E3S Web of Conferences **587**, 03007 (2024) https://doi.org/10.1051/e3sconf/202458703007
GreenEnergy 2024

Technology for obtaining dry construction mixtures based on local raw materials

Mamurjon Mirzajanov[1], *Khamidulla* Mamatov[1*], *Makhmudjon* Ergashev[1], *Bakhodir* Mirzaev[1], *Bakhromjon* Otakulov[1], *Hojiakbar* Solijonov[1], and *Umarbek* Raximjonov[1]

[1]Fergana Polytechnical Institute, 150107 Fergana, Uzbekistan

Abstract. In this article, the physicochemical basis of domestic asbestos slate production waste is studied, and the simple method of producing dry building mixtures from them and the study of the physicochemical compositions and properties of asbestos slate industry waste and their use as binders for dry building mixtures is scientifically based.

1 Introduction

A total of 11,250,000 tonnes of waste is generated in one night around the world. In our country, in 2022, 874,000 tons of industrial waste were released into the atmosphere. The diagram in Figure 1 below shows the distribution of these emissions by area.

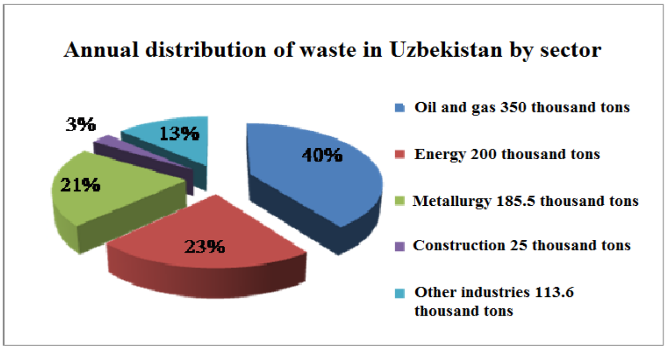

Fig. 1. Distribution of available waste in Uzbekistan by sector as of 2022.

There are more than 50 asbestos slate manufacturing enterprises operating at the same time in our republic. Most of these enterprises, located in the Fergana region, are “Madad”, "Entrepreneur possibility”, “Conizar construction trade”, “Building materials production and trading group”, “Dolina grand slate”, “Sardor sibel”, “Quvasoyshifer”, “Valley cement”, “Ecoisolite”, “Quvasoy lider leasing”, “Dilmurod building group”, “Kuvasay slate invest”, “Quvasoyshifer Ta'mir”, “Satkak cement”, there are large asbestos slate manufacturing enterprises such as ocean slate, Quvasoyshifer Hrizotil.

* Corresponding author: Xamidullamamatov0729@gmail.com

Most often, the following advantages of waste are not taken into account: dispersion, aggregate state, presence of chemically active phases, chemical action, hydrotation, solidification and surface activity. Usually, the main criterion for choosing a waste is its chemical composition.

According to researchers [1], the solidification properties of asbestos fibers with products of hydrotation of clinker minerals and their subsequent carbonization change. In doing so, the volatility capacity of the fibers becomes infected and cannot enter the respiratory system - so it is able to refute information about the level of environmental hazard of asbestos [2].

The authors [4] studied a lot of data on technologies for the production of various building materials and products based on asbestos-cement waste.

Depending on their type, the binding and production methods used, materials and products with different properties appear: in particular, it will be possible to obtain coatings and other thermal insulation materials for pipe insulation from small fractions of asbestos and hydrated cement.

Asbestos-cement waste processing technologies have been extensively studied in the production of aerated concrete and autoclave products[3,4].

The results show the possibility of increasing the strength of autoclaved materials by adding dissolved asbestos-cement waste at 6-8% of the cement mass to the concrete mixture.

[4] the authors propose that asbestos-cement waste can be used to produce light porous fillers.

Research was carried out at the German Research Institute on the creation of technology for processing asbestos-cement materials.

Initially, the asbestos-cement material was subjected to heat treatment, then an additive of CEM I 32.5 R was added in the amount of 5-15% compared to the cement mass. The [4] 5% of additives found have a positive effect on cement properties, providing a 2-day Strength increase of 20% and a 14-and 28-day Strength increase of 11% after 90 days.

The optimal amount of asbestos-cement waste additive contributes to an increase in strength both in the early stages of hardening and in 28 days.

The results show that the most promising for further research in this direction are dry asbestos-cement waste-based compositions that are able to adequately achieve their strength in the project.

According to the asbestos-cement industry, the amount of dry waste is 2.6-4% of the mass of the product produced. The volume of wet waste in the form of charge reaches 1.5-2% of the mass of raw materials in terms of dry matter [4].

The article [12] analyzes the properties of asbestos-cement industry waste and the possibilities of their utilization in construction. Properties of cement stone, asbestos and asbestos-cement are given. In the production of all types of asbestos-cement products, two types of waste are generated: dry and wet. The amount of dry waste in enterprises is 2.5...4% of the mass of manufactured products. On the other hand, wet waste is produced, which is a mixture of cement and asbestos fiber hydration products. This waste has a moisture content of up to 30%. After part of the water is separated in the waste ponds, a mixture-like mass containing 70-80% water is formed. After dewatering in clarifiers, the wet waste is a paste-like mass with a water content of 70-80%. In some factories, the volume of wet waste reaches 1.7% of raw materials compared to dry mass. Reuse of wet waste in production is recommended. Total losses during the entire technological period make up 4-4.5% of the total product, and the amount of waste in some enterprises reaches 14% [13,14,15].

The composition of Asbotsement waste is made up of homogeneous components and varies imperceptibly, mainly depending on the type of raw materials used in enterprises. CaO and MGOs have an average of 60% of the total mass of asbotsement waste. The mineralogical composition of asbotsement waste consists of hydrosilicates, hydroaluminates, calcium carbonate and hydroxide, as well as chrysotile asbestos. Clinker minerals are 53-58%, calcium and magnesium hydroxides – 27-35%, calcium carbonate - 15-20%, asbestos – 5-20%. Hydrated shell clinker minerals are found in depleted waste[4,5]. The presence of undisturbed Minerals is explained by the hydration of cement by chala: during the production and processing of objects, a cement particle with a diameter greater than 10 μm is hydrated to a depth of 6-9 μm. The degree of hydration of the wet waste falling from the recuperator to the clarifier is 0.9. The cement, which stays in the tin for 4-6 hours, is further hydrated by an additional 9%, giving it a hydrotation rate of 27-30% [6]. Data on the degree of hydration of cement in dry asbotsement waste are not found in the literature[4,5,6].

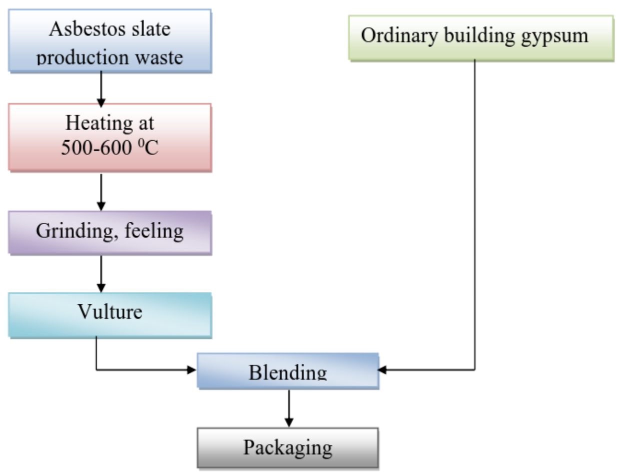

Fig.2. Technological scheme of production of dry building mixes with new composition

Research has been carried out at the Fergana Polytechnic Institute on the creation of the composition and production technology of dry construction mixtures based on asbestos slate production waste and finishing marbles production waste.[20-28]

2 Materials and research methods

The new composition does not require a separate binder for a dry construction mixture, asbestos slate production development (according to GOST-58278-2018) is used as a binder.

As a filler, a finishing marmarthosh production development is used, meeting the requirements of GOST-58278-2018.

Asbotsement waste was found in drying (cooking)in the Nabertherm L 9/11 furnace, the strength to compression and bending in the test Press (Press ispitatelny 1500/250).

Samples were prepared in the form of prisms with dimensions of 40×40×160 mm.

The results of the experimental study were performed in the program "Excel 2007" on strength indicators GOST 58276-2018*.

3 Results and discussion

The results of the study conducted are described in Tables 1-3.

Table 1. Moisture content of asbestos slate production development

Name	Number	Humidity level, [%]
Asbestos slate waste	**Sample -1**	23.0
		23.0

		25.0
	Sample -2	24.0
		24.0
		24.0
	Sample -3	24.1
		24.1
		24.2
	Sample -4	24.1
		24.0
		24.1
	Sample -5	23.9
		23.9
		23.7
	Sample -6	23.6
		23.6
		23.7
	Sample -7	23.6
		23.5
		23.5
	Sample -8	23.5
		23.4
		23.4
	Medial	**23.78**

Asbestos slate production waste contains hydrated minerals that react with large amounts of water. This type of waste can be heated and dehydrated at 600-700 0C to obtain a binder with a strength of 9-10 MPa (Table-2). During heating, the hydrated components of cement and asbestos are dehydrated. As a result, they have the property of binding. In this temperature range, the dehydration period of hydrosilicates is completed, asbestos decomposes and a number of minerals with hydraulic hardening are formed. Coating tiles can be produced by mixing heat-treated asbestos-cement waste with metallurgical slag and plaster. Heat insulating materials can also be obtained by adding lime, sand and porous additives to asbestos-cement waste.

Table 2. Time and duration of drying the resulting samples

Number	Natural mass of the resulting sample, gr	Drying temperature, ^{0}C	Drying duration, hours
Sample-1	1000	120-180	1
	1000	120-180	2
	1000	120-180	3
Sample -2	1000	200-250	1
	1000	200-250	2
	1000	200-250	3
Sample -3	1000	250-300	1
	1000	250-300	2
	1000	250-300	3
Sample -4	1000	300-400	1
	1000	300-400	2
	1000	300-400	3
Sample -5	1000	400-500	1
	1000	400-500	2
	1000	400-500	3
Sample -6	1000	500-600	1
	1000	500-600	2
	1000	500-600	3

Sample -7	1000	600-700	1
	1000	600-700	2
	1000	600-700	3
Sample -8	1000	700-900	1
	1000	700-900	2
	1000	700-900	3

In building materials made from asbestos-cement waste, liquid glass is considered individually effective. Dried and crushed asbestos-cement waste and density 1.1...40 a mixture of liquid glass solution of 1.15 kg/sm^3. Insulation and coating tiles are produced by pressing at a pressure of 50 MPa. In the dry state, the average density of these plates is 1380...1410 kg / m^3, to compression 12. Strength of 16 MPa and bending is 6.5...7 is calculated equal to MPa (Table-3).

Table 3. Strength indicators for compression of the resulting samples

Number	Drying temperature, ^{0}C	Drying duration, hours	Strength to compression (on Day 28), MPa
Sample -1	120-180	1	1.1
	120-180	2	1.1
	120-180	3	1.1
Sample -2	200-250	1	1.2
	200-250	2	1.2
	200-250	3	1.1
Sample -3	250-300	1	1.1
	250-300	2	1.2
	250-300	3	1.2
Sample -4	300-400	1	1.4
	300-400	2	1.4
	300-400	3	1.3
Sample -5	400-500	1	2.6
	400-500	2	2.5
	400-500	3	2.6
Sample -6	500-600	1	4.2
	500-600	2	5.3
	500-600	3	4.8
Sample -7	600-700	1	3.1
	600-700	2	2.9
	600-700	3	2.8
Sample -8	700-900	1	2.1
	700-900	2	1.9
	700-900	3	2.0
Medial	**500-600**	**2**	**4.77**

a)

b)

c)

d)

Fig.3. Samples from asbestos-cement waste from LLC" entrepreneur possibility":
a) asbestos-cement slate fractures with fraction <5 mm;
b) 10...20mm fractional asbestos-cement slate fractures;
c) 20...40mm fractional asbestos-cement slate fractures;
d) 40...70mm fractional asbestos-cement slate fractures.

The result of this study is of particular importance with the analysis of scientific theories on a new type of dry construction mixture, their composition, physical and mechanical and chemical properties, obtained on the basis of local industrial waste.

4 Conclusions

In the feces of the study carried out, conclusions can be drawn as follows.

1. It was studied that the moisture level of dry and wet asbotsement waste is on average 23-24%.
2. By cooking asbestos slate production waste for dry building mixtures at a temperature of 500-600 ^{0}C, for 1-2 hours, a method of obtaining a high-quality 0.25 mm fraction Binder has been developed, which meets the requirements of GOST 58278-2018 for physical and mechanical properties.
3. Finishing marbles were used as fillers for dry construction mixtures, meeting the requirements of GOST 58278-2018 for physical and mechanical properties by drying production waste to 1% humidity, grinding and sieving in a standard sieve of 0.25 mm.
4. Based on the production waste of asbestos slate and the production waste of finishing marbles, the composition of resurstejamkor dry building mixtures has been developed.

References

1. Filippovich N.I. New technologies in the asbestos cement industry. Regional international relations. "The current state and prospects for the development of the asbestos cement industry in the CIS countries of the Central Asian region in the conditions of controlled safe use of asbestos-containing products and materials." Collection of documents. and speeches, Tashkent, 2004, pp.83-85.
2. Tajibaev Sh.S., Pulatov Z.P. Production of asbestos cement sheets using low- and waste-free technology. Regional international relations. "The current state and prospects for the development of the asbestos cement industry in the CIS countries of the Central Asian region in the conditions of controlled safe use of asbestos-containing products and materials." Collection of documents. and speeches, Tashkent, 2004, pp.92-93.
3. Rudy, F.A., Brodsky, V.P., Gorobchan, S.I. Building materials. **7(12)**, 33-34 (1973)

4. Bagautdinov, A.A., Neiman, S.M. Building materials **4**, 5-7 (1993)
5. Natsvalova, Z.A., Chernykh, V.F. Building materials **1-6**, 22-24 (1969)
6. Salimjonov, J., Mamatov, K., Karimova, M., ... Yusupov, A., Otakulov, B. E3S Web of Conferences, **538**, 01017 (2024)
7. Abdullaev, I., Mamatov, K., Abdullaev, U., Umirdinov, I., Vakhobov, A. E3S Web of Conferences, **508**, 05003 (2024)
8. Mirzajanov, M., Mamatov, K., Otakulov, B., ... Otajonov, O., Kuziboev, S. E3S Web of Conferences, **508**, 07003 (2024)
9. Mirzaev, B., Otakulov, B., Mamatov, K., Otajonov, O. E3S Web of Conferences, **452**, 06002 (2023)
10. Mirzajanov, M., Otakulov, B., Kuziboev, S., Mirzaev, B., Khamidov, A., & Abdulkhaev, Z. E3S Web of Conferences **452**, 06015 (2023). EDP Sciences.
11. Abdulfatto Ibrokhimov, Jahongir Orzimatov, Mavlonbek Usmonov, Bakhromjon Otakulov and Saxiba Mirzababayeva. BIO Web Conf., **84** (2024) 02026. DOI: https://doi.org/10.1051/bioconf/20248402026
12. Zokhidjon Abdulkhaev, Mamadali Madraximov, Shairakhon Abdujalilova, Saxiba Mirzababayeva, Bakhromjon Otakulov, Abdusalom Sattorov and Zuhriddin Umirzakov. E3S Web of Conf., **452** (2023) 02010. https://doi.org/10.1051/e3sconf/202345202010
13. M. A. Mirzajanov, M. M. Ergashev and B. A. Otakulov. E3S Web of Conf., **401** (2023) 05043. DOI: https://doi.org/10.1051/e3sconf/202340105043
14. Prasannan, D., Thenmozhi, R.S., Ergashev, M.M., ... Oyebode, O.J., Rawat, R. *Implementation of Soft Computing Techniques in Fine-Tuning of TRM-Concrete Bond Strength Models* 2023 3rd International Conference on Advance Computing and Innovative Technologies in Engineering, ICACITE 2023, 2023,
15. Yunusov, M.P., Teshabaev, Z.A., Mirzaeva, E.I., ... Ruzimuradov, O.N., Murzin, D.Y. Journal of Chemical Technology and Biotechnology, **97(3)**, c771–778 (2022)
16. Yunusov, M.P., Molodozhenyuk, T.B., Ergashev, M.M., ... Gashenko, G.A., Saidulaev, B.M. *Russian Journal of Applied Chemistry*, **80(7)**, 1207–1212 (2007)
17. Ergashev, M., Glazyrin, A.S., Daneker, V.A. *Investigation of the frequency characteristics of vibration and jet diluent* Proceedings of the 9th International Scientific and Practical Conference of Students, Post-graduates and Young Scientists - odern Techniques and Technologies, MTT' 2003, 2003, pp. 139–141, 1438168
18. Sliding of a filament along the surface of a horizontal shelf Érgashev, M. *International Applied Mechanics*, 1994, **30(2)**, 159–164
19. Otajonov O., Sattorov Z. E3S Web of Conferences. – EDP Sciences, **365**, 02022 (2023)
20. Madaliev, M., Usmonov, M., Fayzullaev, J., Khusanov, Y., Radjapov, K., Sattorov, A., & Jalilov, I. E3S Web of Conferences **538**, 01012 (2024). EDP Sciences.
21. Fayzimatov, S., Khusanov, Y., Omonov, A., Matkarimov, B., Sadirov, S., Yusufjonov, O., & Turgunboev, T. E3S Web of Conferences **538**, 01008 (2024). EDP Sciences.
22. Khaydarova, O., Khusanov, Y., Alimjonova, G., & Usmonov, M. E3S Web of Conferences **538**, 01034 (2024). EDP Sciences.
23. Fayzimatov, S., Mardonov, B., Khusanov, B., Fayzimatov, J., Sadirov, S., & Khusanov, Y. E3S Web of Conferences **538**, 01016 (2024) EDP Sciences.

24. Fayzimatov, B., Khusanov, Y., Fayzimatov, S., Sattorov, A., Omonov, A., Nazarova, G., & Usmonov, M. E3S Web of Conferences **538**, 01014 (2024) EDP Sciences.
25. Abdullaev, I., Mamatov, K., Abdullaev, U., Otaqulov, B., Abduganiev, N., Solijonov, H., ... & Vakhobov, A. E3S Web of Conferences **508**, 05003 (2024) EDP Sciences.
26. Mirzajanov, M., Mamatov, K., Otakulov, B., Abduganiyev, N., Abdullaev, U., Otajonov, O., & Kuziboev, S. E3S Web of Conferences **508**, 07003 (2024) EDP Sciences.
27. Mirzajanov, M., Mamatov, K., Otakulov, B., Abduganiyev, N., Abdullaev, U., Otajonov, O., & Kuziboev, S. E3S Web of Conferences **508**, 07003 (2024) EDP Sciences.
28. Salimjonov, J., Mamatov, K., Karimova, M., Abdullayev, U., Nigmatov, U., Yusupov, A., & Otakulov, B. E3S Web of Conferences **538**, 01017 (2024) EDP Sciences.