roots of sugar beet in the production of cupcakes // I.B.Isabaev., N.R. Djuraeva., M.T. Kurbanov.,l.N. Khaydar-Zade., K.S. Rakhmonov //Journal of Critical Reviews //2020, Vol.5, Issue 5, pp. 277-286.

15. K.S.Rakhmonov.Application of phito supplements from medicinal vegetable raw materials in the production of drugs// T. I. Atamuratova., M.E. Mukhamedova., N.K.Madjidova., I.Sh. Sadikov //Journal of Critical Reviews //2020, Vol.7, Issue 12, pp. 934-941.
16. Djurayeva N, Mixtures of Vegetable Fat as a Potential Raw Material for Bakery// Barakayev N, Rakhmonov K,Atamuratova T, Mukhamedova M, Muzaffarova Kh. // International Journal of Current Research and Review// october 2020, Vol.12, Issue 19, pp. 140-148. DOI: http://dx.doi.org/10.31782/IJCRR.2020.12192
17. Djurayeva N, Plant-fat mixtures as a potential raw material for bakery production// Rakhmonov K, Barakayev N, Atamuratova T, Mukhamedova M, Muzaffarova Kh. // Plant Cell Biotechnology and Molecular Biology 2020 21(45-46), pp. 29-42
18. Ravshanov S.S, The impact of ultrasonic activated water on hydrothermal processing of wheat grains grown in dry climate conditions // Rakhmonov K.S., Amanov B.N. // Plant Cell Biotechnology and Molecular Biology 2020 21(45-46), pp. 29-42
19. Kuliev N.SH, Udk 664.8 baking properties and quality expertise wheat flour// Rakhmonov K.S. // *European Journal of Molecular & Clinical Medicine*, *2020*, Volume 7, Issue 2, Pages 6333-6340
20. Ravshanov S.S, The Effect Of Drinking And Activated Water On Field Scales Of Wheat Grains Grown In Arid Climatic Conditions// Rakhmonov K.S. Ergasheva H.B., Yuldasheva Sh. J.//*European Journal of Molecular & Clinical Medicine*, *2020*, Volume 7, Issue 3, Pages 3065-3070
21. S.R. Avizov.Traditional requirements and innovative learning models in the higher education context // T.I. Atamuratova Sh.A. Holova F.R. Kamalova L.H. Akobirova A.T. Oltiev // European Journal of Molecular & Clinical Medicine, 2020, Volume 7, Issue 2, Pages 872-885.
22. Xafizov I.I. Energy saving when using a variable frequency drive in pump installations// K. Gafforov, Sh. Muxammedov. A. Jurakulov//Journal of Critical Reviews //2020, Vol.7, Issue 12, pp. 99-102. doi: 10.31838/jcr.07.12.16
23. Sharipov M.Z., Hayitov D.E., Rizoqulov M.N., Islomov U.N., Raupova I.B. Domain structure and magnetic properties of terbium ferrite-garnet in the vicinity of the magnetic compensation point // Eurasian Physical Technical Journal. – Karaganda, Kazakhstan, 2019. – Vol. 16. - № 2(32). 21-25 pp.
24. Sharipov M.Z., Dzhuraev D.R., Sokolov B.Yu., Kurbanov M. Modulated magnetic structure of on inhomogeneously stressed single crystal $FeBO_3$ // Ukrainian Journal of Physics. 2010, Vol. 55. № 6. - P. 706-711.
25. Sokolov B.Yu., Talabov M.D., Sharipov M.Z. Domain structure of a thin single – crystal plate of terbium iron garnet near the magnetic compensation point // Physics of the Solid State. 2013, Vol. 55. Issue 2. - P. 314-320.
26. Rakhmonov K.S., Confectionery Products for Therapeutic and Preventive Purpose with Medicinal Herbs Uzbekistan// L.N. Khaydar-Zade., N.SH. Kuliev, G.H.Sulaymonova // Annals of the Romanian Society for Cell Biology, Vol. 25, Issue 2, 2021, Pages. 4126 – 4140.
27. Ravshanov S.S., Influence of the Use of Activated Water during Hydrothermal Treatment onthe Quality of Bread// Rakhmonov K.S.,Radjabova V.E., Pardayev Z.T. // Annals of the Romanian Society for Cell Biology, Vol. 25, Issue 2, 2021, Pages. 4091 – 4102