PHYSICO-CHEMICAL PROPERTIES OF RAW MATERIALS USED TO OBTAIN FINE CERAMICS

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ABSTRACT

The moisture content of pressed wood is 9-11%. The pressed powder is moistened with water or steam until it has the desired moisture content. It does not require natural drying or spending on drying porches, but it lasts for a long time (10-15 days). In addition, a large space is required for natural drying. Currently, in large factories, raw materials are usually artificially dried in intermittent chamber dryers and continuous tunnel dryers. In this method, the drying time for raw materials is 1-3 days, and for thin items, it takes several hours. In the production of all fine ceramics, 95-97% of the product is formed by the strapping method, and 3-5% of the product is formed by casting in a plaster mold. By means of belt molding, porcelain and earthenware products, insulators, bowls and other fine ceramic products are produced. In this case, the moisture content of the ceramic mass ranges from 17% to 28%, depending on the type of product.

Keywords: Fine ceramics, ceramic material, clay extraction, natural state extraction of clay extracted from the quarry and transported to the factory, the composition of the ceramic mass, the choice of grinding and molding method of raw materials

INTRODUCTION

Products and materials obtained by molding and burning clay masses or their mixture with mineral additives are called ceramic materials. In construction, ceramic materials and products are used for building walls and covering building roofs, covering floors, walls and facades, filling furnace smoke pipes, building sewerage and drainage, and other purposes[2]. The material from which ceramic products are made is discussed in ceramic technology. Ceramic materials and products are divided into the following groups according to their design[1]:

- masonry (bricks, ceramic stones, brick blocks and panels);
- for roofs (inside blue stones, tiles made of ceramic stones, tombop covering panels, tiles);

- for covering the facade of buildings (ceramic tiles and stones, facade tiles);
- for covering inside buildings (glazed tiles and fashion details, floor tiles);
- sewerage and drainage pipes;
- sanitary ware (sink, toilet, sink, etc.);
- acid-resistant products (bricks, tiles, pipes);
- road materials (bricks, stones);
- heat-insulating (porous hollow bricks and stones);
- fillers for light concrete (keramsite, agloporite);
- fire-resistant products (bricks and molded products).

Clay is the main raw material for the production of ceramic materials and products. Clay is a finely dispersed fraction of rocks, which has the property of forming a plastic mixture with water, retaining the shape given to it after drying, and having the hardness of stone after baking[3].

Production of ceramic materials and products

Ceramic materials and products have different sizes, shapes and properties, but their production technology is approximately the same and includes mining of raw materials, preparation of raw materials, molding of raw materials, drying, baking, includes sorting and warehousing of baked goods[4].

Clay mining. Clay for the production of ceramic materials and products is usually mined from quarries located directly near the factory with the help of excavators and other machines and mechanisms[5]. Clay is transported to the factory in dump trucks, dump trucks, belt conveyors, and tractors.

Preparation of raw material mass[6]. The clay extracted from the karger and transported to the factory in its natural state is often unsuitable for molding objects and destroys its natural structure, removing harmful impurities from it. It is necessary to grind large mixtures, add additives to clay, and also moisten it to form a convenient moldable mass[7].

The mixture of raw materials is prepared in semi-dry, plastic or wet (slicker) methods. Which of these methods to choose depends on the properties of the raw materials, the composition of the ceramic mass and the method of molding the objects, as well as their dimensions and function. In the semi-dry method, raw materials are dried, cut, ground and thoroughly mixed.Clay is usually dried in drying drums, disintegrated and ground in a dry pulverizer, disintegrators or ball mills, and mixed in dry mixers. The moisture content of pressed wood is 9-11%[8]. The pressed powder is moistened with water or steam until it has the desired moisture content.

A semi-dry method of preparing raw materials is used in the production of semi-dry pressed building bricks, floor tiles, facing tiles, etc. In the plastic method, the raw materials are mixed in natural moisture or water is added until the clay mixture becomes a clay mixture when the moisture content is 18-23%. Different types of millstones are used for grinding and processing raw materials, and clay crushers are

used for mixing[9]. A mixture of raw materials is prepared for the production of ceramic bricks, ceramic stones, tiles, pipes, etc., which can be molded plastically. In the slicker method, the raw materials are first crushed into powder, and then mixed thoroughly with a large amount of water, in which a homogeneous suspension (slicker) should be formed[10]. This method is used in the production of porcelain and earthenware, facing tiles and others.

Molding of items. Ceramic products are molded in different ways: plastic, semi-dry and cast[11]. The choice of molding method depends on the type of products, as well as the composition and physical-mechanical properties of raw materials.Molding in the plastic method - making articles from plastic clay masses in presses_ is the most common method in the production of ceramic products. The prepared clay mass with a moisture content of 18-23% is directed to the receiving hopper of the belt press[12]. The mass is additionally mixed with the help of an auger, compacted and squeezed out in the form of a brush through the exit hole of the press equipped with an exchange nozzle. By changing the mouthpiece, you can get a brush of different shapes and sizes[13]. The automatic cutting device cuts the burr continuously coming out of the press into separate parts according to the dimensions of the products being prepared. Covering tiles, floor tiles and other thin ceramic products are semi-dry molded. In this way, it is possible to make clay and other products from raw materials with low plasticity and low clay content[14].

The advantage of semi-dry molding compared to the plastic method is that clay mass with low moisture content (8-12%) is used, which greatly shortens the construction period of the raw material[15].

In the semi-dry method, each product is molded separately in high-performance presses, where the mass to be pressed is double-pressed under a pressure of up to 15 MPa. Semi-dry pressed products have precise shape, dimensions, strong corners and edges[16].

The pouring method is used for the production of sanitary ware and covering tiles. In this method, clay mass (slicker) with a moisture content of more than 45% is poured into special molds or used for molding tiles[18].

Drying items. It is necessary to dry molded products to reduce their moisture content. For example, raw wood is dried to 8-10% moisture. Due to drying, the durability of the product increases, cracks and deformation during cooking are prevented[17]. Products can be dried naturally and artificially.

It does not require natural drying or spending on drying porches, but it lasts for a long time (10-15 days). In addition, a large space is required for natural drying[19].

Currently, in large factories, raw materials are usually artificially dried in intermittent chamber dryers and continuous tunnel dryers. In this method, the drying time for raw materials is 1-3 days, and for thin items, it takes several hours[20].

The first ceramic products were pots. Food was cooked in it and surplus was stored. In particular, the first egg-shaped vessels of the Neolithic period were used for food storage and cooking[21].

In Central Asia, farming began in 3-2 thousand years BC. The settlement of peoples, in turn, caused the creation of pottery.

In China, the development of ceramics began in the Yanshao period of the 3rd millennium BC, and the production of porcelain was established. In the XII-XIII centuries, their fame spread to the whole world. Such products, called CHinni, are also imported to Central Asia and Iran.

In the 8th-12th centuries of Central Asia, the production of ceramic vessels rose to a high level[22]. It is customary to buy green and gray items here. The Ismail Somoni mausoleum is an example of unique constructions created in this period.

The production of ceramic porcelain dates back to the early 1700s in Europe. The first porcelain factory was launched in Meissen in 1710, and the second in Vienna in 1717-1718. The first porcelain factory in Russia was built in 1744 in Petersburg. In the 19th and 20th centuries, the ceramic industry developed rapidly in Central Asia[23].

It is known that ceramic products are used as household appliances, architectural and decorative parts in Uzbekistan. For centuries, ceramic products have been the main building material, and their quality, shape, and production technology have been improving year by year.In the second half of the 20th century, large porcelain enterprises such as Tashkent, Samarkand, Kuvasoi, Khiva, and Regar were built and put into operation. In 1970, the opening of a ceramic factory in the village of Rishton of the Fergana region made it possible to increase the assortment of ceramic dishes and art objects[24].

There are many types of household goods. But few meet all the requirements. Such rare items include ceramics and porcelain.

Products with a fine grain structure, densely fired and covered with a thin layer of vitreous glaze are called fine ceramics[25]. Nowadays, ceramic products are mainly classified into different groups according to the areas of production and recommendation. Fine ceramic products are divided into 2 groups depending on the degree of maturation of the material:

1. items with dense baked ceramic;
2. Porous, partially baked ceramic products.

The shards of the items belonging to the first group are shiny like shells, do not pass liquids and gases, are painted white or uniform, and when they are clicked, they make a loud sound that does not fade away for a long time. Their water absorption will not exceed 5%. They can be glazed or unglazed.

The fragments of the second group have a fine granular structure, have a faded appearance, and pass liquids and gases. Their water absorption is more than 5%. Clicking on such items produces a low sound that fades away quickly. Items may be

thin[26]. Dense baked goods include porcelain, elegant stoneware, and heat-resistant items.

Porous partially baked products include semi-porcelain, earthenware, and earthenware.

Many people know that ceramic and porcelain items are included in the list of elegant ceramic products. Pottery has been used since ancient times. This opinion is confirmed by archeology and geology - remains of various colored, glazed or unglazed, household items found as a result of research.

A deep analysis of these findings revealed that their composition consists of soil, sand and other compounds. There is a huge demand for artistically decorated ceramics that do not require a lot of money and processing. Therefore, it is desirable to further develop this industry and produce more beautiful products.

The range of elegant ceramic products includes products made on the basis of ceramic technology, which have a homogeneous and dense structure of baked or fine-grained (fine-porous) earthenware. Such items differ from "rough" ceramic items by the absence of a multi-component structure visible in the cross-section of the stick.

The color of the items or the massiveness of the handle cannot be the distinguishing factor between fine ceramics and "dome" ceramics. For example, colored porcelain and ceramic, steatite ware and fireclay brick can have the same color, despite being representatives of different groups of ceramics.

At the same time, items belonging to the same group can be white (experimental vessel) or painted in different colors (household dishes - plates, decorative items) depending on the raw materials used and the purpose.

In the production of an elegant ceramic product, the requirements for the purity of raw materials are strong. Processing of raw materials is also complicated. Based on the aesthetic requirements of the buyer, the processing of the surface of the molded products is also complicated Fig.1.

Fig.1

Artistic processing of products is an important process in the production of fine ceramic materials and leaded crystal products. Porcelain and ceramic products are sent

to painting workshop after utilitarian and polytoy firing. There, objects are painted with decalcomania or by hand and sent to re-burning to fix the image. In muffle furnaces, paint is fixed at a temperature of 650-700°C. After the lead crystal is molded, it is sent to the art processing workshop. There, a pattern or picture is drawn on their surface on diamond-edge lathes.

As a result of scientific research, special ceramic products with properties suitable for nuclear energy, mechanical engineering, electronic and rocket technologies are being produced.

All fine ceramics are divided into two large groups:

1. Porous and undercooked products with soft clay;
2. Ripe products with a hard and shiny surface.

Table 1

Properties of fine ceramics

Properties	Hard porcelain	Half porcelain	Faience feldspar	Ceramic	Stone ceramics
Water absorption, %	0-0,04	3-8	9-12	9-12	0,1-9,5
Mechanical strength, MPa To bending strength To compressive strength	 65-114 392-647	 38-45 120-300	 14,7-9,4 98-197,8	 29-49 60-90	 10-50 25-500
General reduction, %	12,8	13	13	9-11	11-13
Coefficient of thermal expansion (t.k.k.), a 10-6 1°C	4,0-6,5	6	6	5-6	
Incineration temperature, °C: Non-glazed items Glazed items	850-900 1380-1430	1230-1280 1100-1120	1230-1280 1000-1120	950-1050 880-1060	900-1040 1120-1430

The items of the first group include:

1. Semi-porcelain (kitchenware, sanitary ware, etc.);

2. Hard faience - tiles used for household and sanitary-technical purposes, tiles with faience;

3. Earthen faience;

4. Lime faience;

5. Colored and white striped majolica (a household item, decorative items, colored mosaic used for facing, panels, etc.);

6. Sanitary-construction and sanitary-technical items - bathtubs, urinals, sinks used for experimental and other purposes;

According to the recommendations, elegant ceramic products are divided into products used in the household and products recommended for technical use

Items of the second group are also common, and they include:

1. Solid household porcelain (kitchen and teaware);

2. Decorative porcelain (biscuit, wedgewood, etc.);

3. Electrotechnical (insulation) porcelain;

4. Multi-purpose technical porcelain (chemical containers, acid-resistant products, pyrometric pipes, high-frequency technical products);

5. Soft, ash and fritta porcelain;

6. White stone products used for various purposes;

7. Fine stone goods;

8. Porcelain and colored stone masses used for decorative purposes, mosaic and oblitsovka;

9. Steatite, alumina, titanium-magnesite and other special masses.

In the production of fine ceramic products, there are the following methods of shaping items:

1. Forming from the strapping mass;

2. pressing from a powdery mass;

3. casting from liquid mass (slicker).

In the production of all fine ceramics, 95-97% of the product is formed by the strapping method, and 3-5% of the product is formed by casting in a plaster mold. By means of belt molding, porcelain and earthenware products, insulators, bowls and other fine ceramic products are produced. In this case, the moisture content of the ceramic mass ranges from 17% to 28%, depending on the type of product. Fine ceramic production enterprises usually use periodic wet mills. (Figure 2).

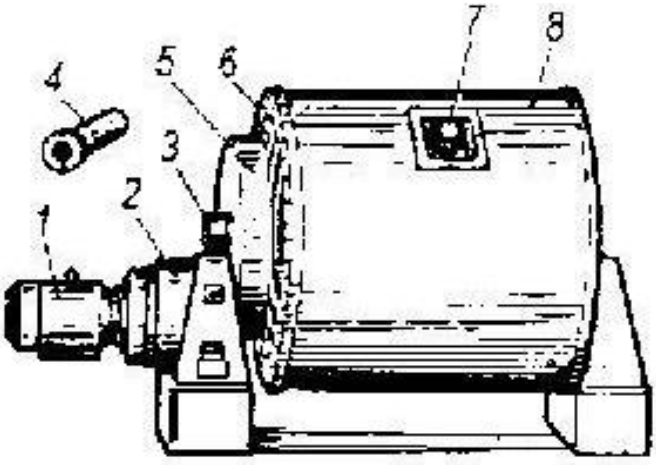

Fig 2. Continuously working grinding mill. 1-electric motor; 2nd reducer; 3-pods; 4th glass; 5th cojux; 6th grade steel bottom; 7th loading window; 8th drum.

The size of the materials being fed to the mill should not exceed 20-40 mm. Their inner surface is covered with silicon, steatite, high alumina, porcelain stoneware and sometimes rubber plate (inner) coverings. Silica stones, porcelain, steatite and uralite stones are grinding bodies, i.e. zoldirs. Their size should be 30-90 mm across, if stones with a size of 30-50 mm 25-50%, 50-70 mm lisi 30-60% and 70-90 mm lisi 20- At 25%, the grinding efficiency is high. The materials loaded in the mill should be passed through a 1.25 mesh (64 holes/cm2) sieve, stones smaller than 30 mm in size are periodically removed from the mill. Usually, the ratio of material loaded in the mill, grinding stones and water is M:T:S, i.e. 1:(1.2-1.8):1. First, stones are put in the mill, then water filtered through layers of cotton or glass wool, and then stony materials. 5-7% soil or 1-2% bentonite is also added to prevent quartz from settling. Often, quartz, waste scraps, soil are first loaded into the mill, and then feldspar, pegmatite or primary incineration waste is loaded after 2.5-3 hours.

Raw materials used to obtain fine ceramics.

The raw materials used to obtain fine ceramics are prepared according to the following order: primary screening, coarse and medium grinding, coarse and high-grade grinding. Stone materials, except for sand, are usually brought in pieces. Grinding according to the size of the pieces is carried out in the order shown in Table 2.

Table 2.

Raw material preparation drawing.

Piece by piece	Finely grained or pre-ground
Coarse grinding	Feeling
In coarse form (jaw and other crushers) the size of pieces is 100 mm	Coarse (disintegrators, rotor mills) grain size 0.1-0.5 mm

Medium size (axis grinder, centrifugal impact mills) particle size 20-100 mm	At a higher level (solid flow mills), the grain size is 0.1-0.01 mm
In the small case (choppers, axis grinders) the size of pieces is 3-20 mm	Ultra fine, colloidal (pneumatic mill) grain size 0.0015 mm

Stone materials are sent to a high level of grinding without passing through the intermediate grinding stage. The stages of medium grinding and coarsening are shown in Table 10.

In the process of filling any material, its crushing begins at the weakest point, that is, at the points of intersection of particles, porosity and cracks. These processes take place more rapidly in a watery environment. As a result of the high hydrophilicity of the material being ground, water molecules with a size of 0.14 nm wet the surface of the newly formed particles as a result of grinding, and it becomes easier to absorb. If surfactants are added in the amount of 0.5-1%, the effect on the quality of the water in the milling process will increase. For this reason, the wet method is 35-45% more efficient than the dry method in mills.

In addition, wet burning increases the reaction activity of stony materials, creates conditions for the removal of unpleasant impurities from them, and accelerates the physical and chemical changes that occur during burning. As a result, the formation of the glass mullite phase increases, the amount of undissolved quartz decreases, and the thermal and mechanical properties of the finished product increase, and the level of whiteness and transparency is high.

REFERENCES:

1. Bafoev, A. X., Rajabboev, A. I., Niyozov, S. A., Bakhshilloev, N. K., & Mahmudov, R. A. (2022). Significance And Classification of Mineral Fertilizers. Texas Journal of Engineering and Technology, 5, 1-5.

2. R.A. Makhmudov, K.Kh. Majidov, M.M. Usmanova, Sh.M. Ulashov, & S.A.Niyozov. (2021). Characteristics Of Catalpa Plant As Raw Material For Oil Extraction. The American Journal of Engineering and Technology, 3(03),70–75. https://doi.org/10.37547/tajet/Volume03Issue03-11

3. Hujakulova, D. J., Sh M. Ulashov, and D. K. Gulomova. "TECHNOLOGY OF DEODORIZATION OF SOYABEAN OIL." Galaxy International Interdisciplinary Research Journal 9.12 (2021): 171-174.

4. Shodiev Z. O., Shodiev S., Shodiev A. Z. THEORETICAL BASIS OF EFFECTIVE SEPARATION OF COTTON FROM AIR FLOW //Современные инструментальные системы, информационные технологии и инновации. – 2021. – С. 12-15.

5. Ниёзов , С., Шарипов, Ш., Бердиев, У. ., Махмудов , Р. ., & Шодиев , А. . (2022). ТРУЩИНЫ, ВЫПУСКАЮЩИЕСЯ ПРИ ПРОИЗВОДСТВЕ ХЛОРИДА КАЛИЯ ИЗ СИЛЬВИНИТОВОЙ РУДЫ. Journal of Integrated Education and Research, 1(4), 440–444. Retrieved from https://ojs.rmasav.com/index.php/ojs/article/view/302

6. Ниёзов С.А., Шарипов Ш.Ж., Бердиев У.Р., & Шодиев А.З. (2022). ВЛИЯНИЕ НИТРАТ И НИТРИТОВ НА ОРГАНИЗМ. Journal of Integrated Education and Research, 1(4), 409–411. Retrieved from https://ojs.rmasav.com/index.php/ojs/article/view/301

7. Amanovich, M. R., Obitovich, M. S., Rakhmatilloyevich, T. H., & Oybekovich, S. Z. (2021). The use of biological active additives (BAA) in the production of flour confectionery products. The American Journal of Engineering and Technology, 3(05), 134-138.

8. Mahmudov Rafik Amonovich, Shukrullayev Javohir Oybek ugli, Ereshboyev Husniddin Fazliddinovich, & Adizova Muqaddas Odil kizi. (2022). Improvement of Technology of Gypsum Production Raw Materials and Products in Production. Texas Journal of Multidisciplinary Studies, 6, 182–184. Retrieved from https://zienjournals.com/index.php/tjm/article/view/1059

9. Фатиллоев, Ш. Ф., Ш. Б. Мажидова, and Ч. К. Хайруллаев. "ВЛИЯНИЕ ДОБАВОК АЗОТНОКИСЛОТНОГО РАЗЛОЖЕНИЯ ФОСФОРИТОВ ЦЕНТРАЛЬНОГО КЫЗИЛКУМА НА ГИГРОСКОПИЧЕСКИЕ СВОЙСТВА АММИАЧНОЙ СЕЛИТРЫ." Gospodarka i Innowacje. 22 (2022): 553-556.

10. Kazakovich, Khayrullayev Chorikul, Fatilloyev Shamshod Fayzullo o'g'li, Dehkonova Nargiza, and Jabborova Aziza. "STUDY OF THE POSSIBILITY OF USE OF LOCAL PHOSPHORITES AND SEMI-PRODUCTS OF THE PRODUCTION OF COMPOUND FERTILIZERS AS ADDITIVE TO AMMONIA NITRETRE." EPRA International Journal of Research and Development (IJRD) 7, no. 4 (2022): 49-52.

11. Фатиллоев, Шамшод Файзулло Угли, Бехзод Мавлон Угли Аслонов, and Алишер Камилович Ниёзов. "ИЗУЧЕНИЕ МЕХАНИЧЕСКИХ СВОЙСТВ КОЖИ ОБРАБОТАННЫМИ ПОЛИМЕРНЫМИ КОМПОЗИЦИЯМИ." Universum: технические науки 11-4 (80) (2020): 49-51.

12. Исматов С. Ш., Норова М. С., Ниёзов С. А. У. Технология рафинации. Отбелка хлопкового масла с местными адсорбентами //Вопросы науки и образования. – 2017. – №. 2 (3). – С. 27-28.

13. Ниёзов, С. А., Махмудов , Р. А., & Ражабова , М. Н. (2022). ЗНАЧЕНИЕ АЗОТНОЙ КИСЛОТЫ ДЛЯ НАРОДНОГО ХОЗЯЙСТВА И ПРОМЫШЛЕННОСТИ. Journal of Integrated Education and Research, 1(5), 465–472. Retrieved from https://ojs.rmasav.com/index.php/ojs/article/view/315

14. Niyozov Sobir Ahror o‘g‘li, Fatilloyev Shamshod Fayzullo o‘g‘li, & Bafoev Abduhamid Hoshim o‘g‘li. (2022). Non-Ferrous Metals and Their Alloys New Innovative Technologies in Production of Non-Ferrous Metals. Neo Science Peer Reviewed Journal, 3, 11–20. Retrieved from https://www.neojournals.com/index.php/nsprj/article/view/31

15. Narzullaeva, A. M., Khujakulov, K. R., Tursunova, D. H., & Teshaeva, M. S. (2020). Study of the Influence of the type of the catalyst on the technological process of hydration of higher fatty acids into alcohols, optimal parameters of the process, the industry of use of higher alcohols. International Journal of Advanced Research in Science, Engineering and Technology, 7(11), 15954-8.

16. Komilovna, H. M. U., Yormatova, D. Y., Tursunova, D. X., Kamolova, Z. M., & Teshayeva, M. S. (2021). Properties of the Soya Flour. Annals of the Romanian Society for Cell Biology, 9042-9046.

17. Олтиев А. Т., Хайдарова М. Ф., & Бозорова Д. Н. (2022). ПЕРСПЕКТИВЫ ТЕХНОЛОГИИ ПРОИЗВОДСТВА ЦУКАТ. *Galaxy International Interdisciplinary Research Journal*, *10*(9), 279–284. Retrieved from https://www.giirj.com/index.php/giirj/article/view/2636

18. Mahmudov Rafik Amonovich, Shukrullayev Javohir Oybek ugli, Ereshboyev Husniddin Fazliddinovich, & Adizova Muqaddas Odil kizi. (2022). Improvement of Technology of Gypsum Production Raw Materials and Products in Production. Texas Journal of Multidisciplinary Studies, 6, 182–184. Retrieved from https://zienjournals.com/index.php/tjm/article/view/1059

19. Худойбердиев Н. С., Ҳайдарова М. Ф. ПРОЦЕСС МОДИФИКАЦИИ ЖИДКОГО СТЕКЛА ПОЛИМЕРАМИ //Galaxy International Interdisciplinary Research Journal. – 2022. – Т. 10. – №. 10. – С. 39-41.

20. Ихтиярова, Г. А., Турабджанов, С. М., Рахмонов, Ш. Т., & Улашев, Ш. ИНТЕНСИФИКАЦИЯ ПРОЦЕССА КРАШЕНИЯ ШЕРСТИ С ИСПОЛЬЗОВАНИЕМ ХИТОЗАНА И СЕРИЦИНА. Узбекско-Казахский Симпозиум «Современные проблемы науки о полимерах» СБОРНИК ТЕЗИСОВ, 145.

21. Улашев, Ш. М., & Ихтиярова, Г. А. ИНТЕНСИФИКАЦИЯ ПРОЦЕССА КРАШЕНИЯ ШЕРСТИ С ИСПОЛЬЗОВАНИЕМ СЕРИЦИНА И ХИТОЗАНА. Узбекско-Казахский Симпозиум «Современные проблемы науки о полимерах» СБОРНИК ТЕЗИСОВ, 146..

22. Ahror o‘g‘li, N. S., & Ahadovna, M. M. (2022, November). UCHTUT DOLOMITE MINERAL OF MINERALOGICAL PROPERTIES, CHEMICAL COMPOSITION AND EXTRACTION OF MAGNESIUM CHLORIDE. In E Conference Zone (pp. 79-87).

23. Niyozov, S., Amonova, H. I., Rizvonova, M., & Murodova, M. A. (2022). MINERALOGICAL, CHEMICAL COMPOSITION OF UCHTUT DOLOMITE

MINERAL AND PHYSICO-CHEMICAL BASIS OF PRODUCTION OF MAGNESIUM CHLORIDE. Journal of Integrated Education and Research, 1(6), 32-38.

24. Ahror o‘g‘li, N. S., & Komil o‘g‘li, B. N. (2022, November). METHODS OF BENEFICIATION OF POTASH ORES AND TECHNOLOGICAL MINERALOGY OF POTASH ORES. In E Conference Zone (pp. 55-66).

25. Ahror o‘g‘li, N. S., Amonovich, M. R., & Komil o‘g‘li, B. N. (2022). METHODS OF BENEFICIATION OF POTASH ORES AND POTASH MINES. European Journal of Interdisciplinary Research and Development, 9, 59-69.

26. Ahror o‘g‘li, N. S., Amonovich, M. R., & Ilhom o‘g‘li, R. A. (2022). PHYSICO-CHEMICAL PRINCIPLES AND TECHNOLOGY OF PRODUCTION OF MAGNESIUM CHLORATE DEFOLIANT BASED ON LOCAL RAW MATERIALS AND SECONDARY PRODUCTS. Web of Scientist: International Scientific Research Journal, 3(11), 224-234.