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ҚАЗАҚСТАН РЕСПУБЛИКАСЫ  
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫ  
Satbayev University

# Х А Б А Р Л А Р Ы

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**ИЗВЕСТИЯ**

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК  
РЕСПУБЛИКИ КАЗАХСТАН  
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**TECHNOLOGICAL REGULATIONS OF CONDITIONS IN PRODUCTION  
OF FERTILIZER MIXTURES “ZHAMB-70”**

**Abstract.** A study of the chemical composition of industrial wastes of various industries was conducted, which can be used instead of natural raw materials for the production of mineral fertilizers. In addition, the use of these wastes through the production of fertilizers, firstly, solves the problem of waste collection and disposal, secondly, reduces the environmental burden in industrial areas and, thirdly, reduces the use of natural resources.

Reducing the amount of waste and recycled materials, reducing the area of industrial waste storage in industrial zones, improving the quality of raw materials and resources through rational and integrated use and introduction of new industrial and innovative technologies are key areas in the economy to solve environmental problems of the regions.

The aim of this work dealt with the issues of reducing environmental burden with the use of industrial wastes as dust cyclone, phosphate fines, internal overburden, dust precipitator of sintering and dust precipitator furnace shop, including neutralization and disposal of harmful solid waste, create environmentally friendly, low - and non-waste technologies are highly relevant. This, in turn, leads to an increase in the use of advanced structural materials, the replacement of expensive materials with cheaper ones, based on the waste of various industries, rational and integrated use of natural and fuel and energy resources, significant involvement in the economic turnover of secondary resources and associated products.

**Key words:** mineral fertilizers, industrial wastes, cyclone dust, phosphorite particles, internal overburden rocks.

**Introduction.** Traditionally, simple, compound and complex fertilizers are obtained by decomposition of natural raw materials with strong acids such as sulfuric, hydrochloric and nitric acids, followed by neutralization and the introduction of various additives at different stages of the technological process.

In the Republic of Kazakhstan, there is a lack of measures to establish safety measures and systems at industrial enterprises producing fertilizer mixtures and other fertilizers to neutralize the environmental damage caused by the processing of raw materials in various industries.

In order to prevent environmental problems in the southern regions of the Republic of Kazakhstan and, in general, to increase the supply of mineral fertilizer mixtures and fertilizers for the cultivation and protection of cereals and other agricultural crops for the processing of small wastes generated in the processing of raw materials across the country, and in the structure of medium-sized businesses, it is necessary to develop a system of central management of safety of production facilities and measures that will allow to set goals and objectives.

Based on the mentioned above, we conducted our research on the introduction into the production cycle 1,2,3 of complex-mixed multicomponent fertilizers using internal overburden rocks (IOR), obtained during the mining not only in brown coal deposit of the former Lengir settlement but also Karaganda and Ekibastuz coal deposits, except cyclones and electrostatic precipitators after agglomeration of fine particles of natural phosphorite in the phosphorus industry [1-3].

To increase the environmental safety of not only fertilizers, but also products of various crops, it is recommended to include in the compound fertilizer glauconite, which has the ability to absorb 66 to 99%

or more of aqueous solutions of heavy metals and radionuclides. This allows not only to increase iron, zinc, sulfur, magnesium, calcium and other nutrients, but also to obtain multicomponent fertilizers containing other trace elements that fertilize saline soil resources [4,5].

**Methods.** We propose to build a small workshop that will not harm the environment and residents of the region and other industrial organizations in the processing of environmentally friendly fertilizer mixtures for arable lands on the basis of simple mixing of various natural raw materials contained microelements and man-made wastes with moisture-keeping and absorbing substances and mechanically activated phosphorites.

The study was conducted in two directions:

- Improving the technology of obtaining mechanically and chemically activated compound fertilizers using natural raw materials consisting of macro and micronutrients [6-9];

- There are technologies for obtaining multicomponent complex-mixed fertilizers from the wastes of various enterprises by the acid-free method without the use of the extraction process of natural phosphorus-containing raw materials. One of the most pressing goals is the development of modern technological and technical bases for the production of environmentally friendly compound fertilizers that provide normal vital activity and working conditions in small shops on these technologies.

In this regard, we have studied the possibility of using glauconite with a number of specific properties in the production of compound fertilizers.

Studies on the electron microscope JSM 6390 LV of the Japanese company JOES and analysis of the literature on the chemical composition and physical properties of various minerals show that in vermiculite and glauconite, which is an aluminosilicate substance, have calcium, magnesium, iron, potassium, phosphorus, sulfur contains other trace elements in addition to internal overburden rocks. The presence of glauconite in compound fertilizers allows reducing the influx of radionuclides and heavy metals in the root system and stems of vegetable and soybean crops, used in everyday life of the population, as well as in the feed of cattle and sheep [10-11].

Table 1- Elemental composition of glauconite in different rocks

No.	Contained components (in%)	Samples of glauconite in different rocks				
		No.1	No. 2	No. 3	No. 4	No. 5
1	O	55,10	54,85	49,06	55,37	55,12
2	Na	0,19	0,20	0,14	0,21	0,13
3	Mg	0,60	0,77	0,56	0,80	0,77
4	Al	12,40	11,30	8,88	11,53	11,41
5	Si	26,43	27,96	23,22	27,31	26,45
6	K	2,60	2,15	1,18	2,24	3,02
7	Ca	0,29	0,24	0,29	0,27	0,08
8	Ti	0,91	0,67	0,54	0,65	0,75
9	Fe	1,48	1,86	15,89	1,63	2,28
10	Mn	-	-	0,23	-	-

Products generated as waste at the Zhana Zhambyl Phosphorus Plant are highly digestible phosphorus, despite the fact that due to their chemical composition, the content of  $P_2O_5$  from natural phosphorus-containing raw materials is lower [12-13].

Depending on these achievements, it is necessary to know the composition of the raw materials' mixtures used in the construction of this small shop. In this regard, it is necessary to analyze the raw materials required for the production of compound fertilizers.

The composition of the elements in the phosphate part of the feedstock, especially the fine phosphorite, cyclone and electrostatic precipitators formed during the production of agglomerate, as well as the IOR of different rocks of vermiculite and lignite are given in Table 2 [14].

Table 2 - The composition of the elements in the phosphate part of the raw material

No.	Contained components (in%)	Name							
		Cyclone dust	Dust from the electrostatic precipitator	Electric filter furnace dust	Fine phosphorite	Vermiculite	Ekibastuz IOR	Lenger IOR	Karaganda IOR
1	C	23,95	17,73	41,92	7,10	-	27,79	26,73	32,08
2	F	3,26	1,91	-	2,26	-	-	-	-
2	Na	0,33	0,29	1,10	0,15	0,11	0,27	-	0,16
3	Mg	1,21	1,31	0,35	1,93	8,63	0,46	0,20	0,40
4	Al	2,14	2,42	0,44	1,17	7,82	6,01	6,45	5,15
5	Si	8,27	9,59	3,14	8,53	17,42	12,77	12,97	11,44
6	S	0,49	0,26	-	0,16	-	1,05	1,50	1,12
7	K	1,19	1,25	10,20	0,72	3,04	1,14	1,01	0,97
8	Ca	13,98	16,12	2,65	22,62	2,12	1,54	0,96	1,58
9	Ti	0,24	0,19	-	-	1,42	0,29	0,37	0,28
10	Fe	2,13	1,58	1,05	1,16	13,28	3,24	3,17	2,83
11	Cl	0,31	-	0,21	-	0,27	-	-	-
12	P	4,44	5,31	9,71	7,42	-	-	-	-
13	Zn	-	-	0,43	-	-	-	-	-
14	Mn	-	-	-	0,25	-	-	-	-

Analysis of Table 2 shows that the mixture contains microelements, which are necessary for plants, like sulfur, titanium, magnesium, potassium, carbon etc. There is no doubt that the presence of them is very important for plants.

As determined by the works of the authors [10]; Physicochemical properties of glauconite reduce the content of heavy metals such as As, Pb, Mg and other elements from 64% to 99%, and radionuclides - from 95-97% in aqueous solution, and it is a good food for various animals. were found to be additives.

In this regard, the purpose is to improve the optimal technological composition of fertilizer mixtures based on complex-mixed fertilizers “ZHAMB-70”, which contain a moisture-retaining substance, trace elements and humates.

In addition to the mechanically and chemically activated properties of the phosphate part of the fertilizer mixture, this allows to obtain a new range of mineral fertilizers in emergencies through the introduction of radionuclide-absorbing glauconite to increase the safety of heavy metals and radionuclides.

In order to address these pressing issues, based on the research of a number of chemical technologists, a new range of “JAMB-70” fertilizer mixtures was found as a result of research, which absorbs nitrates of heavy metals and aqueous solutions with a moisture retardant and radionuclides containing glauconite and increases the safety of human life and environment [2].

The effective content of glauconite in it should not be less than 5% and not more than 10%. Outside of these limits, other properties of the additive may change, affecting its intended function.

It includes not only sanitary and hygienic, but also other technical aspects of the temperature in the working room, safety, ventilation, lighting and fire safety standards, the requirements for the reuse of waste in the technological process, as well as the possibility of maximum concentration and limit stones to avoid harm to the environment. accompanied by storage [15].

Therefore, in the second area of research, research is being conducted on the development and establishment of small businesses, providing comfort to service personnel.

As a result of research, the following relationships between raw materials were identified [16].

Table 3 - Optimal production parameters of “ZHAMB-70”

No.	Phosphorite fine or agglomerated cyclone dust	Electric filter dust	The third small appearance of the furnace shop	Vermiculite	IOR
1	71	3	2	12	12



2	79	3	2	8	8
3	75	3	2	10	10
4	75	3	2	12	8
5	75	3	2	8	12
6	72	3	2	13	10
7	74	4	3	11	8
8	77	4	2	8	9
9	77	3	3	9	8
10	78	2	4	8	8
Average:	75	3	2	10	10

**Results and Discussion.** According to the plan for the production of “ZHAMB-70” in order to increase the quality and volume of finished products of crops of small, medium and individual entrepreneurs in the Republic of Kazakhstan in the regions and districts of those regions, or in 3-4 districts, It is planned to build small enterprises producing at least 18 thousands of tons of fertilizer mixture a year.

As a result, the research conducted an analysis of the real magnitude of the emergency situation in the Turkestan region, and the data of the analytical analysis are given below.

At M. Auezov South Kazakhstan University an experimental plant has been developed for the production of 500 kg of fertilizer mixture per hour. In this unit, the most efficient modes of technology are identified. The experimental plant is shown in Figure 1 [17-19].

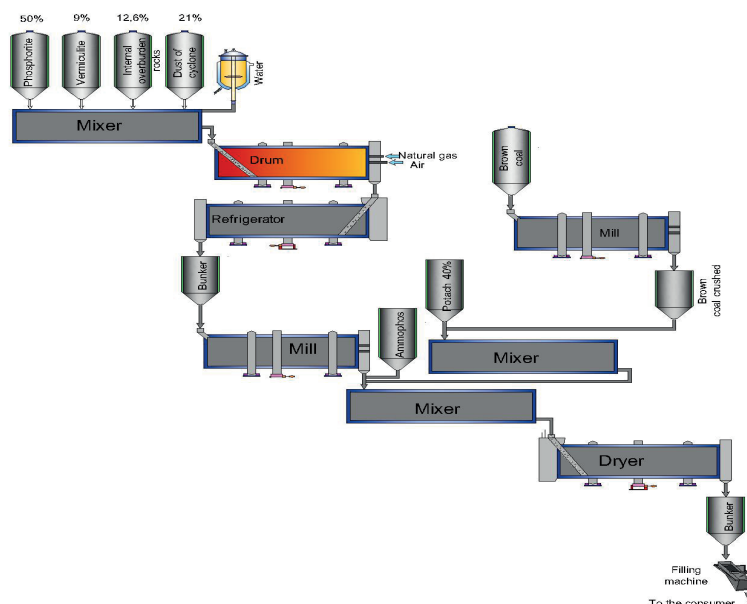


Figure 1 - Technological model for the production of “ZHAMB-70”

According to the model of the equipment shown in Figure 1, technologically efficient procedures for the production of “ZAMB-70” in the practical conditions of production are identified.

The life-threatening nature of the equipment and small businesses and the environment, the personnel serving the premises, the optimality of solutions to eliminate or reduce dust, hazards are aimed at facilitating the work of emergency workers in local areas, regions and districts.

If local decisions are made to design this production, it is necessary to take a number of measures and decisions on the environment of the production facility, the proximity of rural areas, the safety of production workers and service personnel.

Crushed material up to 10 micron grade, containing phosphorus-potassium-humus, vermiculite and trace elements, is fed into a two-shaft mixer for thorough mixing and then transported to the combined mixer hopper. “ZAMB-70” complex mixed fertilizer enters the packing machine from the collection hopper.

**Conclusion.** During the experimental tests, the main technological parameters and thermal-technological procedures for obtaining long-acting “ZHAMB-70” fertilizer mixture on environmental and technological safety were identified.

Phosphorus-containing substances (third return):

- dust of small phosphorite or sinter cyclone - 75%;
- dust from electric filters - 3%;
- vermiculite - 10%;
- internal stripping rocks - 10%;
- The third small appearance of the furnace shop - 2%.

The following optimal thermal technical parameters were identified during the production of “ZHAMB-70”:

- disconnect 3-5 mm of water at the top of the oven;
- temperature in the firing zone-800-900°C;
- exhaust gas temperature 250-300°C;
- water disconnection 180-200 mm before the smoke extractor.
- degree of purification of dust-gas mixture not less than 95%;
- gas pressure in the injector is 0.8-1.5 kgf/cm<sup>2</sup>;
- cooling of the material in the refrigerator up to 400°C.

In the course of experimental and industrial tests, a fundamental possibility of obtaining a long-acting fertilizer “ZHAMB-70” for an agricultural complex close to farms within a radius of 50 km was identified.

During the experimental tests, the following basic technological parameters for the production of long-acting “ZHAMB-70” fertilizer mixture were determined: phosphorus-containing substances (third return); dust of cyclones 10; dust of electric filters-10) -60-65; vermiculite -9-11; internal overburden rocks-8-10; brown coal -9-11 and patosh K<sub>2</sub>CO<sub>3</sub> – 9-11.

The following optimal thermal technical parameters were determined during the production of “ZHAMB-70” fertilizer mixture: temperature in the firing zone-800-900°C; exhaust gas temperature 250-300°C; cooling of the material in the cooler with a gas pressure of 0.8-1.5 kgf/cm<sup>2</sup> and up to 400°C.

The mixed raw material enters the kiln. It is necessary to organize fire safety measures, as the firing temperature is 800-900°C. To do this, fire alarms and fire sensors were placed in the scheme in accordance with the size of the production site. The installed fire alarm system must be connected to central control devices.

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### **«ЖАМБ-70» ТУКОҚОСПА ШЫҒАРУДАҒЫ ӨНДІРІСТІК ЖАҒДАЙЫНЫҢ ТЕХНОЛОГИЯЛЫҚ ТӘРТІПТЕРІ**

**Аннотация.** Мақалада минералды тыңайтқыштар алу үшін табиғи шикізаттың орнына пайдалануға болатын әртүрлі өндірістердің өнеркәсіптік қалдықтарының химиялық құрамын зерттеу жүргізілді. Сонымен қатар, осы қалдықтарды тыңайтқыш алу арқылы пайдалану, біріншіден, қалдықтарды жинау және көму проблемасын шешеді, екіншіден, өнеркәсіптік аймақтардағы экологиялық жүктемені азайтады және үшіншіден, табиғи ресурстарды пайдалануды азайтады.

Экономикада қалдықтар мен қайталама материалдардың санын азайту, өндірістік аймақтардағы өнеркәсіптік қалдықтарды сақтау алаңдарын азайту, жаңа өнеркәсіптік және инновациялық технологияларды енгізу, ұтымды және кешенді қолдану арқылы шикізат пен ресурстардың сапасын жақсарту сияқты негізгі бағыттарды пайдалану құрылыс экономикасының әр түрлі салаларының жұмыс істеуінің сенімді механизмін құруға және еліміздің өнеркәсіптік аймақтарының экологиялық мәселелерін шешуге мүмкіндік береді.

Сонымен қатар, жасалынған жұмыста біз фосфор өнеркәсібінде табиғи фосфоритті майда ұсақтарын агломерация тәсілімен кесектегенде циклондар мен электрсузгілердің ұнтақты шаң тозаңдары сияқты техногендік қалдықтарымен қатар, бұрынғы Леңгір мекенжайының қоңыр көмір кен орындарының ғана емес, сонымен қатар Қарағанды және Екібастұз көмір туынды мекендерінің терикондар түріндегі көмір өндіргенде ішкі қазба жыныстарын (ІҚЖ) қолдана күрделі-аралас көпкомпонентті тыңайтқыштарын алу өндірістік циклына ендіру бойынша зерттеу жұмыстарын жүргіздік.

**Түйінді сөздер:** минералды тыңайтқыштар, өндірістік қалдықтар, циклон шаңы, фосфорит ұнтағы, ішкі қазба жыныстары.

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### **ТЕХНОЛОГИЧЕСКИЕ РЕЖИМЫ ПРОИЗВОДСТВЕННЫХ УСЛОВИЙ РАЗРАБОТКИ ТУКОСМЕСИ «ЖАМБ-70»**

**Аннотация.** Проведены исследования по изучению химического состава промышленных отходов различных производств, которые могут быть использованы взамен природного сырья для получения минерального удобрения. Кроме того, использование данных отходов с получением удобрений, во-первых, решает проблему складирования и захоронения отходов, во-вторых, снижает экологическую нагрузку в промышленных регионах и, в-третьих, сокращает использование природных ресурсов.

Использование таких основных направлений в экономике, как бережное отношение к ресурсам за счет сокращения количества отходов и вторичных материалов, сокращение площадей хранения промышленных отходов в производственных регионах, внедрение новых промышленных и инновационных технологий, повышение качества сырья, ресурсов за счет их рационального и комплексного применения, позволяет создать надежный механизм функционирования различных отраслей строительной экономики и решить экологические проблемы промышленных регионов нашей страны.

Кроме того, были проведены исследовательские работы по внедрению в производственный цикл получения сложных комбинированных многокомпонентных удобрений с применением внутренних вскрышных пород при добыче угля в виде терриконов не только месторождений бурых углей бывшего Ленгера, но и производных угля Караганды и Экибастуза, наряду с техногенными отходами, такими как порошковая пыль циклонов и электрофильтров при резке природных фосфоритных мелких частиц агломерационным способом.

**Ключевые слова:** минеральные удобрения, промышленные отходы, циклонная пыль, частицы фосфорита, внутренние вскрышные породы.

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## МАЗМҮНЫ-СОДЕРЖАНИЕ-CONTENTS

<b>Abuova R.Zh., Ten E.B., Burshukova G.A.</b> STUDY OF VIBRATION PROPERTIES OF CERAMIC-METAL NANOSTRUCTURAL TIN-CU COATINGS WITH DIFFERENT COPPER CONTENT 7 AND 14 AT. % ON CHROMIUM-NICKEL-VANADIUM STEELS.....	6
<b>Abetov A., Kudaibergenova S.</b> INTEGRATED RESEARCH OF SUFFOSION AND KARST PROCESSES AT THE KOGCF BY GEOLOGICAL AND GEOPHYSICAL AND GEODESIC METHODS.....	14
<b>Amangeldykyzy A., Kopobayeva A.N., Bakyt A., Ozhigin D.S., Blyalova G.G.</b> MINERALOGY AND GEOCHEMISTRY OF THE SHUBARKOL DEPOSIT JURASSIC COALS.....	23
<b>Dikanbayeva A.K., Auyeshov A.P., Satayev M.S., Arynov K.T., Yeskibayeva Ch.Z.</b> RESEARCHING OF SULFURIC ACID LEACHING OF MAGNESIUM FROM SERPENTINES.....	32
<b>Duisen G.M., Aitzhanova D.A.</b> NATURAL RESOURCE POTENTIAL OF KAZAKHSTAN AND CENTRAL ASIAN COUNTRIES: PROSPECTS OF USE.....	39
<b>Edygenov E.K., Vassin K.A.</b> ELECTROMAGNETIC VEHICLE WITH AUTOMATED CONTROL SYSTEM FOR SURFACE MINING OPERATIONS.....	47
<b>Ismailov B.A., Dossaliev K.S.</b> TECHNOLOGICAL REGULATIONS OF CONDITIONS IN PRODUCTION OF FERTILIZER MIXTURES “ZHAMB-70”.....	54
<b>Issagaliyeva A.K., Istekova S.A., Aliakbar M.M.</b> GEOPHYSICAL DATA COMPLEX INTERPRETATION TECHNIQUES FOR STUDIES OF THE EARTH CRUST DEEP HORIZONS IN THE NORTH CASPIAN REGION.....	61
<b>Mekhtiyev A.D., Soldatov A.I., Neshina Y.G., Alkina A.D., Madi P.Sh.</b> THE WORKING ROOF ROCK MASSIF DISPLACEMENT CONTROL SYSTEM.....	68
<b>Mustafayev Zh.S., Kozykeeva A.T., Tursynbayev N.A., Kireychev L.V.</b> APPLIED MODEL OF ENVIRONMENTAL SERVICES - DEVELOPMENT OF ECOLOGICAL AND ECONOMIC DRAINAGE SYSTEM OF TRANSBOUNDARY RIVER BASINS (on the example of the Talas river basin).....	77
<b>Petr Hajek, Baimaganbetov R.S.</b> GEOSTABILIZATION OF ECOLOGICAL EQUILIBRIUM AS A RESULT OF FOREST FIRES.....	84
<b>Salikhov N.M., Pak G.D., Shepetov A.L., Zhukov V.V., Seifullina B.B.</b> HARDWARE-SOFTWARE COMPLEX FOR THE TELLURIC CURRENT INVESTIGATION IN A SEISMICALLY HAZARDOUS REGION OF ZAILIYSKY ALATAU.....	94



<b>Saukhimov A.A., Ceylan O., Baimakhanov O.D., Shokolakova Sh.K.</b> REDUCING POWER AND VOLTAGE LOSSES IN ELECTRIC NETWORKS OF OIL FIELDS USING THE MOTH FLAME OPTIMIZATION ALGORITHM.....	103
<b>Soltanbekova K.A., Assilbekov B.K., Zolotukhin A.B., Akasheva Zh.K., Bolysbek D.A.</b> RESULTS OF LABORATORY STUDIES OF ACID TREATMENT OF LOW-PERMEABILITY ROCK CORES.....	113
<b>Surimbayev B., Bolotova L., Shalgymbayev S., Razhan E.</b> RESEARCH OF THE COMPLEX STAGE-BY-STAGE SCHEME OF GRAVITY SEPARATION OF GOLD ORE.....	124
<b>Temirbekov N.M., Los V.L., Baigereyev D.R., Temirbekova L.N.</b> MODULE OF THE GEOINFORMATION SYSTEM FOR ANALYSIS OF GEOCHEMICAL FIELDS BASED ON MATHEMATICAL MODELING AND DIGITAL PREDICTION METHODS.....	137
<b>Tileuberdi N., Zholtayev G.ZH., Abdeli D. Zh., Ozdoev S.M.</b> INVESTIGATION OF DRAINAGE MECHANISM OF OIL FROM PORES OF OIL SATURATED ROCKS USING NITROGEN AT THE LABORATORY CONDITION.....	146
<b>Tleulesov A.K., Suyundikov M.M., Shomanova Zh.K., Akramov M.B., Suiindik N.M.</b> ASSESSMENT OF QUALITATIVE AND QUANTITATIVE ELEMENTAL COMPOSITION OF WASTE IN THE TERRITORY OF SLUDGE COLLECTOR OF PAVLODAR ALUMINIUM PLANT.....	153
<b>Turgumbayev J.J., Turgunbayev M.S.</b> PREDICTION OF THE CUTTING RESISTANCE FORCE OF THE SOIL CONTAINING STONY FRACTIONS.....	161
<b>Uakhitova B., Ramatullaeva L., Imangazin M., Taizhigitova M., Uakhitov R.</b> ON THE STATE OF INDUSTRIAL INJURIES OF WORKERS IN INDUSTRIAL ENTERPRISES OF THE AKTUBINSK REGION.....	170
<b>Sherov K.T., Sikhimbayev M.R., Absadykov B.N., Karsakova N.Zh. Myrzakhmet B.</b> METROLOGICAL ENSURING ACCURACY OF MEASUREMENT OF ANGLES V-SHAPED SURFACES GUIDE PARTS OF MACHINES FOR PETROCHEMICAL AND GEOLOGICAL EXPLORATION INDUSTRY.....	176

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