

ISSN 2181-8622

Manufacturing technology problems



Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX  COPERNICUS
INTERNATIONAL

**Volume 11
Issue 1
2026**



NamMTI ILMIY-TEXNIKA JURNALI TAHRIR HAY'ATI A'ZOLARI

Bosh muharrir: f-m.f.d., prof. O.O. Mamatkarimov

Bosh muharrir o'rinbosari: k.f.d., prof. O.K. Ergashev

TEXNIKA FANLARI (PAXTA, TO'QIMACHILIK VA YENGIL SANOAT)

- | | | |
|------------------------------|---|--|
| 1. Prof. Dr. Metin ÇOLAK | - | Ege Universiteti, Turkiya |
| 2. Prof. Dr. Suneel KATERIYA | - | Javoharlal Nehru Universiteti, Hindiston |
| 3. Prof. Dr. Muradov RUSTAM | - | Namangan To'qimachilik Sanoat Instituti |
| 4. Prof. Dr. Obidov AVAZBEK | - | Namangan Muhandislik-Texnologiya Instituti |
| 5. Prof. Dr. Maxkamov ANVAR | - | Namangan Muhandislik-Texnologiya Instituti |
| 6. Prof. Dr. Azizov SHUXRAT | - | Namangan Muhandislik-Texnologiya Instituti |
| 7. Dr. Qorabayev SHERZOD | - | Namangan Muhandislik-Texnologiya Instituti |

TEXNIKA FANLARI (QISHLOQ XO'JALIGI VA OZIQ-OVQAT TEXNOLOGIYALARI)

- | | | |
|------------------------------------|---|--|
| 1. Prof. Dr. Sakina BINTU ABDULLAH | - | Malaya Universiteti, Malayziya |
| 2. Prof. Dr. Abdalova GULISTAN | - | Taraz davlat universiteti, Qozog'siton |
| 3. Prof. Dr. Xudayberdiyev ABSALOM | - | Namangan muhandislik-texnologiya instituti |
| 4. Prof. Dr. Merganov AVAZXON | - | Namangan muhandislik-texnologiya instituti |
| 5. Prof. Dr. Sherquziyev DONIYOR | - | Namangan muhandislik-texnologiya instituti |
| 6. Prof. Dr. Qanoatov XAYRULLO | - | Namangan muhandislik-texnologiya instituti |
| 7. Prof. Dr. Mamatov SHERZOD | - | Toshkent shahridagi Vebster Universiteti |

TEXNIKA FANLARI (MEXANIKA VA MASHINASOZLIK)

- | | | |
|--|---|--|
| 1. Dr. Jaclyn SHARP | - | Pittsburg Universiteti, AQSH |
| 2. Prof. Dr. Aleksey KAZINSKY | - | Saratov davlat texnologiya universiteti, Rossiya |
| 3. Akad. Prof. Zaynobbiddinov SIROJIDDIN | - | Andijon Davlat Universiteti |
| 4. Prof. Dr. Usmanov PAZLITDIN | - | Namangan muhandislik-texnologiya instituti |
| 5. Prof. Dr. Matkarimov PAXRIDDIN | - | Namangan muhandislik-texnologiya instituti |
| 6. Prof. Dr. Sharibayev NOSIRJON | - | Namangan muhandislik-texnologiya instituti |
| 7. Prof. Dr. Erkaboyev ULUG'BEK | - | Namangan muhandislik-texnologiya instituti |

KIMYO FANLARI (KIMYO VA KIMYOVIY TEXNOLOGIYALAR)

- | | | |
|----------------------------------|---|---|
| 1. Prof. Dr. Abel SANTOS | - | Porto Universiteti, Portugaliya |
| 2. Prof. Dr. Junli YANG | - | Lanzhou kimyoviy fizika instituti, Xitoy |
| 3. Akad. Prof. Namazov ShaFOAT | - | O'zR FA Umumiy va Noorganik Kimyo instituti |
| 4. Prof. Dr. Botirov ERKIN | - | O'zR FA O'simlik Moddalar Kimyosi Instituti |
| 5. Prof. Dr. Akbarov HAMDAM | - | O'zbekiston Milliy Universiteti |
| 6. Prof. Dr. Nurmanov SUVANKUL | - | O'zbekiston Milliy Universiteti |
| 7. Prof. Dr. Salihanova DILNOZA | - | O'zR FA Umumiy va Noorganik Kimyo instituti |
| 8. Prof. Dr. Kattayev NURIDDIN | - | O'zbekiston Milliy Universiteti |
| 9. Prof. Dr. Sulstonov PO'LATJON | - | Geologiya fanlari universiteti |

TA'LIMDA ILG'OR PEDAGOGIK TEXNOLOGIYALAR

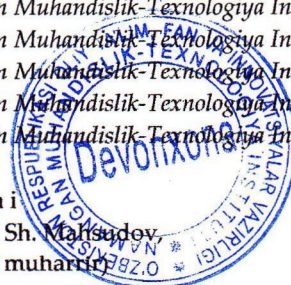
- | | | |
|--------------------------------|---|--|
| 1. Prof. Dr. Paul TIKALSKY | - | Oklahoma Davlat Universiti, AQSH |
| 2. Dr. David Leffler | - | Liberty Universiteti, AQSH |
| 3. Prof. Dr. Wen-Jian ZHANG | - | Zhejiang Universiteti, China |
| 4. Prof. Ergashev SHARIBBOY | - | Namangan Muhandislik-Qurilish Instituti |
| 5. Prof. Dr. Musayev JAHONGIR | - | OFIV |
| 6. Prof. Dr. Eshbayeva ULBOSIN | - | Namangan Muhandislik-Texnologiya Instituti |
| 7. Prof. Dr. Xoshimova DILDORA | - | Namangan Muhandislik-Texnologiya Instituti |

IQTISODIYOT FANLARI

- | | | |
|----------------------------------|---|--|
| 1. Dr. Biral MERCAN | - | Necmettin Erbakan Universiteti, Turkiya |
| 2. Dr. Orsolya KATONA | - | Miskolc Universiteti, Vengriya |
| 3. Prof. Dr. Soliyev AHMADJON | - | Namangan Muhandislik-Texnologiya Instituti |
| 4. Prof. Dr. Saidboyev ShERMIRZA | - | Namangan Muhandislik-Texnologiya Instituti |
| 5. Prof. Matkarimov KAMOLIDDIN | - | Namangan Muhandislik-Texnologiya Instituti |
| 6. Dr. Bustonov MANSUR | - | Namangan Muhandislik-Texnologiya Instituti |
| 7. Dr. Rashidov RAKHMATILLA | - | Namangan Muhandislik-Texnologiya Instituti |

Muharrirlar guruhi

O. Kazakov, B. Xolmirzayev, A. Mirzaev, Sh. Maksudov,
A. Tursunov, O. R. Qodirov (mas'ul muharrir)



GRAIN COLD CONDITIONING DEVICE AND TECHNOLOGICAL SOLUTION

AKRAMOVA GULXAYO

PhD student, Andijan State Technical Institute, Andijan, Uzbekistan

Phone.: (0894) 780-7337, E-mail.: obidhonovnagulhayo@gmail.com

ORCID 0009-0008-3544-0176

Abstract: The article studies the method of cold conditioning of grain. In the conducted research, a device was developed using intensive moistening of grain, that is, cold conditioning methods. As a result of the data obtained and the conducted research, the device is suitable for use in moistening grain before crushing.

Keywords: grain, grain soaking, hydrothermal treatment, cold conditioning of grain.

Introduction. Over the past 6 years, the world's population growth rate has approached 6%. Therefore, the demand for bread and bakery products is also increasing year by year, and due to the increase in the volume of grain production and the level of flour consumption, special attention is paid to the development and introduction of resource-saving, technically and technologically modernized equipment for moistening the processed flour. However, the lack of modern and resource-saving technologies in the field of high-quality flour production is becoming an urgent problem.

The consumption of more than 100 tons of water for grain moistening in flour production enterprises has had a significant impact on the cost of flour, so flour exports in our country account for 10% of production volume. Industry experts have identified the high cost of water used in the grain moistening process as one of the main factors affecting the quality and price of flour, and the lack of modern technologies in the process and the lack of knowledge of the grain moistening process are the main reasons.

The purpose of this article is to introduce the cold conditioning process of grain as a method of grain moistening in flour processing enterprises in our country and to select the most optimal option for grain moistening, conduct experiments and put it into practice. The most important part of the production process in flour production enterprises is the grain moistening process. The purpose of moistening grain is to moisten the grain, which contains gluten and gliatelin, which after absorbing water into the grain, turns into gluten. Gluten is one of the greatest quality indicators of flour. To increase the gluten content in the grain, it is necessary to moisten high-quality grain. The methods of grain moistening studied in the enterprises where the research was conducted were based on traditional soaking methods. The daily consumption of 117 tons of water for 168 tons of wheat led to a sharp increase in the price of flour. The fact that the market price of locally produced flour was higher than that of imported flour reduced the production performance of the enterprise.

Methodology & empirical analysis. Grain moistening devices have been studied by scientists from a number of countries, including the USA, Ukraine, Russia, China and many others. The studies conducted show that the devices designed for moistening grain were designed taking into account the region and climate. However, due to the climatic

conditions of our country, the method of intensive grain moistening has not been implemented.



Figure 1. Appearance of the grain cold conditioning device

In order to increase the efficiency of the steam humidifier and the speed of cold conditioning of grain, the design of the humidifier was developed, the relative effect of the steam emitted from the special steam-driven blades of the humidifier was mainly used, and the energy- and resource-saving device was developed as an experimental device for cold conditioning of grain in laboratory conditions. The general view of the experimental humidifier is shown in Figure 1.

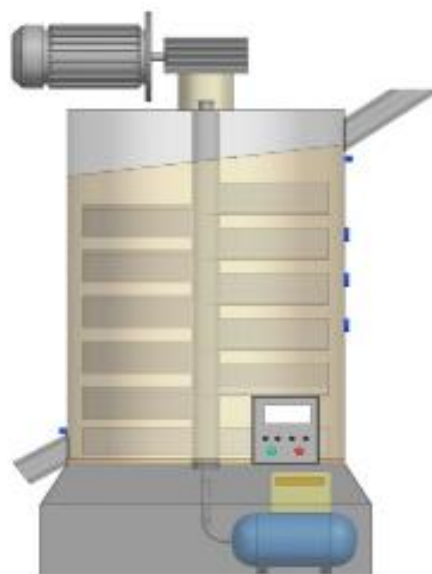


Figure 2. Graphical representation of a grain cold conditioning unit

The purpose of the experiment is to consistently replace the cold conditioning method of grain with a new method, eliminate the shortcomings and energy resource consumption of the current method, reduce the shortcomings and water resource consumption of the current method, and find an optimal solution for cold conditioning of grain.

The experimental humidifier has the following technical specifications:

Productivity, kg/hour	23.3;
Consumption power, kVt	1.5;
Mains voltage, V	220V;
Number of revolutions of the humidification device shaft, revolutions/minute	11-18;
Humidifier diameter, mm	500;
Humidifier length, mm	700;
Wetting temperature, °C	16-22;
Weight, kg	140;

Results. The flow rate of wheat grains being fed to the grain cold conditioning unit was monitored using a grain flow sensor. The air pressure was selected depending on the initial moisture content of the wheat grains.

$$\text{initial weight} - \text{dried grain weight} = \text{result} \times 20 = \text{final humidity}$$

$$18.25 - 17.84 \times 20 = 8.2\%$$



Figure 3. Initial moisture content of grain being moistened in the device

The cold conditioning process of grain was carried out under the air pressure of the device, at the specified speed of rotation of the shaft and the amount of water consumed. The change in grain moisture content during the cold conditioning process is related to the water consumed. It can be described by the following formula;

$$S = \left(M \times \frac{\varphi_{ch}}{100} \right) - \left(M \times \frac{\varphi_k}{100} \right) \quad (1)$$

where: M –is the initial mass of the grain (kg), φ_k –is the initial moisture content (%), φ_{ch} –is the final moisture content %, S –in the required amount pf water (kg).

Initial weight: 140 kg, initial moisture content 8.2%, optimal moisture content 16%, dimensions of the humidification parameters: device height 70 cm, device diameter 50 cm, air pressure 10 MPa. In the first step, we determine the initial moisture content of the grain. Knowing the initial moisture content, the following formula was used to calculate the required amount of water:

$$\begin{aligned} & \text{initial humidity} \times \text{starting weight} \div 100\% = \text{dry grain weight, kg} \\ & \text{Dry grain weight} + \text{Amount of water consumed, } S \\ & 8.2\% + 140\text{kg} \div 100\% = 11.48 \\ & 11.48 + 12.9 = 24.38 \\ & 140. + 12.9 = 152.9 \\ & \text{Optimal humidity} = \frac{24.38}{152.9} \times 100\% = 16\% \\ & S = 12.9 \text{ kg} \end{aligned}$$

The amount of water used for optimal grain moisture was found to be 12.9 kg.

Table 1. Time variation of water consumption for grain moisture increase in a grain cold conditioning unit with a rotation speed of 15 times per minute and an air pressure of 9 MPa

No	τ , min.	enter	S_{spend} , kg	φ_{exit}
1	60	8.2	2.15	9.9
2	120	8.2	4.3	12.2
3	180	8.2	6.45	13.8
4	240	8.2	8.6	14.2
5	300	8.2	10.75	15.6
6	360	8.2	12.9	16

Where τ – soaking time, m_{en} , – moisture content of the graion at the entrance to the soaking device, S_{spend} , – the amount of water consumed for soaking the grain, N_2 –final moisture content of 140 kg of wheat was increased from 8.2% to 16% in a cold condition device under a pressure of 9 MPa, the following formulas were used to calculate the optimal moisture content of the grain:

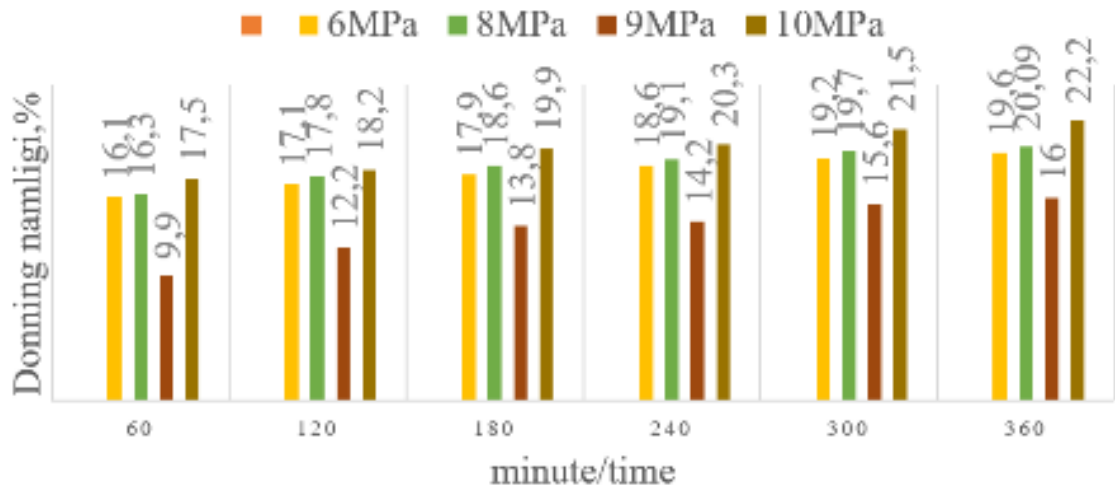


Figure 3. Graph of the results of the rotation of the rotating shaft of the device per minute at different air cross sections

The graphs in the figure show that the mass changes of grains under different conditions are also different. This is due to the grain cold conditioning device's ability to humidify the grain in different modes and under different air pressures.

Experiments and analyses conducted to select the optimal mode show that the time of the experiment should also be taken into account and the electric energy consumption should be reduced when choosing the experimental method. The moisture content of the grain at the inlet is important for this. Therefore, the above factors should be used when selecting the values of the number of revolutions of the device shaft and the air pressure supplied by the compressor.

Table 2. Graph of experimental input factors

T/r	1	2	3	4
z_1	8	9	9	8
z_2	10	10	10	10
z_3	14	13	12	13
z_4	9	9	9	9
Y_φ	16.2%	16.1%	15.1%	15%

Conclusions. In the process of conducting research on the topic “Development of a cold conditioning device for grain at flour production enterprises”, the following scientific results were obtained: An in-depth analysis of the conditioning methods and the design of the humidification device was carried out, which made it possible to choose the necessary humidification method and type of humidification device. It was shown that using the combined conditioning method, it is possible to increase the moisture absorption rate and reduce the water consumption of the device. A dynamic model was developed that allows modeling and controlling the process of humidifying wheat grains. Empirical and mathematical models of the conditioning device were developed,

which made it possible to predict the moisture content of wheat grains at the outlet of the device under various humidification mode parameters. An empirical mathematical model of the conditioning device was developed, which made it possible to predict the water consumption of the humidification device due to the presence of water and air spray blades. A method for conducting experimental studies on humidifying wheat grains in the developed vertical shaft-type combined conditioning device was developed. In the developed experimental humidifier, wheat grains were transferred at different shaft rotation speeds.

REFERENCES

1. P.Birwal, R.Megh Goyal, M.Sharma, Handbook of Research on Food Processing and Preservation Technologies, 1st Edition, 24 November 2021, New York, ISBN 9781003161295, <https://doi.org/10.1201/9781003161295>
2. С.Б.Бекбосынов, Н.К.Абдильдин, И.Т.Мизанбеков, Повышение технической оснащённости сельскохозяйственного производства, механизация и электрификация сельского хозяйства, ISSN 2304-3334, 2021
3. Z.M.Mukimov, Donni saqlash va qayta ishlash texnologiyasi, o'quv qo'llanman, Toshkent 2021, ISBN 978-9943
4. R. Megh Goyal, K.S.Mishra, P.Birwal, "Food Processing and Preservation Technology", 2022 Apple Academic Press
5. X.T.Berdimuradov, E.K.Raxmonov. Selection and justification of wheat varieties for flour milling // Central Asian Research Journal for Interdisciplinary Studies (CARJIS). – 2022. – P. pp147–156.
6. K.A.Rosentrater., "Storage of cereal grains and their products". Darslik. Woodhead publ. cereals,grains assoc,bookstore.2022
7. H.K.Sharma, N. Kumar, "Agro-processing and food engineering: operational and application aspects", Springer, book. ISBN 978-981-16-7288-0. 2022
8. M.R. Goyal, K.S.Mishra, P.Birwal, "Food Processing and Preservation Technology". Book . Apple Academic Press. ISBN 9781771889957, 2022 .pp-17
9. Berdimuradov X.T., Raxmonov E.K. "Navli un tortishda bug'doy navlarini tanlash va asoslash" -T.:Central Asian Research Journal For Interdisciplinary Studies (CARJIS), 2022. bet 147-156b.
10. S.M.Jafari, N.Malekjani., "Drying technology in food processing", doi.org/10.1016/j.fbio.2022.101677 Elsevir (Science direct) 2023
11. H.K.Sharma, N.Kumar, "Agro-processing and food engineering: operational and application aspects", Springer, ISBN: 978-981-1-7288-0, 2022
12. Т.В.Бобровская , Г.А.Булатова , О.И.Германб И.Н.Санниковой, Экономическая безопасность предприятия мукомольно-крупяной промышленности : учебно-методическое пособиеб учебное пособие, 2023, ISBN:9785449936813-235с,
13. Akramova.G.A, "Donni sovuq konditsionerlash qurilmasining xo'jalik sinovlari va uning iqtisodiy samaradorligi", Muhandislik va iqtisodiyot ijtimoiy-

iqtisodiy, innovatsion texnik, fan va ta'limga oid ilmiy-amaliy jurnali,-2025- №1.-207-217-b.(05.01.00)

14. Yusupov.A.A, Akramova.G.A, “ Un ishlab chiqarish korxonalarida donni sovuq konditsionerlash tizimining modellari va ularning tavsiflari”. Muhandislik va iqtisodiyot ijtimoiy-iqtisodiy, innovatsion texnik, fan va ta'limga oid ilmiy-amaliy jurnal, -2024.- №5.-211-219-b(05.01.00)

15. Yusupov.A.A, Akramova.G.A, “Research of an improved device for the process of thermal processing based on cold conditioning of cereals”. Universum : технические науки. – Москва-2025. - №4 (133).

C O N T E N T S

TECHNICAL SCIENCES: COTTON, TEXTILE AND LIGHT INDUSTRY

Parpiyeva N., Kayumov J., Parpiyev D., Tukhtasinov D., Rizayev D., Komilov M.	3
Rotational auto-oscillations of ribbed cylinders in a pneumatic pressure supply system	
Mirzaumidov A.	14
Integrated multi-track laser surface hardening of gears and rotating components: thermal field control and residual stress engineering	
Mirzaumidov A., Xabibullayev D.	20
Practical study of determining vibrations of 5LP machine in experimental research	
Kozokov S.	26
Determination of optimal parameters of an advanced device for cleaning cotton from large impurities based on a mathematical model	
Mamakhanova Z.	38
Biomechanical principles of sportswear design for kayak slalom athletes	

TECHNICAL SCIENCES: AGRICULTURE AND FOOD TECHNOLOGIES

Sattarov K., Khazratkulov J.	46
Use of non-traditional raw materials in the production of fish feed	
Akramova G.	52
Grain cold conditioning device and technological solution	
Ravshanov S., Abdullayeva F., Zaynobiddinov M.	59
Investigation of the chemical composition, structure, and functional-technological properties of the secondary product "gluten" from kokand spirit JSC	
Abdurahimov A., Tashmurotov A., Kuzibekov S., Ochilova S., Toshmurotov M.	63
Comprehensive assessment of linear dimensions, physical-mechanical and chemical properties of cotton seeds of foreign and local varieties	
Yakubjanova Y.	69
Milk-based refreshing beverages: classification, nutritional benefits and comparative advantages over other beverage types	
Aliyeva G., Kanoatov X.	73
Study of the efficiency of using cryoprotectors on the rheology of the test	

Abdurazzokova M., Raxmonova X.	
Degradation of pectin and starch in sweet sorghum stem juice using enzymes	83
Ismanova A., Meliboyev M.	
Physico-chemical analysis methods in combined drying of topinambur raw materials	87
Atamirzayeva S.	
Investigation of additives in the composition of meat canned products based on taraxacum officinale Wigg. plant	93
Abdullayeva B.	
Comprehensive assessment of quality and safety indicators of minced meat semi-finished products	100
Ikromov F., Ikromova Y., Xamdamov A.	
The importance of using reverse osmosis in tomato paste production	105

CHEMICAL SCIENCES

Janaev M., Adilov R., Ergashev O.	
Laws of micelle formation in aqueous solutions of azomethines based on monoethanolamine and acetaldehyde	111
Mukhammadjonov M., Rakhmatkariyeva F., Oyidinov M.	
Hydrothermal synthesis of KA (LTA-type) zeolite from Angren kaolin: structural, morphological, and adsorption characterization	117
Abdukhamidova F., Ibragimova K., Khusenov A., Rakhmanberdiev G.	
Nitro-carboxymethylinulin synthesis	128
Yusupova M., Mamadjonova M., Egamberdiev S., Abduvohidov I.	
Study of the process of aminolysis of secondary polyethyleneterephthalate with monoethanolamine without the participation of a catalyst and analysis of the obtained product	134
Eshonkhodzhaeva O., Mirzarakhmetova D.	
Features of cationic pectin synthesis and properties	140
Urinboeva M., Abdikamalova A., Mamataliev N., Ismadiyorov A.	
Synthesis of surfactants based on fatty acids and their spectral analysis	147
Urinboeva M., Abdikamalova A., Mamataliev N., Ismadiyorov A.	
Adsorption activity of bentonite clays toward dyes	153
Hakimova Kh., Makhkamova D., Turayev Z.	
Extraction of the nickel microelement from industrial secondary products using sulfuric acid	166
Ochilov G., Boymatov I., Ganiyeva N.	
Adsorption properties of modified adsorbents for dyes	176

Shamuratova M., Giyasidinov A., Abdikamalova A., Eshmetov I.	
Bonding of porous structure and soil moisture retention in modification surfactants and polymers	180
Giyasidinov A., Sultonov B., Dedaboyeva M., Aliyev O.	
Optimal amounts and concentrations of calcium nitrate solution in the production of phosphate fertilizers	186
Shermatov A., Sherkuziyev D.	
Optimization of acid decomposition of washed calcined phosphoconcentrate using a mixed secondary sulfuric–extraction phosphoric acid system: chemical and ftir investigation	195
Umirov F., Erkaev A., Kucharov B., Maxmudov R., Baxshilloev N.	
Production of magnesium chloride from magnesium-containing brines by the isothermal method at 25 °C based on the system $2Na^+, Mg^{2+} \parallel SO_4^{2-}, 2Cl^- - H_2O$	202
Urinov A., Aslonov A.	
Development of an effective anti-corrosion polymer composition for oil and gas trunk pipelines on a resource-saving basis	209
Khamidov R., Oydinov M., Abdulkhaev T.	
Crystalline structure and spectroscopic analysis of LIA zeolite	216

TECHNICAL SCIENCES: MECHANICS AND MECHANICAL ENGINEERING

Azamov S.	
Improvement of methods for increasing the energy efficiency indicators of an off-grid solar photovoltaic system	224
Kayumov U., Pardaeva Sh.	
Operational characteristics of centrifugal pumps in the mining industry	231
Mamanazirov J., Mamatkulov Sh.	
Investigating mxene material for evolution reaction in water splitting	240
Obidov A., Khudayberdiyeva D., Mirzaakhmedova D.	
Experimental construction development of the device for cleaning cotton from small impurities	247
Sultanov D., Mamahonov A.	
Assessment of the chemical and mineralogical properties of rocks from the mountainous areas of chortoq district, namangan region, based on xrf and ftir methods	257
Abduvakhidov M., Mirjalolzoda B., Umarov A.	
Bending vibrations of flexible packet-type working bodies of technological machines	271



Abduvakhidov M., Mirjalolzoda B., Umarov A.

Theoretical study of bending vibrations of packet-type working bodies of technological machines with account of internal longitudinal forces **278**

ECONOMICAL SCIENCES

Ergashev A.

The impact of public–private partnership (PPP) mechanisms on enterprise competitiveness in the implementation of green technologies **283**
