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Integrated Organic Binder from Local Materials of Uzbekistan

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Abstract--- *Integrated organic binders created in Uzbekistan and the CIS countries are considered. The composition and properties of the constituent components of Integrated organic binders (IOB) were studied. The composition of the Integrated organic binders was optimized by the method of mathematical planning of experiments. A model of viscosity of IOB with the content of not enough and defecate is obtained.*

Keywords--- *Dispersed Systems, Deformability, Elasticity, Framework, Gossypol Resin, Integrated Organic Binders, Sufficient Kinetic Stability*.

I. INTRODUCTION

The basic scientific principle of obtaining Integrated organic binders is good compatibility of components, sufficient kinetic stability of the obtained binders, and ensuring the required set of technological and operational properties.

Due to the increasing volumes of construction and repair of roads with asphalt concrete pavement, there is a shortage of viscous bitumen in Uzbekistan. Therefore, the production and use of alternative types of organic binders from local raw materials and industrial waste remains an urgent task.

Intergrated organic binder, being a dispersed system, consists of heavy products of oil and coal processing (heavy oil, viscous and liquid bitumen, coal tar, tar, etc.), as well as various additives, surfactants, polymers and highly dispersed fillers (gossypol resin, oil sludge, lime, etc.).

The main prerequisite for obtaining use of alternative species is the idea of them as dispersed systems with an optimal volume of the dispersed phase, which forms a spatial coagulation framework that provides strength and heat resistance, and with a dispersion medium that determines the necessary deformability and elasticity. Moreover, in cases where a polymer is used in the composition of the IOB, along with the coagulation framework, an elastic structural network is formed in the system, which provides or increases the strength, heat resistance, elasticity, and crack resistance of the system [1-5].

One of the promising alternative binders is a intergrated organic binder based on oil, gossypol resin and structure-forming additives [6-8].

II. COMPONENTS OF AN INTEGRATED ORGANIC BINDER

To obtain Integrated organic binders used: Dzharkurgan oil; gossypol resin is a waste of the Yangiyul oil and fat plant; structure-forming additives - dispersed powders (not enough and defecate) - chemical and sugar production wastes.

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Dzharkurgan oil belongs to the class of heavy oils and is characterized by the following properties [9-11]:

Density, at *20 °C, g/sm*^{3}, not less 0,9
Conditional viscosity, at *60 °C, 5 mm, s,* not less 9
Flash point in an open crucible, *°C,* not less 75
Paraffin content, %, no more 7,0
Water content, %, no more 5,0
Content of mechanical impurities, %, no more 0,2
Group oil composition:
- asphaltenes, masses % 8,8
- oil mass % 45,2
- resin mass % 46

Gossypol resin is a waste of the Yangiyul oil and fat factory. The resin contains from 52 to 64 % of synthetic fatty acids and their derivatives, the rest is the products of condensation and polymerization of gossypol and its conversion.

Gossypol resin has the following properties:

Appearance	uniform viscous fluid mass
Color	dark brown to black
Acid number, mg/g	70 - 100
Solubility in acetone, %, not less than	80
Mass fraction of ash, %, no more	1,0
Mass fraction of moisture and volatiles substances, %, no more	4,0

"not enough" is a product after the extinguishing of lime - a waste product of caprolactam. Composition and weight content of chemical elements (compounds) in the waste, in %:

Appearance. .....white powder
Calcium carbonate ($CaCO_3$) 60
Impurities 10
Humidity 30
Hazard Class III
Flammability .....incombustible

The filter cake (defecate) is a calcium-lime waste of sugar production, formed during the purification of diffusion juice, contains 75 80 % $CaCO_3$ and 20 - 25 % organic and mineral non-sugars, including nitrogenous and without nitrogenous organic compounds (proteins, pectin substances, calcium salts of oxalic, citric, malic and other acids, saponin, mineral substances, etc.).

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Ozokerite was used as a mineral powder for asphalt concrete. The powder is a waste of ozokerite production. The difference in the content of ozokerite in powder samples of one batch should not exceed ± 0.5 % of the mass. The properties of the powder must meet the requirements specified in the table. 1.

Table 1: Properties of ozokerite mineral powder

The name of indicators	Indicators
Grain composition, % by weight, not less than	
smaller than 1.25 mm	100
finer 0.315 mm	90
finer 0.071 mm	70
Porosity, % by volume, not more than	35
Powder swelling	
with bitumen, % by volume, no more	2,5
Bitumen consumption rate, g, not more than	65
Humidity, % by mass, no more	1,0

III. Optimization Of Composition Of An Integrated Organic Binder

The mathematical method experiment planning performs the optimization of the composition of the DLC.

When optimizing the composition of the Integrated organic binders, the influence of the following factors was studied: X_1 - content of HS, %; X_2 - the amount was missing from the content (defecate) of the HS,%; X_3 is the temperature of the heating of oil and gas. The intervals of variation of variable factors for the CVD are given in table 2.

The optimized parameter is the viscosity of Integrated organic binders, which was determined by the standard method. The choice of zero levels was made in such a way that the optimized parameter (viscosity) should take optimal values, the coordinates of zero levels should lie within the definition areas at a certain distance from their boundaries.

Table 2: Intervals of variation of variable factors with not enough (defect)

Factors	Units rev.	The code	Levels of variation		
			-1	0	1
HS content	%	X_1	30	40	50
The amount of deficient (defecate) from the content of the HS	%	X_2	5	10	15
Temperature of warming up oil and gas	°C	X_3	120	140	160

The maximum and minimum values of the factors were assigned on the basis of technological requirements for Integrated organic binders based on a priori information and preliminary studies.

According to the conditions of the problem being solved, research objectives and the area of results use, plan B3 was selected. The number of measurements is 15, according to the determinant B3 this plan is close to D3 - the

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optimal plans, and the value is det A. This is one of the best plans for describing the process in the entire studied area. The matrix of plans and the results of the active experiment are given in table. 3.

Because of the corresponding calculations, we obtained viscosity models of integrated organic binders with the content of not enough and defecate:

- for missing:

$У=197,66 +3,12X_1+2,59X_2+2,12X_3-0,84X_1^2-1,698X_3^2-1,675X_1X_3$

- for defecate:

$У=199+4,15X_1-3,47X_2+2,12X_3-2,23X_2^2-1,975X_1X_2-2,25X_1X_3+1,6X_2X_3$

For clarity, the analysis of the obtained models can be performed graphically. The graphical dependences of the change in the viscosity of the KOV of variable variables are shown in fig. 1 and 2. Analysis of the above models of viscosity IOB showed the following:

Table 3: Matrix of the 3-factor plan for Integrated organic binders with the content of not enough l (defecate)

№ Experience	**Planning matrix (Xi)**				**Viscosity, s**
	X_0	**X_1**	**X_2**	**X_3**	
1	1	-1	-1	1	150/170
2	1	1	-1	-1	198/150
3	1	-1	1	-1	162/165
4	1	1	1	1	187/186
5	1	-1	-1	-1	225/207
6	1	1	-1	1	198/190
7	1	-1	1	1	220/220
8	1	1	1	-1	167/210
9	1	-1,215	0	0	185/205
10	1	1,215	0	0	163/230
11	1	0	-1,215	0	225/225
12	1	0	1,215	0	230/200
13	1	0	0	-1,215	200/172
14	1	0	0	1,215	225/230
15	1	0	0	0	230/225

Note. The numerator shows the viscosity with not enough, the denominator with the defect.

- The most significant factor affecting the viscosity of Integrated organic binders with the addition of not enough and defecate is the content of HS, because the coefficients of the regression equation in both equations with this factor turned out to be the largest;

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- The next factor in terms of the significance of the effect on the viscosity of IOB turned out to be the content of the mineral additive in the first case, and in the second case the defect;
- The least significant factor of those considered was temperature of warming up oil and gas, because the coefficients of the regression equation with this factor have the smallest values.

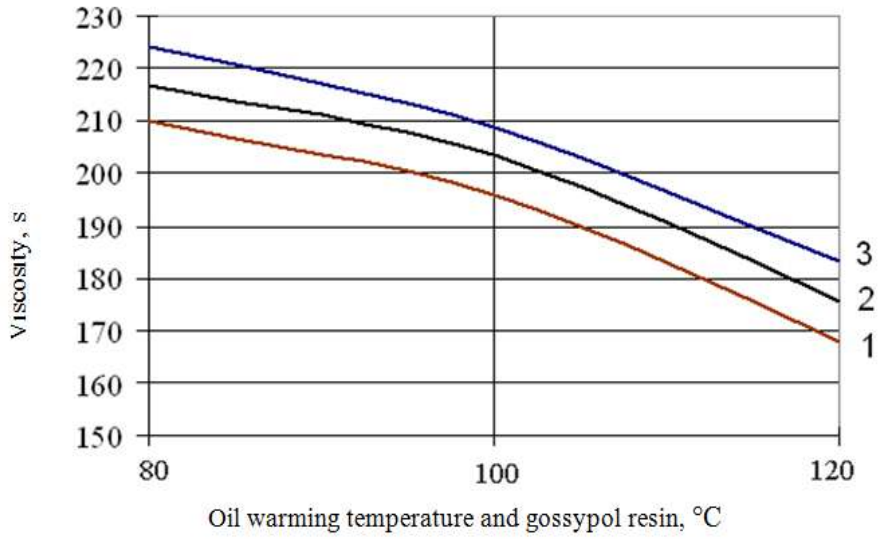

Figure 1: Dependence of the viscosity of Integrated organic binders on the content of HS. At a flow rate of 10 % of the gas supply, the heating temperature was 120 (1), 140 (2),0 (3) °C, respectively

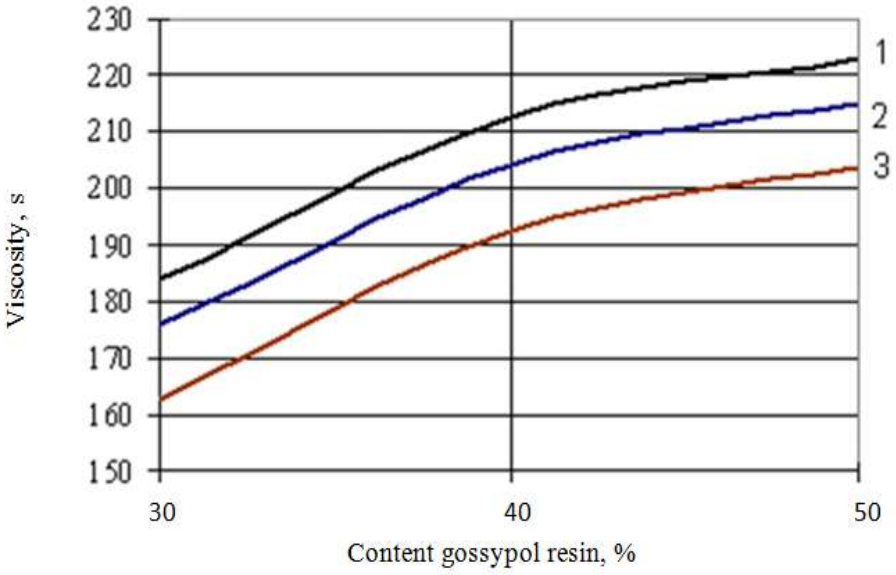

Figure 2: The dependence of the viscosity of Integrated organic binders from temperature warming up oil and gas. When the content was less than 10 % of the HS, the content of the HS was 30 (1), 40 (2), 50 (3) %, respectively.

An analysis of the graphical dependences of the viscosity of Integrated organic binders on the studied variable factors showed the following:

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- Curves of changes in the viscosity of Integrated organic binders from the studied variable factors are of the same nature;
- Change in the viscosity of Integrated organic binders is not extreme. Therefore, the optimal values of the content of HS were taken from technical and economic considerations and for both cases amounted to 40 %;
- The most optimal value of the viscosity of IOB from the content of mineral additives (defecate and not enough), based on the experience of previously obtained results, showed that with the introduction of 10 % of the content of HS the necessary viscosity is achieved;
- The change in the viscosity of Integrated organic binders from the temperature of heating the oil and HS is also not extreme, therefore, the optimal value was chosen from technical and economic considerations, and amounted to 120 °C [12-14] :.

The ratio of the constituent components of the Integrated organic binders is determined by calculation in% by weight:

Dzharkurgan oil 58
Gossypol resin 42
not enough (defecate) from the content of the HS 10

IV. CONCLUSION

Consequently, obtained Integrated organic binders compositions in viscosity meet the standard requirements for road liquid bitumen MG 130/200.

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