The Effect Of Complex Chemical Additives on Foam and Its Properties

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ABSTRACT

The effect of complex chemical additives on foam foaming, foam stability, hardening and other properties is studied in the article.

Keywords: Foam, mixture, component, bubbles, foaming tool PB2000.

In the production of foam concrete materials, the characteristics of the foam concrete mixture play an important role. Because they determine the parameters of hardened foam concrete.

The production technology of foam concrete products is based on a large number of small air bubbles evenly distributed in the cement paste, which binds the fillers together. The foaming process can be divided into three periods. In the first period, the foam bubbles form a viscous liquid system that separates the liquid from each other by thick membranes and can move freely.

At this stage, the foam looks like a simple concentrated emulsion.

In the second period, due to the fact that the system is saturated with air, the bubbles lose their free movement and turn into thin, slightly curved, polyhedral cells separated by liquid membranes.

The third stage-combination is due to the rapid disintegration of the foam and its transformation into a two-phase (liquid-air) system. The resulting foams are considered two-phase. They are mixed with building compounds or polymer suspensions to form aggregates.

Stability and stability of the foaming component are important in the preparation of foam concrete mixtures.

Taking into account the effect of foam preparation conditions on its properties, it is therefore necessary to first study the effect of the duration of foam preparation on its expansion level (increase in volume).

The foam was prepared in the following way:

300 ml of water was poured into the frother. Then, 1.5 ml of liquid foaming agent PB2000 was added and mixed by the high-speed beater blades until a homogeneous foam was formed.

The foaming rate indicator represents the ratio of the volume of foam formed to the initial volume of the mixture of water and foaming agent.

Table 1 shows the effect of water-foaming solution mixing time on foam volume growth. The optimal time for foam preparation was 3-4 minutes, because during mixing, the maximum increase in the volume of the foam was 12 times more than the initial volume

Table 1 Dependence of the foam volume increase on the mixing time

Mixing time, min.	0,5	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0	6,0
Increase the volume of the foam, times	4	6	8	10	11	12	12	11	10	10	9

Mix the data obtained for more than 4 minutes. showed a decrease in foam volume.

When the duration of mixing was 0.5-1.5 minutes, large pores were formed, which gradually turned into small pores evenly distributed throughout the volume as the mixing time increased.

The effect of the concentration of the foaming agent on the degree of expansion was also studied. The amount of foaming agent was changed from 0.5 to 1%. Figure 1 illustrates the effect of foaming agent concentration on the rate of expansion.

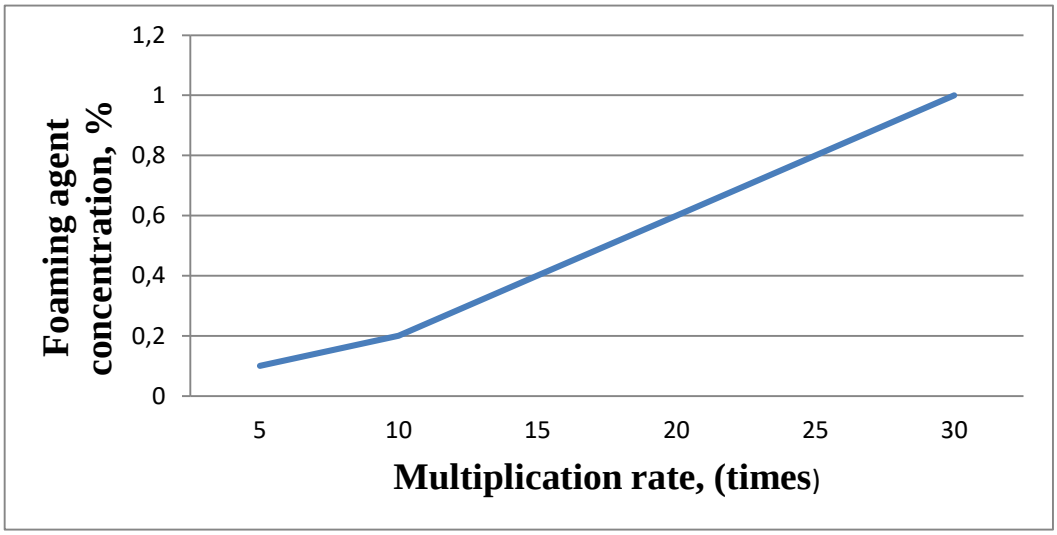

Figure 1 Foam of the composition of the foaming agent effect on the degree of formation. The graph shown in

Figure 1 shows that increasing the foaming agent concentration to 1% in the composition of the mixture made it possible to increase the foam volume by up to 30 times.

Thus, the main parameter of the foam, the increase in volume, depends on the composition of the foaming agent and the time of preparation of the technical foam. Depending on the preparation time, the optimal amount of PB 2000 in the mixture is 0.5% of the volume of water.

Any foam concrete mass, as a dispersed system, must have a certain stability, if it decreases, the cement stone must hold its weight - otherwise, the process of settling of the foam mass will begin. The type and nature of the foaming agent has a significant effect on the strength of the setting cement. Because the

resistance to volume reduction during foam settling falls on the cement.

Therefore, the effect of PB-2000 foaming agent on the hardening period of portland cement produced by Kuvasoytsement OJSC was studied.

The hardening period of cement paste of normal thickness was determined on the Vika equipment in accordance with the requirements of GOST 310.3-76. The results of the study showed that the PB-2000 foaming agent reduced the setting time of the cement paste by 30 minutes from the beginning and 1 hour at the end.

This process can be explained by the presence of water-soluble sulfates in the foaming agent PB-2000, which accelerate the hardening of cement.

The strength of foam-cement compositions should increase due to the reduction of water demand with the use of plasticizers. But this method gives positive results if their use does not cause the foam to break. Therefore, the effect of KDz-3TsMB and KDz-3 complex chemical additives on the degree of foaming of PB-2000 foaming agent was studied.

The obtained results are given in Table 2.

Without addition	Type and amount of complex chemical additive,%											
	KDj-3CHMB			KDj -3			KDj -3CH			KDj -3M		
	Multiplication rate, (times)											
7	8	10	12	0,6	0,9	1,2	0,6	0,9	1,2	0,6	0,9	1,2
9	11	12	13	9	10	10	6	7	7	8	9	9

The data in Table 2 show that chemical additives have a positive effect on the degree of foaming of the foaming agent PB-2000, and KDz-3TsMB additive KDz-3 has a higher index than KDz-3Ts, KDz-3M, and KDz-3Ts, KDz-3M additives we can see that it is low compared to the foam without additives.

Summary:

1. Foam plays an important role in the production of foam concrete. The effect of complex chemical additives on its expansion and stability was studied.
2. The degree of foaming in foam production of complex chemical additives increased from 9 to 12 barabar.

References

1. Абдукаримов Бекзод Абобакирович, Отакулов Бахромжон Адхамович, Рахмоналиев Санжарбек Мухаммаджон Угли, & Муродалиева Нилуфар Авазбек Кизи (2019). Способы снижения аэродинамического сопротивления калориферов в системе воздушного отопления ткацких производств и вопросы расчета их тепловых характеристик. Достижения науки и образования, (2 (43)), 28-33.
2. Alimovich, M. M., Abdullaevich, M. H. (2022). Investigation of the Effect of Plasticizers on the Properties of Binders Based on Gypsum-Containing Waste. Journal of Architectural Design, 6, 1-4
3. Абдимоминов, И. И., Орипов, З. Б., Арисланов, А. С., Пахратдинов, А.А., Маматов, Х.А., & Рўзметов, Ф.Ш. (2022). Шаҳар магистрал кўчаларининг транспорт-эксплуатацион ҳолатини транспорт шовқинига таъсирини баҳолаш ва прогнозлаш (Тошкент шаҳри мисолида). Образование, 8(9)
4. Mirzajonov Mamurjon Alimovich, Mamatov Xamidulla Abdullayevich, Karimova Mukhtasar Isroiljon kizi In volume 6, of Journal of Architectural Design (JAD) May, 2022 ISSN (E): 2795-7608
5. X.A. Mamatov, Vliyanie keramzita na svoystva penobetona Ekanoma I sotsium ISSN: 2225-1545 Vol.4, No 4(94), 2022
6. Mamatov Xamidulla Abdullyevich. (2022). Physical and mechanical properties cement stone with chemical additive kdj-3.*Spectrum*

Journal of Innovation, Reforms and Development, *9*, 308–313. Retrieved from

7. Mamatov Xamidulla Abdullyevich, & Sabirova Dilfuza Tillavaldievna. (2022). Prospects for the production of new generation makeup products in the republic. *Spectrum Journal of Innovation, Reforms and Development*, *9*, 296–301. Retrieved from
8. Mamatov Xamidulla Abdullyevich, & Sabirova Dilfuza Tillavaldievna. (2022). Optimal compositions for local cellular concrete raw materials. *Spectrum Journal of Innovation, Reforms and Development*, *9*, 290–295. Retrieved from
9. Х.А. Маматов, З.Б. Махмудов Влияние зола унос на свойства пенобетона SCIENTIFIC PROGRESS VOLUME 3 | ISSUE 7| 2022 ISSN: 2181-1601 Scientific Journal Impact Factor (SJIF 2022=5.016) Passport: htt Page 1 SCIENTIFIC PROGRESS VOLUME 3
10. Samigov N.A., Karimov M.U., Mamatov X.A. Physicochemical Structure And Properties Of Cement Stones With A Complex Chemical Additive KDj-3CHMB.| The American Journal of Engineering and Technology (ISSN – 2689-0984 Published: April 25, 2021 | Pages: 42-53 Doi: https://doi.org/10.37547/tajet/Volume03Issue04-07
11. ХА Маматов, УМ Абдуллаев, Заполнители для шлакощелочных легких бетонов Vol. 1 No. 5 (2022): Innovative Development in Educational Activities (IDEA) 31-38
12. Маматов Хамидулла Абдуллаевич, Влияние керамзита на свойства пенобетона, Экономика и социум 4 (4), 2022/4 1-5
13. Бахромов Махмуд Маматхонович, Отакулов Бахром Адхамович, & Рахимов Элбек Хасанбой Угли (2019). Определение сил негативного трения при оттаивании околосвайного грунта. European science, (1 (43)), 22-25.
14. Bakhromjon Adhamovich Otakulov, Muxtasar Isrolijon Qizi Karimova, & Ikromjon Aminjonovich Abdullayev (2021). USE OF MINERAL WOOL AND ITS PRODUCTS IN THE CONSTRUCTION OF BUILDINGS AND STRUCTURES. Scientific progress, 2 (6), 1880-1882.
15. Юсупов Абдулхамид Рахмонбердиевич, Милладжонова Зулхумор Рахматовна, Отакулов Бахромжон Адхамович, & Рахимов Элбек Хасанбой Угли (2019). К расчёту неравнопрочных термогрунтовых тел на сдвигающие нагрузки. Достижения науки и образования, (2 (43)), 22-23.
16. Мирзажонов Мамур Алимович, & Отакулов Бахром Адхамович (2018). Восстановление разрушенных частей бетонных и железобетонных конструкций. Достижения науки и образования, (13 (35)), 13-14.
17. Xalimjon o'gli, S. J. (2021). Influence on durability of contact zone of working joint time of the endurance of a new concrete. EPRA International Journal of Environmental Economics, Commerce and Educational Management, 8(5), 1-2.
18. Bakhromjon Adhamovich Otakulov, Ikromjon Aminjonovich Abdullayev, & Khumoyun Sharifjon Ogli Sultonov (2021). RAW MATERIAL BASE OF CONSTRUCTION MATERIALS AND USE OF INDUSTRIAL WASTE. Scientific progress, 2 (6), 1609-1612.
19. Tulaganov, A., Hodjaev, S., Sultanov, A., Tulaganov, B., Otakulov, B., Hodjaev, N., & Abdasov, D. (2021). Festigkeitsbeschreibung des schwerbetons auf alkalischlacken–bindemittel. The Scientific-Practice Journal of Architecture, Construction and Design, 1(1), 5.
20. Abdukarimov Bekzod Abobakirovich, Otakulov Bahrom Adhamovich, Mahsitaliyev Barhayot Iftihorjon Ugli, & Murodaliyeva Nilufar Avazbek Qizi (2019). Increasing the efficiency of solar

air heaters in free convection conditions. Достижения науки и образования, (2 (43)), 26-27.
21. Bakhromjon Adhamovich Otakulov, Ikromjon Aminjonovich Abdullayev, & Jurabek Otabek Oglu Toshpulatov (2021). IMPORTANCE OF HEAT-RESISTANT CONCRETE IN CONSTRUCTION. Scientific progress, 2 (6), 1613-1616.
22. Bakhromjon Adhamovich Otakulov, Yusufjon Amonovich Isoyev, & Jasurbek Halimjon O'G'Li Salimjonov (2021). ABOUT MONOLITHIC REINFORCED CONCRETE STRUCTURES IN CONSTRUCTION. Scientific progress, 2 (7), 722-724.
23. Bakhromjon Adhamovich Otakulov, Yusufjon Amonovich Isoyev, & Jasurbek Halimjon O'G'Li Salimjonov (2021). WAYS TO SAVE CERAMICS AND FIRE BUILDING MATERIALS. Scientific progress, 2 (7), 718-721.
24. Bakhromjon Adhamovich Otakulov, Yusufjon Amonovich Isoyev, & Jasurbek Halimjon O'G'Li Salimjonov (2021). THE SCIENCE OF BUILDING MATERIALS TAKES PLACE IN ARCHITECTURE. Scientific progress, 2 (7), 725-727.
25. Bakhromjon Adhamovich Otakulov, Yusufjon Amonovich Isoyev, & Jasurbek Xalimjon O'G'Li Sailimjonov (2021). IMPROVING THE EARTHQUAKE RESISTANCE AND HEAT RESISTANCE OF BUILDINGS BUILT OF MODERN ENERGY-SAVING MATERIALS. Scientific progress, 2 (7), 117-120.
26. Bakhromjon Adhamovich Otakulov, Muxtasar Isrolijon Qizi Karimova, & Ikromjon Aminjonovich Abdullayev (2021). IMPROVING THE DURABILITY OF ASPHALT-CONCRETE. Scientific progress, 2 (7), 121-124.
27. Bakhromjon Adhamovich Otakulov, Dilfuza Tillavoldiyevna Sobirova, & Madinakhon Tolib Qizi Yokubova (2021). RAW MATERIALS AND OPTIMAL COMPOSITIONS FOR NEW GENERATION CELLULAR CONCRETE. Scientific progress, 2 (8), 473-478.
28. Otakulov Bakhromjon Adhamovich, Abduganiyev Nu'Monjon Nabijonovich, & Risolatkhon Gayratjon Qizi Madaminova (2021). THE ROLE OF MONOLITHIC REINFORCED CONCRETE CONSTRUCTION IN MODERN CONSTRUCTION. Scientific progress, 2 (8), 735-739.
29. Bakhromjon Adhamovich Otakulov, Nu'Monjon Nabijonovich Abduganiyev, & Risolatkhon Gayratjon Qizi Madaminova (2021). WORKING JOINTS OF MONOLITHIC AND PREFABRICATED STRUCTURES AND METHODS OF OVERCOMING THEIR NEGATIVE CONSEQUENCES. Scientific progress, 2 (8), 731-734.
30. Bakhromjon Adhamovich Otakulov, Bekzod Xomidjonovich Kodirov, & Hojiakbar Solijon O'G'Li Solijonov (2021). SELECTING THE OPTIMAL BITUMEN CONTENT. Scientific progress, 2 (8), 415-420.
31. Bakhromjon Adhamovich Otakulov, Bekzod Xomidjonovich Kodirov, & Hojiakbar Solijon O'G'Li Solijonov (2021). ASPHALT CONCRETE PREPARATION TECHNOLOGY. Scientific progress, 2 (8), 421-425.
32. Bakhromjon Adhamovich Otakulov, Bekzod Xomidjonovich Kodirov, & Hojiakbar Solijon O'G'Li Solijonov (2021). CALCULATING THE COMPOSITION OF THE MINERAL PART. Scientific progress, 2 (8), 403-408.
33. Bakhromjon Adhamovich Otakulov, Bekzod Xomidjonovich Kodirov, & Hojiakbar Solijon O'G'Li Solijonov (2021). ASSESSMENT OF THE QUALITY OF SOURCE MATERIALS FOR ASPHALT CONCRETE. Scientific progress, 2 (8), 396-402.
34. Bakhromjon Adhamovich Otakulov, Bekzod Xomidjonovich Kodirov, & Hojiakbar Solijon O'G'Li Solijonov (2021). DETERMINATION OF ASPHALT CONCRETE COMPOSITION. Scientific progress, 2 (8), 409-414.
35. Bakhromjon Adhamovich Otakulov, Dilfuza Tillavoldiyevna Sobirova, &

Madinakhon Tolib Qizi Yokubova (2021). FACTORS THAT REDUCE THE HEAT-SHIELDING PROPERTIES OF ENCLOSING STRUCTURES. Scientific progress, 2 (8), 479-485.
36. Tulaganov, A., Hodjaev, S., Sultanov, A., Tulaganov, B., Otakulov, B., Hodjaev, N., & Abdasov, D. (2021). FESTIGKEITSBESCHREIBUNG DES SCHWERBETONS.
37. Bakhromjon Adhamovich Otakulov, Dilfuza Tillavoldiyevna Sobirova, & Madinakhon Tolib Qizi Yokubova (2021). INFLUENCE OF DRY AND HOT CLIMATE ON CONCRETE AND REINFORCED CONCRETE STRUCTURES. Scientific progress, 2 (8), 486-489.
38. Бахромов, М. М. Отакулов Бахром Адхамович, & Рахимов Элбек Хасанбой Угли (2019). Определение сил негативного трения при оттаивании околосвайного грунта. European science,(1 (43)), 22-25.
39. Мирзажанов, М. А., & Отакулов, Б. А. Бетон ва темирбетон конструкция-ларининг ишчи чоклари муста^ камлигига таъсир этувчи факторлар. ФерПИ научно-технический журнал, 21.
40. Mirzaev B., Otakulov B., Mamatov K., Otajonov O. Research of physical-mechanical and physicalchemical properties of expanded direction concrete with complex polymer – mineral additive of a new generation based on local raw materials //E3S Web of Conferences. – EDP Sciences, 2023. – T. 452.
41. Research of physical-mechanical and physical-chemical properties of expanded direction concrete with complex polymer - mineral additive of a new generation based on local raw materials Bakhodir Mirzaev, Bakhromjon Otakulov, Khamidulla Mamatov and Olmosbek Otajonov E3S Web of Conf., 452 (2023) 06002 DOI: https://doi.org/10.1051/e3sconf/202345206002
42. Gypsum binders based on ceramic industry waste Mamurjon Mirzajanov, Bakhromjon Otakulov, Shoirjon Kuziboev, Bakhodir Mirzaev, Adkhamjon Khamidov and Zokhidjon Abdulkhaev E3S Web of Conf., 452 (2023) 06015 DOI: https://doi.org/10.1051/e3sconf/202345206015
43. Flow trajectory analysis and velocity coefficients for fluid dynamics in tubes and holes Zokhidjon Abdulkhaev, Mamadali Madraximov, Shairakhon Abdujalilova, Saxiba Mirzababayeva, Bakhromjon Otakulov, Abdusalom Sattorov and Zuhriddin Umirzakov E3S Web of Conf., 452 (2023) 02010 DOI: https://doi.org/10.1051/e3sconf/202345202010
44. Mirzajanov, M. A., M. M. Ergashev, and B. A. Otakulov. "Steam structure and thermal conductivity of lightweight concrete aggregate." E3S Web of Conferences. Vol. 401. EDP Sciences, 2023.
45. Otakulov B.A. (2022). AERABLE CONCRETE AND MODERN FACING MATERIALS AND PRODUCTS BASED ON THEM. Экономика и социум, (11-1 (102)), 1125-1127.
46. Otakulov B.A. (2022). WALL DESIGNS AND THEIR HEATING AND TECHNICAL INDICATORS OF MODEL HOUSES BUILT INDIVIDUALLY. Экономика и социум, (4-1 (95)), 130-133.
47. Otakulov B.A., & Ismoiljonova M.M. (2022). USE OF BINDERS IN CONSTRUCTION. Экономика и социум, (4-2 (95)), 373-375.
48. B. A. Otakulov, & Z. B. Mahmudov (2022). OPERATION OF BUILDINGS ON SEDIMENTARY SOILS. Scientific progress, 3 (7), 104-107.
49. B. A. Otakulov, & Z. B. Mahmudov (2022). TECHNICAL OPERATION OF BUILDINGS IN SEISMIC REGIONS. Scientific progress, 3 (7), 99-103.
50. Otakulov B.A., Abdurasulova N.Sh., & Xaydarov J.O. (2022). IMPORTANCE OF SULPHATE-RESISTANT PORTLAND

CEMENT IN CONSTRUCTION. Экономика и социум, (5-1 (96)), 161-163.
51. Bakhromjon Adhamovich Otakulov, & Khumoyun Sharifjon O'Gli Sultonov (2022). FACTORS AFFECTING THE QUALITY OF CONCRETE AGGREGATES. Scientific progress, 3 (3), 616-620.
52. Bakhromjon Adhamovich Otakulov, & Khumoyun Sharifjon O'Gli Sultonov (2022). EXPLOITATION OF EXPANDED CLAY IN CONSTRUCTION. Scientific progress, 3 (3), 621-624.
53. Bakhromjon Adhamovich Otakulov, & Ulug'Bek Maxmudovich Abdullayev (2022). INCREASING THE DURABILITY OF STRUCTURAL ELEMENTS OF TANKS FOR WATER USING COMPOSITE MATERIALS. Scientific progress, 3 (3), 358-361.
54. Ergashev M.M., & Otakulov B.A. (2021). ABOUT THE USE OF WOLLASTONITE AGGREGATE CONCRETE. Экономика и социум, (11-1 (90)), 180-183.
55. Otakulov B.A., & Abdullayev U.M. (2021). HISTORY OF FOAM CONCRETE PRODUCTION DEVELOPMENT. Экономика и социум, (12-1 (91)), 485-488.
56. Ergashev M.M., & Otakulov B.A. (2021). USE OF VERMICULITE FOAMED WITH THERMAL INSULATION MATERIAL. Экономика и социум, (11-1 (90)), 173-175.
57. Otakulov B.A., & Abdullayev U.M. (2021). IMPROVING THE SORBTION PROPERTIES OF SALT UNDERWAY. Экономика и социум, (12-1 (91)), 482-484.
58. Ergashev M.M., & Otakulov B.A. (2021). USE OF ALKALINE CEMENT OBTAINED WITHOUT BURNING IN CONSTRUCTION. Экономика и социум, (11-1 (90)), 176-179.
59. Adhamovich, B., Amonovich, Y., & Halimjon o'g'li, J. ABOUT MONOLITHIC REINFORCED CONCRETE STRUCTURES IN CONSTRUCTION.
60. Adhamovich, B., Amonovich, Y., & Halimjon o'g'li, J. THE SCIENCE OF BUILDING MATERIALS TAKES PLACE IN ARCHITECTURE.
61. Adhamovich, B. WORKING JOINTS OF MONOLITHIC AND PREFABRICATED STRUCTURES AND METHODS OF OVERCOMING THEIR NEGATIVE CONSEQUENCES Bakhromjon Adhamovich Otakulov.
62. Goncharova, N. I., Raxmanov, B. K., Mirzaev, B. K., & Xusainova, F. O. (2018). Properties of concrete with polymer additives-wastes products. Scientific-technical journal, 1(2), 149-152.
63. Kuzibaevich, M. B., & Nabijonovich, A. N. M. (2021). Analysis of study of physical and mechanical properties of vermiculite concrete with new generation complex chemical addition KDj-3. International Engineering Journal For Research & Development, 6(3), 5-5.
64. Mirzaev, B. K., & Mirzazhanov, M. A. (2022). PROPERTIES OF EXPANDED CLAY CONCRETE WITH COMPLEX POLYMER-MINERAL ADDITIVES. Экономика и социум, (4-1 (95)), 106-109.
65. Kozibaevich, M. B. (2022). THE EFFECT OF ADDITIVES THAT ACCELERATE SOLIDIFICATION ON THE MAIN PROPERTIES OF FOAM CONCRETE: CHANGES IN PHYSICAL AND MECHANICAL PROPERTIES. International Journal of Advance Scientific Research, 2(11), 67-76.
66. Мирзаев, Б. К., Собирова, Д. Т., & Умирдинов, И. О. (2021). Методы Повышения Физико-Механических Свойств Вермикулитного Бетона. Central Asian Journal of Theoretical and Applied Science, 2(12), 293-297.
67. Samigov, N. A., Djalilov, A. T., Karimov, M. U., Sattorov, Z. M., Samigov, U. N., & Mirzayev, B. Q. (2019). Physical and chemical researches of the relaxol series of cement composition with complex chemical additive KDJ-3. Scientific-technical journal, 23(4), 71-77.
68. Kozibaevich, M. B. (2021). Study of the effect of new synthesed complex chemical additions on rheological

properties of portland cement. Innovative Technologica: Methodical Research Journal, 2(12), 133-137.
69. Kuziboevich, M. B. ., & Nabijonovich, A. N. . (2021). Results Of Studying The Physical And Mechanical Properties Of Polystyrene Concrete With Additional Complex Chemical Additive Kdj-3 Based On Local Raw Materials. The American Journal of Engineering and Technology, 3(06), 30–34.
70. Sattorov1, Z., Mirzayev, B., & Mamatov1, V. (2023). GIPS BLOKINI ISHLAB CHIQISH ORQALI CHIQINDILARNI UTILIZATSIYA QILISH VA ENERGIYA TEJAMKORLIKNI OSHIRISH. GOLDEN BRAIN, 1(1), 165–171. Retrieved from https://researchedu.org/index.php/goldenbrain/article/view/4530
71. Абдуллаев У.М., ., Абдуллаев И.Н., . (2021). Пути развития производства пенобетона. Американский журнал техники и технологий , 3 (7), 9–14. Получено с https://inlibrary.uz/index.php/tajet/article/view/9867.
72. Bakhromjon Adhamovich Otakulov, & Ulug'Bek Maxmudovich Abdullayev (2022). INCREASING THE DURABILITY OF STRUCTURAL ELEMENTS OF TANKS FOR WATER USING COMPOSITE MATERIALS. Scientific progress, 3 (3), 358-361.
73. Otakulov B.A., & Abdullayev U.M. (2021). HISTORY OF FOAM CONCRETE PRODUCTION DEVELOPMENT. Экономика и социум, (12-1 (91)), 485-488.
74. Otakulov B.A., & Abdullayev U.M. (2021). IMPROVING THE SORBTION PROPERTIES OF SALT UNDERWAY. Экономика и социум, (12-1 (91)), 482-484.
75. Zh, N. U. (2022, April). WORKING PRINCIPLE OF A SOLAR CELL. In E Conference Zone (pp. 87-89).
76. Кулдашов, О. Х., & Нигматов, У. Ж. (2021). Автоматизированная система мониторинга температуры рабочей поверхности солнечных панелей. Автоматика и программная инженерия, (3 (37)), 108-111.
77. Ергашев, С. Ф., & Нигматов, У. Ж. (2021). Солнечные параболоцилиндрические установки, конструктивные особенности и расчет отдельных параметров. Журнал Сибирского федерального университета. Техника и технологии, 14(1), 33-41.
78. Ergashev, S. F., & Nigmatov, U. Z. (2021). Solar Parabolocilindrical Installations, Constructive Features and Calculation of Individual Parameters. Journal of Siberian Federal University. Engineering & Technologies, 14(1), 33-41.
79. Rakhimov, R. K., Irgashev, S. F., Abdurakhmanov, S. M., & Nigmatov, U. J. (2017). The automated computer system of measurement of productivity of solar water heaters from portion preparation of hot water. Computational nanotechnology, (1), 23-26.
80. Рахимов, Р. Х., Эргашев, С. Ф., Абдурахмонов, С. М., & Нигматов, У. Ж. (2017). Автоматизированная компьютерная система измерения производительности солнечных водонагревателей с порционной подготовкой горячей воды. Computational nanotechnology, (1), 23-26.
81. Эргашев, С. Ф., Нигматов, У. Ж., & Пулатов, Э. У. У. (2018). Анализ перепадов температур, возникающих в тепловых трубах солнечных параболоцилиндрических установок. Проблемы науки, (5 (29)), 18-21.
82. Эргашев, С. Ф., & Нигматов, У. Ж. (2020). Солнечные параболоцилиндрические установки, конструктивные особенности и расчёт отдельных параметров. Universum: технические науки, (11-5 (80)), 51-56.
83. Нигматов, У. Ж. (2020). Анализ конструктивных элементов охлаждения гибридных солнечных коллекторов. Вестник науки и образования, (2-3 (80)), 4-15.

84. Нигматов, У. Ж., & Наимов, Ш. Б. (2020). Анализ потенциала использования энергии солнечного излучения на территории республики Таджикистан. In International scientific review of the technical sciences, mathematics and computer science (pp. 59-71).
85. Эргашев, С. Ф., Нигматов, У. Ж., Орипов, А., & Ощепкова, Э. А. (2019). Энергоэффективный трекер без использования светозависимых датчиков (Фоторезисторов, фотодиодов и тд). Известия Ошского технологического университета, (3), 234-236.
86. Эргашев, С. Ф., Нигматов, У. Ж., Абдуганиев, Н. Н., & Юнусов, Б. С. А. (2018). Солнечные параболоцилиндрические электростанции-современное состояние работ и перспективы использования их в народном хозяйстве Узбекистана. Достижения науки и образования, (5 (27)), 6-8.
87. Мирзаев, Б. К., Собирова, Д. Т., & Умирдинов, И. О. (2021). Методы Повышения Физико-Механических Свойств Вермикулитного Бетона. Central Asian Journal of Theoretical and Applied Science, 2(12), 293-297.
88. Umirdinov, I. O., & Solijonov, X. S. (2021). Prospects for the use of Polymer Composite Reinforcement in the Reinforcement of Concrete Structures in the Republic of Uzbekistan. American Journal of Social and Humanitarian Research, 2(9), 147-150.
89. Solijon o'g'li, S. H. (2023). MAHALLIY XOMASHYOLAR ASOSIDA OLINGAN YENGIL KERAMIK OLOVBARDOSH G 'ISHTNING TARKIBI VA TEXNOLOGIYASINI ISHLAB CHIQISH. Scientific Impulse, 1(10), 862-868.
90. Umirdinov, I. O. (2022). Foam Glass Lightweight Aggregate: The New Approach. Central Asian Journal of Theoretical and Applied Science, 3(11), 205-211.
91. Umirdinov I.O. (2022). SHISHA BETONNING TURLARI. Экономика и социум, (11-2 (102)), 243-248.
92. Umirdinov I.O. (2022). ASPHALT CONCRETE IN HOT-DRY CLIMATE CONDITIONS DEVELOPMENT DEFICIENCIES AND ITS ELIMINATION. Экономика и социум, (4-1 (95)), 182-184.
93. Umirdinov, I. O., & Solijonov, X. S. (2021). Prospects for the use of Polymer Composite Reinforcement in the Reinforcement of Concrete Structures in the Republic of Uzbekistan. American Journal of Social and Humanitarian Research, 2(9), 147-150.
94. Solijonov, X. S. (2022). USE IN THE INDUSTRY OF BUILDING MATERIALS OF ASH AND SLAG OF THERMAL POWER PLANTS. Экономика и социум, (4-1 (95)), 164-167.
95. Solijonov, X. S. (2022). USE IN THE INDUSTRY OF BUILDING MATERIALS OF ASH AND SLAG OF THERMAL POWER PLANTS. Экономика и социум, (4-1 (95)), 164-167.
96. Otakulov, B. A., Kodirov, B. X., & Solijonov, H.S. O.G.L.(2021). Assessment of the quality of source materials for asphalt concrete. Scientific progress, 2(8), 396-402.
97. Otakulov, B. A., Kodirov, B. X., & Solijonov, H. S. O. G. L. (2021). Calculating the composition of the mineral part. Scientific progress, 2(8), 403-408.
98. Otakulov, B. A., Kodirov, B. X., & Solijonov, H. S. O. G. L. (2021). Determination of asphalt concrete composition. Scientific progress, 2(8), 409-414.
99. Otakulov, B. A., Kodirov, B. X., & Solijonov, H. S. O. G. L. (2021). Selecting the optimal bitumen content. Scientific progress, 2(8), 415-420.
100. Otakulov, B. A., Kodirov, B. X., & Solijonov, H. S. O. G. L. (2021). Selecting the optimal bitumen content. Scientific progress, 2(8), 415-420.

101. Кодиров, Б. Х. (2022). Изготовления топливных брикетов из листьев в домашних условиях сельской местности Республики Узбекистан. Academic research in educational sciences, 3(1), 335-339.
102. Абдуганиев Назиржон Набижонович, Мирзаева Гулчехра Сотволдиевна, & Абдуганиев Нумонжон Набижонович (2019). Пути интенсивности работы аэратенков с пневматической аэрацией. Universum: технические науки, (12-1 (69)), 5-