(E) ISSN: 3030-3214
Volume 2, № 4-1
2024

UDC: 666.622.7.553.532 10.70769/3030-3214.SRT.2.4-1.2024.23

IMPACT OF EXTERNAL FACTORS ON THE QUALITY OF MATERIALS FROM THE AYDARKUL BASALT DEPOSITS AND THEIR PROCESSING




Sattorov Laziz Kholmurodovich
Docent Karshi engineering-economics institute, Karshi, Uzbekistan

Kurbanov Abdiraxim Axmedovich
Professor Bukhara engineering - technological institute, Bukhara, Uzbekistan

Nomozov Bakhtiyor Yuldashovich
Docent Karshi engineering-economics institute, Karshi, Uzbekistan

Juraeva Huriyat Zoirovna
Lecturer of the University of Economics and Pedagogy, Karshi, Uzbekistan

Abstract. *The article presents the results of research on the impact of external factors on the quality of processed materials from the "Aydarkul" basalt deposits. Experiments involved mechanical cleaning and chemical property assessment of basalt rock samples from three different deposits. The findings demonstrated opportunities to extend the service life of equipment and enhance corrosion resistance through basalt washing. The paper also provides recommendations for using basalt as thermal insulation materials and ensuring their environmental safety.*

Keywords: *basalt rock, thermal insulation, corrosion resistance, mechanical cleaning, environmental safety, geotechnics, mining.*

ВЛИЯНИЕ ВНЕШНИХ ФАКТОРОВ НА КАЧЕСТВО МАТЕРИАЛОВ ИЗ БАЗАЛЬТОВ МЕСТОРОЖДЕНИЯ «АЙДАРКУЛЬ» И ИХ ПЕРЕРАБОТКА

Сатторов Лазиз Холмуродович
Доцент Каршинского инженерно-экономического института, Карши, Узбекистан

Курбанов Абдурахим Ахмедович
Профессор Бухарского инженерно-технологического института, Бухара, Узбекистан

Номозов Бахтиёр Юлдашович
Доцент Каршинского инженерно-экономического института, Карши, Узбекистан

Жураева Хурият Зоировна
Преподавателя Экономического и педагогического университета, Карши, Узбекистан

Аннотация. *В статье представлены результаты исследования воздействия внешних факторов на качество переработанных материалов из базальтов месторождения «Айдаркуль». В ходе экспериментов были проведены механическая очистка и оценка химических свойств образцов базальтовых пород, взятых из трех различных месторождений. Полученные результаты показали возможности увеличения срока службы оборудования и повышения коррозионной стойкости за счет промывки базальтовых пород. В статье также даны рекомендации по использованию базальтов в качестве теплоизоляционных материалов и обеспечению их экологической безопасности.*

Ключевые слова: *базальтовые породы, термоизоляция, коррозионная стойкость, механическая очистка, экологическая безопасность, геотехника, горное дело.*

AYDARKUL BAZALT KONLARIDAGI MATERIALLARNING SIFATIGA TASHQI OMILLAR TA'SIRI VA ULARNING QAYTA ISHLANISHI

(E) ISSN: 3030-3214
Volume 2, № 4-1
2024

Sattorov Laziz Xolmurodovich
Qarshi muhandislik-iqtisodiyot instituti dotsenti, Qarshi, O'zbekiston

Kurbanov Abdiraxim Axmedovich
Professor Buxoro muhandislik-texnologiya instituti, Buxoro, O'zbekiston

Nomozov Baxtiyor Yuldashovich
Qarshi muhandislik-iqtisodiyot instituti dotsenti, Qarshi, O'zbekiston

Jo'rayeva Huriyat Zoirovna
Iqtisodiyot va pedagogika universiteti o'qituvchisi, Qarshi, O'zbekiston

Annotatsiya. *Ushbu maqolada "Aydarkul" bazalt konlarida qayta ishlangan materiallarning sifatiga tashqi omillar ta'sirini tadqiq etish natijalari keltirilgan. Eksperimentlar davomida uchta turli konlardan olingan bazalt jinslari namunalarini mexanik tozalash va kimyoviy xususiyatlarini baholash amalga oshirildi. Olingan natijalar, bazalt jinslarini yuvish orqali uskunalarning xizmat muddatini uzaytirish va korroziyaga chidamliligini oshirish imkoniyatlarini ko'rsatdi. Maqolada bazaltlarning termal izolatsiya materiallari sifatida qo'llanishi va ekologik xavfsizligini ta'minlashga doir takliflar berilgan.*

Kalit so'zlar. *bazalt jinslari, termal izolatsiya, korroziyaga chidamlilik, mexanik tozalash, ekologik xavfsizlik, geotexnika, konchilik.*

Introduction. In this process, the rock is supplied for removal of sludge after medium crushing, i.e. after dividing large-sized basalts 250÷300 mm into smaller pieces (according to the equipment characteristics - 40 mm). After the first stage of rock crushing in a jaw crusher, tightly adhered cemented layers, and in some cases, traces of dirt, may remain on the surface of the basalt rock. To test the effectiveness of the recommended cleaning method, an experiment was conducted to wash basalts from sludge. The experiment involved 200 kg of basalt samples from the research objects. The experiment was carried out according to the following scheme. The results of the experiment are listed in table 1.

Table 1

Indicators of mechanical cleaning of basalts from the Gavasai, Asmansay and Aidarkul deposits

№	Name of indicators	Field		
		Gavasai	Asmansay	Aydarkul
1	Mass of basalt sample subjected to washing, kg	200	200	200
2	Mass of basalts with a particle size of 5÷6 mm, after crushing, kg	199,5	199,5	199,0
3	Mass of basalts after washing, kg	199,0	198,5	198
4	Masses of basalts after washing, kg rel.% of the original	1,0	1,5	2,0

Literature analysis and methods. In turn, mechanical washing of all three rock samples was carried out in the butare. After washing, all basalt rock samples were dried. Research shows that after the crushing process, the mass of rock impurities isolated from every 200 kg amounted to an average of 0.5% (approximately 0.5 kg) of the total mass. The change in rock mass after washing was 0.5% (approximately 0.5 kg). The mass of released sludge increases with increasing salinity of the soil of the deposit [3,4].

Table 2

Results of studies to determine the corrosion time of metals using "basalt wool" obtained from basalts of various deposits

№	Name of indicators	Field		
		"Gavasai"	"Asmansay"	"Aydarkul"
1	Time of appearance of corrosion on pipes (basalt without flushing), year	6-8	5-6	2-4
2	Time of appearance of corrosion on pipes (basalt after washing), year	15	12	12
3	Degree of soil population in basalt deposits, %	28	85,4	92,9
4	Time of appearance of corrosion on the surface of the working parts of the equipment, year	12	12	12

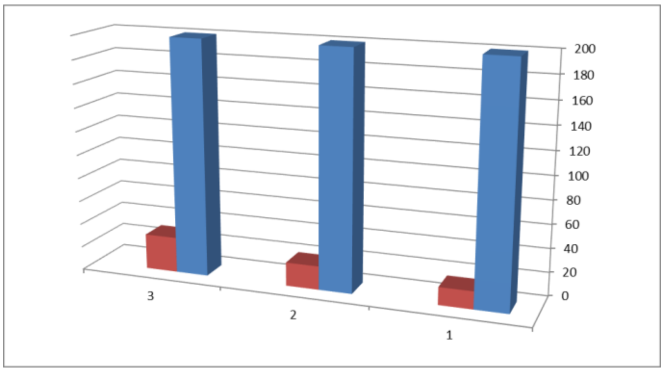

Figure 1. Indicators of mechanical cleaning of basalts from the deposits: "Gavasay", "Asmansay" and "Aydarkul".

(E) ISSN: 3030-3214
Volume 2, № 4-1
2024

To study the influence of sludge on the quality of the final product and the causes of premature damage to pipelines or other objects from corrosion, an experiment was conducted. The experiment involved basalts from three deposits: “Gavasay”, “Asmansay” and “Aydarkul” and pipelines of industrial enterprises in Navoi, which were protected from external influences by basalt thermal insulation wool.

Results and discussions. A 100 kg rock sample was selected from each basalt deposit for the experimental study. The necessary equipment and devices were prepared in advance to conduct the research. Each rock sample was weighed and divided into 100 kg portions. Initially, the basalt samples were subjected to crushing and melting. Subsequently, additional 100 kg basalt samples were washed using a butare and then sent for melting. The resulting thermal insulation wool was applied to pipelines for insulation purposes [4,5,6].

The experiment spanned 12 years, and its results are summarized in Table 2.

The longest service life was observed in materials obtained from the basalts of the Gavasai deposit. This finding correlates with the soil salinity levels in the areas where the basalts are located. Furthermore, thermal insulation materials derived from cleaned basalts extended the service life of pipelines by approximately two times and that of equipment by an average of 3.5 times, confirming the effectiveness of desliming basalts.

During the study, the water composition was analyzed before and after the washing process. After washing the basalts, the changes in the concentrations of positive ions (cations) and negative ions (anions) relative to their initial levels were as follows [7,8]:

I. Gavasai Deposit (mg/l):

- **Cations**: Decrease in Ca^{2+} and Mg^{2+} by 1.6 and 2.64, respectively. Increase in $Na^{+}+K^{+}$ and NH_4^{+} by 6.41 and 0.5, respectively. Fe^{3+} showed no change.
- **Anions**: Decrease in SO_4^{2-} and NO_3^{-} by 2.17 and 1.21, respectively. Increase in HCO_3^{-}, Cl^{-}, and NO_3^{-} by 2.0, 2.60, and 0.03, respectively. No change in CO_3^{2-} was observed.
- **Dry Residue**: Increased by 197.4 mg/l.

II. Asmansay Deposit (mg/l):

- **Cations**: Decrease in Mg^{2+} and NH_4^{+} by 9.49 and 0.08, respectively. Increase in Ca^{2+} and $Na^{+}+K^{+}$ by 4.58 and 6.16, respectively. Fe^{3+} showed no change.
- **Anions**: Decrease in HCO_3^{-} and NO_3^{-} by 10.0 and 0.92, respectively. Increase in CO_3^{2-}, SO_4^{2-}, Cl^{-}, and NO_3^{-} by 1.49, 10.0, 1.29, and 0.05, respectively.
- **Dry Residue**: Increased by 218.2 mg/l.

III. Aydarkul Deposit (mg/l):

- **Cations**: Decrease in Ca^{2+} by 2.12. Increase

Table 3

Results of analysis of water samples

No. p/p	Selection places	Mass of basalt, kg and volume of water, l	pH	Dry the remaining water before and after washing the basalt material, mg/l	CATIONS mg -eq % mg –eq						ANIONS mg -eq % mg-eq							Hard total Weigh, mg/l
					Ca^{2+}	Mg^{2+}	$Na^{+}+K^{+}$	Fe^{3+}	NH_4^{+}	∑	CO_3^{2-}	HCO_3^{-}	SO_4^{2-}	Cl^{-}	NO_2^{-}	NO_3^{-}	∑	
1	Basalt Gavasaya -before washing		7,57	930,0	43,11	37,18	17,46	<0,05	0,11	100,0	н/обн	37,14	46,22	11,21	0,06	3,79	100,0	13,4
	-after washing	10/25	8,01	1127,4	41,44	34,54	23,87	<0,05	0,16	100,0	н/обн	39,14	44,39	13,81	0,09	2,58	100,0	29,8
2	Basalt Asmansay -before washing		7,67	1133,6	33,09	43,80	22,18	<0,05	0,12	100,0	н/обн	48,73	34,68	9,14	0,02	5,56	100,0	21,16
	-after washing	10/25	8,22	1351,8	37,67	34,31	28,02	<0,05	0,10	100,0	1,49	38,73	44,68	10,43	0,07	4,64	100,0	31,4
3	Basalt of Aydarkul -before washing		7,84	1233,6	38,67	31,31	29,76	<0,05	0,12	100,0	0,2	38,22	44,45	11,87	0,05	4,55	100,0	24,2
	-after washing	10/25	8,42	1419,3	36,55	31,54	31,01	<0,05	0,18	100,0	1,5	42,05	44,27	10,51	1,06	0,61	100,0	36,15

(E) ISSN: 3030-3214
Volume 2, № 4-1
2024

in Mg^{2+}, $Na^{+}+K^{+}$, and NH_4^{+} by 0.33, 1.25, and 0.06, respectively. Fe^{3+} showed no change.

- **Anions**: Decrease in SO_4^{2-}, Cl^{-}, and NO_3^{-} by 0.23, 0.64, and 3.91, respectively. Increase in CO_3^{2-}, HCO_3^{-}, and NO_3^{-} by 1.3, 3.83, and 1.0, respectively.
- **Dry Residue**: Increased by 185.7 mg/l.
- **pH**: Increased by 0.58.

The analysis of water samples before and after washing the basalts is presented in Table 3. It was found that the highest dry residue by mass was observed in the basalts from the Asmansay and Aydarkul deposits, which aligns with the higher salinity levels of the soils in these areas [9,10,11].

Thus, it has been established that it is promising to remove sludge from the surface of basalts by washing using a specialized machine - a butara. Thus, a reduction in time spent on the cleaning process cycle is achieved. This approach to performing operations is easily achieved using the lattice wall of the butara, which in this case plays the role of a sieve, the size of which is adjusted to the size of the crumbs in a very simple way. The process proceeds as follows. To begin with, basalt in separate pieces, 250÷300 mm in size, is fed into crushers, depending on the technical parameters of the equipment.

When choosing the power of a crushing plant, it is based on the production capacity of the enterprise. When using technology for processing hard (3000÷5000 kgN/sm^3) basalts using jaw crushing, separation of harder rock fractions from less hard ones is achieved. At the same time, the standard technical capabilities of the crushing plant remain unchanged. After separating the solid part of the rock, it is transferred to a butara machine, which, after disintegration, is specialized for screening.

Under the influence of the rotational movement of the machine drum, the basalt crumbs are divided into smaller pieces and shaken out. The supply of water at this moment inside the drum helps to loosen the raw material. The presence of corners and annular thresholds inside the drum enhances the shaking of the rock pieces and thereby creates artificial washing. The dimensions of the holes in the walls of the drum are adjusted to the size of the crumbs, free from impurities of large pieces of basalt rock [12,13].

The process of cleaning basalt rock from chemical impurities.

One of the properties of rocks is their porosity. The pores of rocks can be filled with harmful impurities of various origins. In some areas of the rock there are smaller, relatively isometric pores filled with calcedony-like quartz. Quartz contains pseudorock, aggregated contents of amorphous chlorite in very small segregations. Unlike other minerals, plagioclase rarely allows harmful impurities to penetrate into the rock.

It is known that natural basalt stone, due to its high porosity, is susceptible to pollution and adverse effects of its environment. Indoors, basalt stone wears out and is exposed to household pollution. For this reason, basalt stone needs proper care, and this means protecting and cleaning the stone. Thus, in this case we consider basalt impurities located only on the surface of the rock.

It has been noted that basalt rocks are chemically stable and highly durable. The use of basalts as a natural stone material is limited. For example, basalt stone is used in the construction and cladding of various objects, as well as as a material for sculptures intended for installation in the open air. Therefore, basalt stone is rarely subjected to chemical cleaning. Basalt stone is easy to clean using manual and automatic means; no traces of scratches remain on the surface of the basalt slab. Plates can also be cleaned of compressed dirt with a powerful jet of water under pressure [14,15].

As a result of the analysis of basalts, it was revealed that the surface of individual pieces of basalt contains $NaCl$, KCl, $CaCl_2$, CaO, etc. formed in exogenous and hydrophobic natural processes, which can be removed during crushing (partially) and washing. Currently, basalt processing enterprises pay insufficient attention to cleaning basalts from harmful impurities. This is due to the fact that the effects of sludge on the service life of equipment and product quality have not been studied. It is believed that impurities at heating temperatures up to 1300÷1400°C can simply burn out and be released into the atmosphere.

Basalt, being an acidic rock, is sometimes used as an acid scavenger. In other cases, the role of chemical or physical-chemical cleaning is small. Those impurities that are found on the surface of the rock, in the form of adhered dirt, salt, sludge, etc.

(E) ISSN: 3030-3214
Volume 2, № 4-1
2024

are easily removed during mechanical cleaning. Therefore, chemical cleaners must be used in cases where basalt impurities are detected during an external inspection of the rocks. Physico-chemical processes associated with the melting of basalt can very slightly contribute to the release of harmful impurities from the rock. Note that due to the high cost of chemical cleaning, it is rarely used when washing rocks [16].

In general, the process of processing basalt by dissolving it in acidic environments and subsequent production of products from it has not been mastered by enterprises. Methods for cleaning basalts with chemical reagents have also not been mastered. The economic feasibility of currently existing minor types of cleaning of finished products with chemical cleaners has not been proven. As a result, only mechanical methods of cleaning basalts can be given a positive assessment.

Conclusion. Thus, the environmental purity of basalts can be ensured only if, during the processing process, the basalt rock is subjected to mechanical cleaning and dry processing. This method plays an important role in preventing the appearance of corrosion on the surface of the working parts of processing machines and the manufacture of composite products.

REFERENCES

1. A.A.Kurbanov, L.Kh.Sattorov, Zh.Kh.Rakhmonov, Calculation of the deflection of filters made of basalt fiber. Certificate of official review of the program created for Electronic Calculators No. DGU 01891. 2009 3.
2. A.A.Kurbanov, U.S. Normurodov, L.Kh.Sattorov, New in the processing of basalts in Uzbekistan, Bulletin of the Tula State University and Automation: problems , ideas, solutions, Tula, APIR-18, 127-130 (2013).
3. Салимсоков Ю.А., Ибодуллаев А.С. Technology of production of fibers from basalt rocks of Uzbekistan and composite materials based on them // Materials of the republican scientific and technical conference. Tashkent. -2007. -Pp. 77.
4. L.Kh.Sattarov, A.A.Kurbanov, The flexural stiffness and tension state of basalt filter, RMZ-M&G Materials and Geoenvironment - Slaveniya, 64, 53-62 (2017).
5. N.F.Drobot, O.A.Noskova, A.V.Steblevskii, Use of Chemical and Metallurgical Methods for Processing of Gabbro-Basalt Raw Material, Theoretical Foundations of Chemical Engineering, 47, 4, 484-488 (2013).
6. A. Gibadullin, V. Pulyaeva, E3S Web of Conferences, 114, 02002 (2019).