Environmental Damage Of Polymer Products That Have Been Turned Into Assembly AfterBeing Out Of Use

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Abstract
In this study, the reasons for the decommissioning of polymer materials are shown and recycling methods are analyzed. Polymer materials do not rot, corrode, etc. if their characteristics are taken into account, their recycling is an economic problem as well as an ecological problem that needs to be solved. Taking into account all this, the methods of obtaining purposeful compositions from some polymer wastes have been studied. its destruction mainlyoccurs as a result of high temperature. As a result, the molecular mass of RS (rubber scrub) decreases. When studying this in an oxygenated and non-oxygenated environment, the maximum stability of RS is observed in the temperature interval of 180°C. Therefore, we adopted the temperature of 180°C to modify road oil bitumen with RS waste. The most effective field of use of polymer materials is the modification of road bitumen
Keyword Waste of polymer materials, ecology, modification, road oil bitumen, polymer-bitumen composition, polymer asphalt concrete mixture

Introduction

Every year, the amount of polymer products used in households in the world is constantly increasing, and these products become waste after use, causing ecological damage to our flora and fauna (0. The waste of polymers used in technology is also increasing every year with the same intensity. .... Subject to biological decomposition The recycling of residual polymer waste is of both ecological and economic importance. However, the lack of full study of recycling methods limits the use of these valuable raw materials.

During the last 20 years, the use of plastic mass-based products in European countries has reached 80-90 kg per person per year. Calculations have shown that by 2025, the amount of plastic used annually by each person will be 130-140 kg.

150 types of plastic mass are produced on an industrial scale. 30% of them are mixtures of different polymers. ......In order to improve the physical and mechanical properties of plastic masses, various chemical substances are added to them, which are called "ingredients". At the current stage, the production of plastic mass is increasing every year by about 6-10%, and by 2027, its production volume is expected to reach 250 million tons.

41% of produced plastics are used as coating materials..... The quality and cheapness of plastic mass-based products expands their areas of use. After use, polymer products become waste. The recycling of these wastes is of both economic and environmental importance. Currently, the recycling and modification of plastic masses and rubbers has entered the highest stage of development.

Plastic mass recycling technology includes the following operations:

a) Chemical transformations by adding ingredients to the initial plastic mass and creating the required material;

b) Forming the obtained material and obtaining the intended finished product from the formed material.

The field of recycling of rubber and plastic masses includes the preparation of the material for processing and its further processing, calculation of technical and economic indicators...

1. Method andDiscussion

.PREPARATION OF POLYMER-BITUMEN COMPOSITION AND THE MAIN CONTENT OF THE APPLICATION WORK

Modification of road oil bitumen with polystyrene and polyethylene waste

If their structure remains and they are not destroyed, recycling of polymers with the same composition is quite easy. Of course, the destruction process is such that as a result of it, important changes can occur in the macromolecule and morphology of the polymer. As a result of these changes, all the physical properties of the polymer deteriorate.Therefore, the use of a mechanical method when recycling polymer waste does not give the desired results. Because during mechanical processing, macromolecules are destroyed more and lose their physical and mechanical properties. The method of preparation of bitumen modified with polymers, as a rule, involves the process at high temperature (150-200°C) and intensive mixing of the components. The decomposition temperature of most of the polymers used for bitumen modification (polyethylene, polypropylene, ethylene-propylene rubber, thermally flexible plastic) is higher than the temperature of their compatibility with bitumen. Therefore, thermal and mechanical destructive reaction of polymers does not occur in the bitumen mass.If it does, it is very weak. When heated, bitumens soften, and thermoplastic polymers go into a viscous-flow state, regardless of whether they are crystalline or amorphous. High temperatures accelerate the swelling or dissolution of the polymer in the bitumen.

Dissolution of polymeric materials occurs in the swelling phase. The swelling processconsists of dissolving the polymer in the solvent with the increase in volume and mass

Models of the dispersed structure of road bitumen (Figure 1) form 3 types of gel. In type I gels, the type I environment in which the asphalt-concrete is located is more dispersed. The type III structure is structured with more resins than the type I environment of structural connections of individual aggregates. Type III structure is a system consisting of a dispersed medium. Type II structure is composed of electron pairs [28-67].

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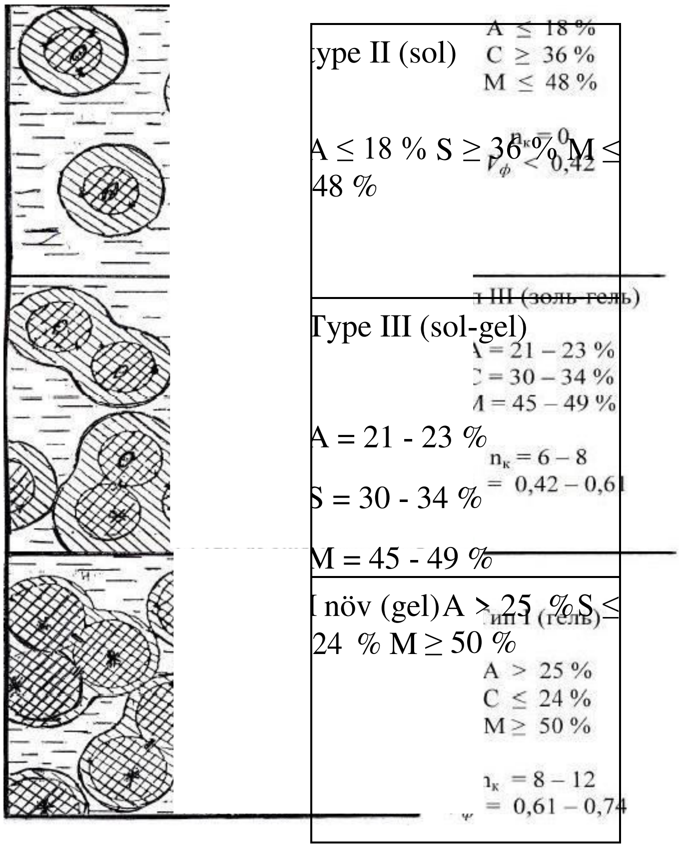

Figure 1. Models of road bitumen dispersion structure

- localized unpaired electron;
- delocalized unpaired electron;
- weak covalent bond.

Taking into account that there are 40-50 thousand tons of polyethylene and polystyrene waste every year in our republic, we determined that the method of their disposal is the modification of road oil bitumen.

Polystyrene destruction mainly occurs as a result of high temperature. As a result of destruction, PS molecular mass decreases. This can be seen more clearly in Figure 2.

Polystyrene recycling and utilization methods. Recycling of homogeneous polymers is quite simple if their structures have not been destroyed. If the structure of the polymer is destroyed, then its molecular mass decreases and the physical-mechanical properties of the polymer deteriorate [51-52].

If the polystyrene waste has preserved its original physical and mechanical properties, it can be used only for special purposes.

Polystyrene is used in various fields [53-54]. Polystyrene is the main raw material in the production of packaging material, coating, electrical and electronic structures, toys and other products.

In this work, the polystyrene waste shown in table 1 was used to obtain a polymer-bitumen composition.

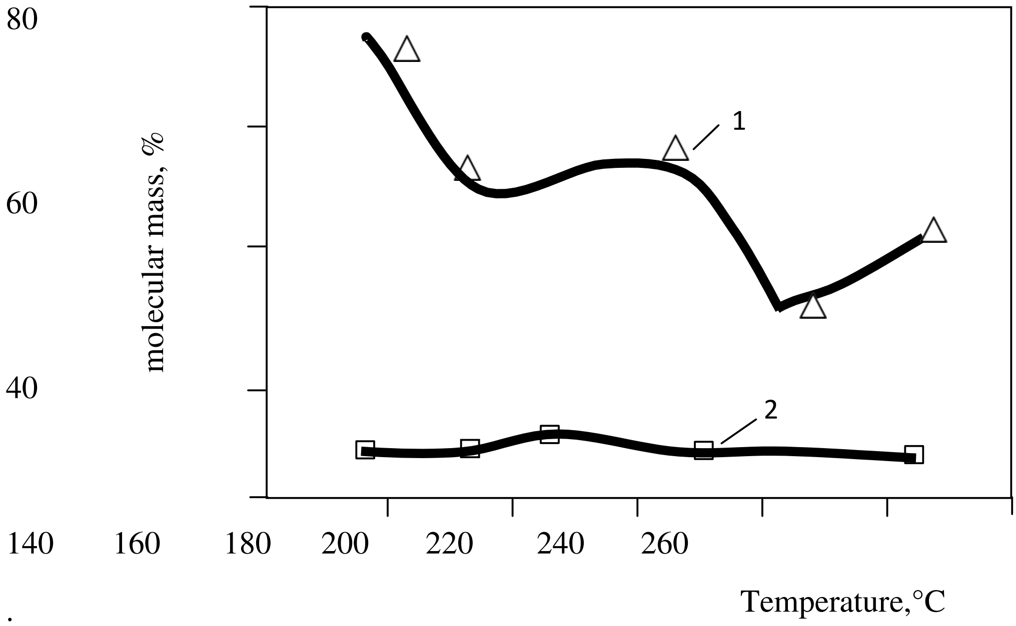

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Figure 2. PS destruction in oxygenated and non-oxygenated environment

1-with oxygen, 2-without oxygen. The combined use of PS and polyethylene waste is also of great ecological and economic importance. "Baku" brand bitumen was modified with polymer waste. The physical and mechanical properties of the obtained polymer-bitumen binder were studied by 2 modern research methods, and

the obtained results are shown in table .1., .2., .3. and given in .4.

Table .1.
Physical and mechanical properties of the polymer-bitumen composition obtained with "Baku"brand oil bitumen modified with polystyrene waste

Name of indicators	Requirements for Standard 52 056.2003	Baku «25\85» bitumen	Polymer bitumen composition modified with 2.5 mass parts of polystyrene waste
Depth of penetration of the needle into the sample, 0.1 mm At25°C At0°C	60 32	74 25	62 27
Length, smAt25°C At0°C	25 11	140 3,5	103 23
Yumşalma temperaturu, °C	54	42	58
Elastiklik, % at 25°C a t0°C	80 70	4 3	89 70
Sticking to sand and stone	It sticks well		
Kinematic viscosity at 135°C	455	-	1159
Dynamic viscosity at 60°C	270	-	931

After testing according to ASTM P 1734			
Change in volume, in % by mass	-	0,3	0,21
Softening temperature, ºC	-	45	108

Table 2.
Polymer-bitumen modified with polyethylene waste physical and mechanical properties of its composition

Name of indicators	Requirements for Standard 52 056.2003	Amount of polyethylene in polymer-bitumen composition, mass part .		
		2 mas . part	4 mas . part.	6 mas . part
Depth of penetration of the needle into the sample, 0.1 mm At25°C At0°ə	 40 25	74 25	43 22	41 20
Length, sm At25°C At0°C	15 8	20 8,5	18 10	16 9
Softening temperature, °C	48	63	69	76
Brittleness temperature, °C	-18	-22	-26	-40
Elasticity, % at25°Caf0°C	80 70	85 Not checked	95	60
Change in softening temperature after heating, ºC	5	3	2	1
Ignition temperature, °C	210	300	320	350
Kinematic viscosity at 135°C	-	455	4768	5940

Table 3.

Physical and chemical indicators of polyethylene waste

№	Characteristics	Brands of polyethylene waste::					
		A-1	A-2	A-3	B-1	B-2	B-3 B-4
1	Primary raw material	Household waste, caps, packaging materials, plastics			Low-pressure polyethylene waste, production waste		
2	density, g/sm^3	0,915	0,915	0,915	0,945	0,945	0,945
3	Alloy flow index: 21.17 H (2.16 kgs) at load 49.0 H (5.0 kgs) in cargo	0,1-10 -	0,1-10 -	0,1-10 -	- 0,1-35	- 0,1-35	- 0,1-2,0
4	Mass fraction of volatile substances, %	0,30	0,30	0,30	0,30	0,30	0,30
5	Mass fraction of sol, %	5,0	5,0	7,0	5,0	5,0	0,1
6	Maximum tensile strength, MPa	8,0	8,0	8,0	15,0	15,0	15,0
7	Relative elongation at break, MPa	300	300	300	250	250	250
8	Compaction density kg/m3	400	400	250	400	400	400

Table .4.
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Physico chemical properties of industrial wastes produced on the basis of industrial wastes

№	Characteristics	Industrial waste consisting of low and high pressure polyethylene mixtures					
		Brands					
		B-1	B-2	B-3	Q-1	Q-2	Q-3
1	Primaryraw material	Polyethylene industrial waste			Industrial waste consisting oflow and high pressure polyethylene mixtures		
2	density,, g/sm^3	0,915	0,915	0,915	0,915	0,915	0,915
3	Alloy flow index: 21.17 H (2.16 kgs) at load 49.0 H (5.0 kgs) in cargo	0,1-35 0,1-35	0,1-35 0,1-35	0,1-35 0,1-35	0,1-35 0,1-35	0,1-35 0,1-35	0,1-35 0,1-35
4	Mass fraction of volatile substances, %	0,30	0,30	0,30	5,0	5,0	5,0
5	Mass fraction ofsol, %	5,0	5,0	5,0	7,0	7,0	7,0
6	Maximum tensile strength , MPa	8,0	8,0	8,0	8,0	8,0	8,0
7	Relative elongation at break ,MPa	8,0	8,0	8,0	8,0	8,0	8,0
8	Compaction density kg/m3	300	300	300	250	250	250
9	Density of scattering and pouring (ball formation), kg/m3	400	400	400	300	300	300

Polymer-bitumen binder

Polymer-bitumen binder (BBM) is the most important element of the top layer of the asphalt-concrete surface of a modern highway. The life of the road built on the basis of polymer asphalt concrete mixture prepared using PBE is at least 7-8 years longer. We have used the tread rubbers of old tires that are out of service to produce PBU.

The waste of tires that are out of operation increases many times the basic properties of oil road bitumen. The experiments we conducted showed that the received polymer bitumen has strength, water and cold resistance, anti-cracking, heat resistance (up to 85°C), displacement resistance, etc. it was possible to increase the indicators several times. . Although we increase the price of asphalt concrete by 1% by using PBE, its other properties: the long life of the paved road, its environmental friendliness, and the fact that the road surface meets world standards confirm that its use is effective [55-58].

Rubber scrub|RO| The physical-mechanical property of the polymer-bitumen composition prepared on the basis depends on the property of the primary bitumen. Even 2.5% mass of bitumen rubber scrub. h. by giving, the elasticity of such a composition can be raised above 70% at 25°C. RO added to bitumen dramatically increases its viscosity. The aging resistance of the polymer- bitumen composition was studied by the ASTMD 1754 methodology. The obtained results are shown in table 5. As can be seen from table 5, kinematic viscosity at 135°C and dynamic viscosityat 60°C with 2.5% RO addition of kraton DT 1101CS blunt. increases by 2.4 and 3.65 times, respectively.

As can be seen from Table 5, the amount of RO in the polymer-bitumen composition is 2.5%. 4.0%k from h. Increasing h increases both the kinematic viscosity and the dynamic viscosity. At the same time, the physical and mechanical properties of the composition fully meet the requirements of DÜIST 52058-2003.

The high degree of structuring of the polymer-bitumen binder does not allow it to be fully studied.The amount of RO in the polymer-bitumen composition is 6% k. When it reaches h, the "softeningtemperature" increases sharply and it becomes difficult for the needle to enter the sample.

Thus, by changing the amount of RO in the polymer-bitumen binder, it is possible to obtain a modified PBE with any characteristic.

Table .5.

Polymer-bitumen obtained using RO physical and mechanical properties of its composition

Name ofindicators	Bakı 85/25 bitumun göstəriciləri	DÜIST 52056 əsasən tələbat	RO miqdarını -lə modifikasiya olunmuş polimer-bitum		
			2 k. h. RO miqdarını	4 k. h. RO miqdarını	6 k. h. RO miqdarını

The depth of penetration of the needle into the sample (Penetration), 0.1 mm at25°C at0°C	40 25	47 25	64 26	78 27	68 25
Don't lie downı, sm at25°Cat0°C-	15 3	40 3,5	50 13	48 12	53 14
Yumşalma temperaturu, °C	56	48	53	72	78
Change in annealing temperature after heating , °C	3	2	2	1	1
Brittleness temperature , °C	-15	-19	-23	-24	-26
Elasticity ,% at25°Cat0°C	40 30	80 70	75 65	85 74	85 75
Ignition temperature , °C	230	300	340	360	400
Adhesion (sticking) to sand or marble	meets demand				
Fire hazard	it is dangerous				
Kinematic viscosity at135°C Dynamic viscosity at60°C	- -	455 210	980 1806	1914 2947	2102 3048
olume change by ASTMD 1754 method, % mass	after testing				
Residual penetration, %	-	72	80	93	96

Softening temperature, °C	40	53	63	76	85
Elongation at 25°C, %	110	47	45	38	32
Kinematic viscosity at 135°C Dynamic viscosity at 60°C	561 604	570 610	1017 3029	1134 3134	1340 3680

3.3. Polymer asphalt concrete based on oil refinery and rubber waste preparation and application

Comparison of polymer asphalt concrete and asphalt concrete. The main properties of asphalt concrete prepared on the basis of modified bitumen are manifested only during use. The tested polymer asphalt concrete fully met the parameters of DÜIST 28-97 bitumen under operational conditions. Compared to asphalt concrete, polymer asphalt concrete has high deformation, strength,water and mine resistance.

Polymer asphalt concrete has shown to have better deformation properties than asphalt concrete at20ºC (table. 6).

In the mechanical process, Mu P-100 research conducted under dynamic conditions (piston travelspeed 1200 mm/min) showed that the temperature at which the brittle disintegration of asphalt concrete takes place is indeed in the negative temperature region. One of the most important indicators is its tolerance to temperature changes. Physical and mechanical properties of polymer asphalt concrete DÜIST 28-97 prepared on the basis of bitumen modified with HRS were mainly determined and the obtained results are given in table 7. Deformation of asphalt concrete and polymer asphalt concrete was studied under both static and dynamic loading mode.

Table 6.

Properties of polymer asphalt concrete

Name of indicators	Yükün təsir etmə vaxtı, san	Tem peratur, ºC	İstifadə olunan əlaqələndirici			
			Neft bitumu	İstifad ə oluna n bitum	5%-li HRS	10%-li HRS
Balancemodule $E_n \cdot 10 \left(\frac{kq \cdot s}{sm^2}\right)$		+20 -20	1,09 36,5	0,77 8,5	1,57 5,92	3,13 19,5

Deformation module $E \cdot kq \cdot s \cdot 10^{3} / sm^2$	10 0,02	+20 -20 -20	0,24 18,3 133	0,16 4,7 32,2	0,36 3,4 22	0,96 9,4 50,5
Plasticity, P	- -	+20 -20	0,34 0,15 1	0,39 0,149	0,34 0,142	0,28 0,107
The highest viscosity of the conditional-dispersion structure $\eta^{x} \cdot 10^{10} \frac{kqs}{sm^2}$	- - -	+20 -20 -	11,6 488 42	7,6 270 35	15,6 340 22	31,2 1300 42
Aging factor α_0 -until old age α_1 -after aging	-	-20	1,76	1,73	1,39	-

In this case, the bending strength of polymer asphalt concrete is greater than that of asphalt concreteat a positive temperature.

Polymer asphalt concrete prepared on the basis of bitumen modified with HRS has more deformation properties at negative temperature and good brittleness and high dynamic resistance atpositive temperature.

To determine the aging of polymer asphalt concrete, we heated it and determined its acoustic indicators.

As an indicator of aging, it is calculated according to the ratio of the attenuation coefficients of thesound waves in the sample before and after heating at 120ºC for 40 hours.

The elastic-viscous-plastic characteristics of polymer asphalt concrete samples at 50ºC were determined. The obtained results are given in table 7.

Table 7.

Polymer asphalt prepared on the basis of bitumen modified with HRS indicators of brittle-viscous-plastic characteristics of concrete

Name of indicators	BND brand bitumen (prototype)	Polymer – bitumen-based binder (suggested)
The highest plastic viscosity, $\eta_0 10^{4}$, Pa· san	8,5	54,0
1	4,9	23,7

Ən aşağı plastik özlülük η_m11 , Pa· sec		
Dynamic displacement limit, $P_{1<2}$, Pa	4,4	24,0
Equilibrium fragility modulus Gm,P < $P_{1<2}$when it happens Pa	139	463
Voltage reaction cycle q· η_O /Gm· sec	611	1166

Analysis of rheological characteristics shows that the viscosity and brittleness of polymer asphalt concrete prepared on the basis of modified bitumen is 5-6 times higher than that of asphalt concrete.

The effect of HRS viscosity and the granulometric composition of the mineral part was

studied for the preparation of polymer asphalt concrete mixture according to the requirements of DÜIST 52056 – 2003. The obtained results were compared with the properties of asphalt concrete prepared on the basis of standard BND 60/90 and BND 200/300 brand bitumens. 5 k. h. The rheological curve of polymer bitumen and petroleum bitumen prepared on the basis of HRS is given in figure 3. As can be seen from the figure, polymer asphalt concrete obtained on the basis of HRS

modified bitumen is morethe actual strength of asphalt concrete obtained on the basis thanpetroleum bitumen. of

Figure 3 shows that polymer asphalt concrete is more resistant to movement and vibration than asphalt concrete. This is explained by the fact that bitumen modified on the basis of HRS reaches such a high level that it is not found in petroleum bitumen.

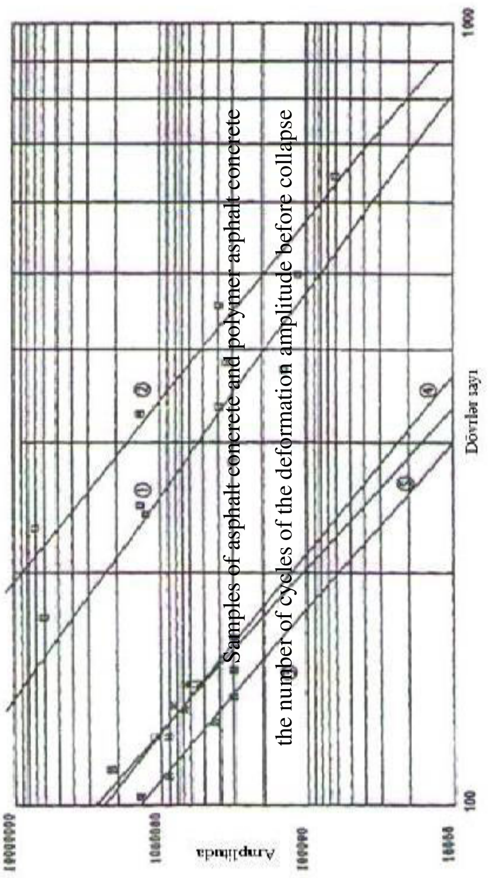

Figure 3. 5 k. h. Rheological curve of polymer bitumen and oil bitumen prepared on the basis of HRS

To prepare polymer asphalt concrete mixture according to the requirements of DÜIST 52056 – 2003

The obtained indicators allow us to say that the displacement tolerance of polymer asphalt concrete
(and) is more durable than asphalt concrete. The sum of ΣR=R20+R50 is taken as strength. Because displacement can occur at 20ºC. We take P=2tg 4+c as the sum of displacement continuity. Polymer asphalt concrete prepared on the basis of modified bitumen based on HRS (type B) P25=98 ΣR=5.61 MPa is less than asphalt concrete type B prepared on the basis of BND 60/90 (P25=48) ΣR=6.4 MPa - P2 .18 and as many as 2.02. In this case, polymer asphalt concrete is more
than asphalt concrete.

These indicators make it possible to reduce R50 and R20 norms for polymer asphalt concrete by 10% compared to asphalt concrete. Polymer asphalt concrete can maintain its basic properties even at high temperatures. This fact can be confirmed by analyzing R0/R50 ratios.

CONCLUSION

We modified "Baku 85/25" branded bitumen with polyethylene, polystyrene, SBS and rubber coating. As a result, we received a high-quality polymer-bitumen composition.
. By adding polymer waste to bitumen, it was possible to increase its viscosity by 2 times and itsstrength by 4 times.
. After modifying the bitumen with polymer waste, we studied the properties of the obtained composition. The obtained results show that the penetration of the prepared sample is 1.4 timeshigher than the standard, and its elasticity is 4 times higher.
Since the physical and chemical properties of bitumen are very low, the asphalt-concrete road surfaces made of them soften in high temperature conditions in the summer months and release toxic chemicals into the atmosphere. In order to prevent all this, we managed to obtain ecologicallyclean bitumen by modifying road-oil bitumen with polymer-based waste. It has been proven by the results of our scientific research that the eco-friendly bitumen we offer is 4 times more flexible thanthe bitumen currently produced on an industrial scale, and it is possible to increase its heat resistance up to 120°C, which creates fertile conditions for its application in the industry.

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