SCIENCE AND INNOVATION
INTERNATIONAL SCIENTIFIC JOURNAL VOLUME 2 ISSUE 1 JANUARY 2023
UIF-2022: 8.2 | ISSN: 2181-3337 | SCIENTISTS.UZ

METHOD OF EXAMINATION BITUMEN ADHESION TO VARIOUS MINERAL MATERIALS

[1]Rakhmatova Dilnoza Muxitdinovna, [2]Karimova Kamola Bahodirovna
[1]PhD., dotsent of the Tashkent State Technical University named after Islam Karimov
[2]Assistant of the Tashkent State Technical University named after Islam Karimov
https://doi.org/10.5281/zenodo.7568961

Abstract. *Experimental data on the assessment of the adhesion strength of bitumen to the surface of various mineral materials are presented. graphical dependences of the adhesion of bitumen BOR 60/90 and BOR 90/130 with additives to various mineral materials are constructed. with the same acid-base characteristics of mineral materials, the adhesion strength of bitumen to the surface of a rough material (granite crushed stone) is greater than with the surface of a smoothly rolled material (gravel).*

Keywords: *bitumen, oil sludge, gossypol resin (fat-oil plant), technical sulfur, asphalt concrete, road pavement.*

INTRODUCTION. For the research, the following mineral materials were used [1, 2]:

1. Gravel is a round or ovoid round or ovoid rock fragments with a smooth surface, usually of river or sea origin. In the research, granite gravel of fraction 5-20 mm was used, used in the construction of roads. Granite is an acidic igneous rock.

2. Crushed stone is an inorganic material obtained by crushing rocks. The average density of crushed stone is from 1.4 to 3 g / cm. Granite crushed stone is crushed stone from solid rock of granular structure, consisting of crystals of feldspar, quartz, mica. In the studies, a fraction of 5-20 mm was used, since it is in the greatest demand and is used in road and airfield pavements.

3. In the studies, marble was used as a mineral material containing CaCO3. Marble consists of dolomite (calcium and magnesium carbonate - CaMg (CO3) 2) or calcite (calcium carbonate - CaCO3), or both. Marble almost always contains admixtures of other minerals, such as iron oxide, iron sulfide, iron-containing silicates (chlorite and epidote), iron and manganese carbonates, bitumen or graphite admixtures.

The marble was used as an analogue of crushed limestone. It is a product of the crushing of sedimentary limestone rock, consisting mainly of calcite (calcium carbonate-CaCO3). This is one of the main types of crushed stone, which, in addition to gravel and granite crushed stone, is used in road construction. The choice of marble as an analogue of crushed limestone is also justified by the fact that during metamorphism limestones recrystallize and form marbles.

Thus, the mineral materials were selected:

1) by acid-base properties: acidic: granite crushed stone and gravel, - basic: marble.

2) according to the characteristics of the surface charge of the material:

- electronegative: crushed granite and gravel,
- electropositive: marble.

Experimental data [3, 4] on the assessment of the adhesion strength of bitumen with the surface of various mineral materials are shown in Table 1.

MATERIAL AND METODS

Table 1

Adhesion strength of bitumen to the surface of various mineral materials

Additive % mass.	Mineral materials					
	Granite rubble		Granite gravel		Marble	
	%coverage	points	% coverage	points	% coverage	points
BND-60/90	76	3	74	2	78	3
BND-60/90 +O-1, 35%	83	3	78	3	87	3
BND-60/90 +O-2, 40%	87	3	85	3	91	4
BND-60/90 +O-3, 45%	93	4	90	4	94	4
BND-60/90 +O-4, 35%	92	4	90	4	94	4
BND-60/90 +O-5, 40%	94	4	91	4	96	5
BND-60/90 +O-6, 45%	97	5	93	4	98	5
BND-90/130	69	2	67	2	70	2
BND-90/130 +O-1, 35%	80	3	78	3	79	3
BND-90/130 +O-2, 40%	85	3	84	3	86	3
BND-90/130 +O-3,	90	4	90	4	90	4

45%						
BND-90/130 +O-4, 35%	83	3	80	3	85	3
BND-90/130 +O-5, 40%	91	4	90	4	92	4
BND-90/130 +O-6, 45%	93	4	92	4	94	4

O- remnants of the industry.

O-1 composition (oil sludge-25% and sulfur 10%);

O-2 composition (oil sludge -25% and sulfur 15%);

O-3 composition (oil sludge -25% and sulfur 20%);

O-4 composition (tar (gossypol resin) -25% and sulfur 10%);

O-5 composition (tar (gossypol resin) -25% and sulfur 15%);

O-6 composition (tar (gossypol resin) -25% and sulfur 20%).

RESULTS. Note: decoding of points: 2 - "unsatisfactory", less than 75% of the surface of crushed stone particles is covered with a binder film; 3 - "satisfactory", 75% of the surface of the crushed stone particles is covered with a binder film; 4 - "good", a binder film covers 90% of the surface of crushed stone particles; 5 - 95% of the surface of the crushed stone particles is covered with a binder film.

Based on the tabular data, graphical dependencies were built, presented in Figures 1 - 2.

Fig-1.

Bitumen adhesion BND 60/90 with additives to various mineral materials

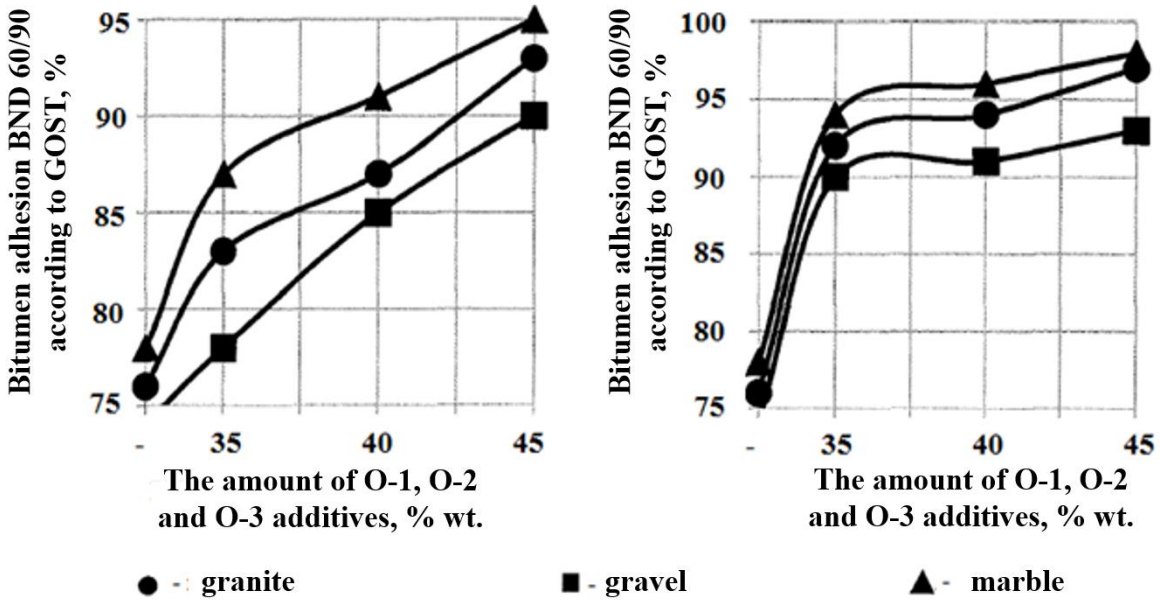
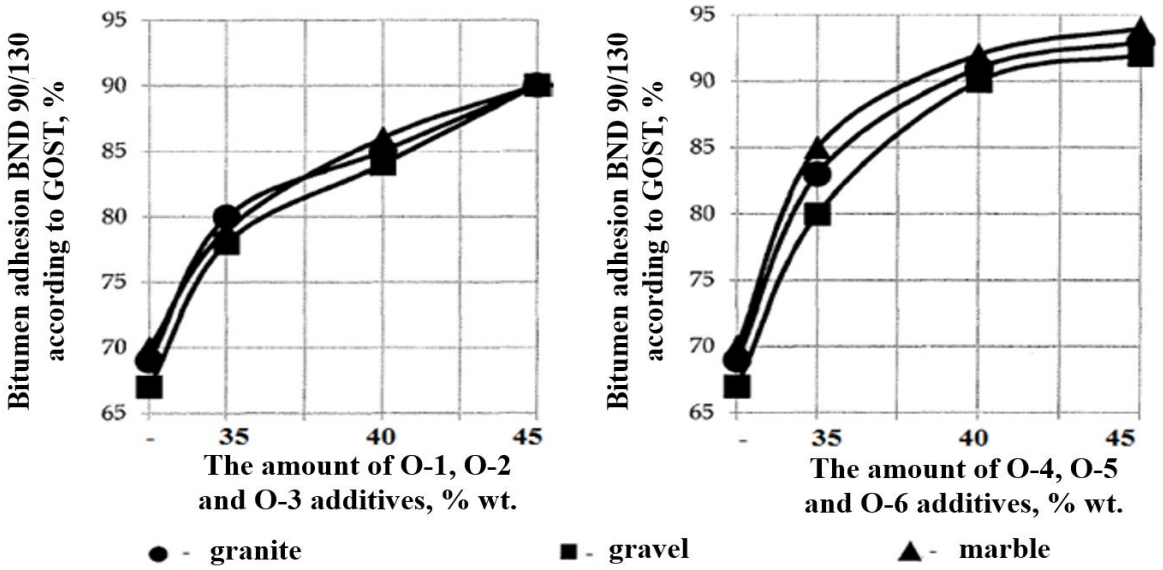


Fig-2.

Bitumen adhesion BND 90/130 with additives to various mineral materials



According to Table 1 and the graphs presented in Figures 1 and 2, it can be concluded that the adhesion of bitumen decreases in the following order: marble - granite crushed stone - granite gravel. In other words, the bond strength of bitumen with basic rocks (marble) is better than with acidic rocks (granite materials). Also, according to the table, it can be seen that with the same acid-base characteristics of mineral materials, the adhesion strength of bitumen with the surface of a rough material (granite crushed stone) is greater than with the surface of a smoothly rolled material (gravel). This can be explained using some of the reference points of the mechanical theory of adhesion [5, 6]. When bitumen adheres to an uneven surface, a "key-lock" type of adhesion occurs: bitumen penetrates into the unevenness of the mineral material, followed by physical fixation, while any movements of the two phases are limited by the fact that the bitumen is plastically deformed and acts as an energetically absorbing mechanism, bringing an obvious increase boundary strength.

The surface roughness of the mineral material prevents abrupt load transfer in the horizontal plane, loads are transferred through the bitumen, which behaves like a viscoelastic material. In addition, surface roughness improves adhesion by physically increasing the contact area. The sum of the interactions between the active centers of the bituminous binder and the mineral material increases in proportion to the increase in the contact area.

According to the data in Table 1, it can be seen that the adhesion of bitumen is better to a mineral material with electropositive surface characteristics (marble) and worse to materials with electronegative surface characteristics (granite materials). It is logical to explain this effect within the framework of the electrostatic theory of adhesion.

RECOMMENDATIONS

1. Experimental data on assessing the adhesion strength of bitumen with the surface of various mineral materials are presented.

2. According to the tabular data, graphical dependences of the adhesion of bitumen BND 60/90 and BND 90/130 with additives to various mineral materials were built.

3. According to Table 1 and the graphs presented in Figures 1 and 2, it can be concluded that the adhesion of bitumen decreases in the row: marble - granite crushed stone - granite gravel.

In other words, the bond strength of bitumen with basic rocks (marble) is better than with acidic rocks (granite materials).

4. The table shows that with the same acid-base characteristics of mineral materials, the adhesion strength of bitumen with the surface of rough material (granite crushed stone) is greater than with the surface of smoothly rolled material (gravel).

REFERENCES

1. Мусаев М.Н., Рахматова Д.М. Проблема обеспечения безопасности обезвреживания и утилизации аварийно-опасных ядовитых химических отходов. /Сб. Материалов III Международной заочной конференции «Безопасность человека и общества: совершенствование системы реагирования и управления защитой от чрезвычайных ситуаций», 2019., Минск, - С.168-170.
2. Мусаев М.Н., Рахматова Д.М. Анализ безопасной утилизации ядовитых и химических отходов. /Ж: Проблемы энерго - и ресурсосбережения, *ISSN 2091-5985, № 3-4*, Ташкент-2020., - С.302-304.
3. Burak Sengoza, Ali Topala, Cagri Gorkemb. Evaluation of natural zeolite as warm mix asphalt additive and its comparison with other warm mix additives // Construction and Building Materials, June 2013, Vol. 43, pp. 242–252.
4. Amir Modarres, Morteza Rahmanzadeh. Application of coal waste powder as filler in hot mix asphalt // Construction and Building Materials, Sep. 2014, Vol. 66, pp. 476–483.
5. Umurova Sh.Sh., Zhamolova N.Zh., Amonov M.R., Ravshanov K.A., Niyozov A.K. Bituminous compositions based on gossypol // Universum: Technical sciences: electron. scientific. zhurn 2020. No. 4 (73).
6. Turaev F.T., Beknazarov Kh.S., Dzhalilov A.T. Study of modification of road bitumen with elemental sulfur // Universum: Technical sciences: electron. scientific. zhurn. 2019. No. 2 (59).
7. Юльтимирова, И.А. Проблемы утилизации нефтешламов // Налоги. Инвестиции. Капитал. -2004. -№1.
8. Ягафарова Г.Г., Барахнина В.Б., Сафаров А.Х., Ильина Е.Г., Ягафаров И.Р. Биоремедиация нефтезагрязненной почвы // Материалы секции Д III Конгресса Нефтепромышленников России ≪Нефтепереработка и нефтехимия: проблемы и перспективы≫. - Уфа, 2001. - С. 207-208.
9. Чалов, К.В. Каталитический пиролиз нефтешламов: автореф. дис. ... канд. хим. наук: 05.17.04. -М., 2013. - 18 с.
10. Гурылева, Н.Л. Снижение техногенной нагрузки на окружающую природную среду путем переработки нефтешламов: автореф. дис. ... канд. техн. наук: 03.02.08. - Иваново, 2013. - 16 с.
11. Фетисов, Д.Д. Утилизация нефтешламов и древесных опилок путём использования в производстве топливных брикетов: автореф. дис. ... канд. техн. наук: 03.02.08. - Пенза, 2013. - 22 с.
12. Косулина Т.П., Кононенко Е.А. Повышение экологической безопасности продукта утилизации нефтяных шламов // Научный журнал КубГАУ. - 2012. -№78.

13. Ручкшюва О.И. Разработка ресурсосберегающих технологий безопасной утилизации твердых отходов нефтедобычи: автореф. дне. ... док. техн. наук: 03.00.16. - Пермь, 2004. - 34 с.
14. Мустафин И.А. Разработка комплексной установки утилизации нефтяных шламов: автореф. дис. ... канд. техн. наук: 05.17.07 - Уфа, 2013. - 23 с.
15. Гарабаджиу А.В. Кластер технологических установок переработки многотоннажных накоплений кислых гудронов и нефтешламов // Нефтепереработка и нефтехимия. Научно-технические достижения и передовой опыт. - 2012. - Вып. 9. - С. 37-48.
16. Гурарий Е.М. Влияние серы на структурообразование в битумах// Тр. СоюзДорНИИ. 1971. Вып.44. 137 с.