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THE COMPOSİTE BASED ON MODİFİED EPOXY OLİGOMER

Abstract: *Epoxy oligomers occupy the second place in the world in terms of production (the first place - the phenol-formaldehyde oligomer). This is due to the fact that it has many valuable properties. One of the main properties is high viscosity. Due to this, it is used as a binder in the preparation of multi-purpose composites. Oligomers produced by different brands in terms of the number of epoxy groups included in their composition differ from each other in many respects and have certain disadvantages. In order to eliminate the shortcomings in the research work, for the first time during the synthesis, the epoxy oligomer was modified with acetamide and the coating composition was developed on its basis. As a result, the main indicators of both the co-oligomer, including heat resistance and adhesion resistance, and the composite coating obtained on its basis are increased by about 1.0 – 1.4 times.*

Key words: *epoxy oligomer, modification, composition, filler, anticorrosive coat.*
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Introduction

Numerous research works have been carried out in the field of technology and application of epoxy oligomers, and research work in this direction, especially in order to further improve its physical-mechanical and operational performance, is one of the urgent problems. The main characteristics of the connectors (oligomers) used to protect equipment and devices used on an industrial scale from corrosion should always be in focus. When preparing the coating composition, the other components should be selected in such a way that they are both economically and environmentally favorable, do not cause accidents during operation of equipment and facilities, increase reliability, obtain a clean product and, most importantly, to some extent help to protect the metal stock [1 -2]. In order to increase the resistance of the epoxy oligomer to heat and aggressive environments, it was modified with acetamide in a known way, the main physicochemical, physico-mechanical, spectral, as well as performance characteristics of the obtained soligomer were studied. In parallel, a study was performed on unmodified epoxy oligomer for comparison.

Boxite sludge (industrial waste) was used as a filler, polyethylene-polyamide as a binder, and acetone as a solvent in the preparation of the modified soligomer and the unmodified oligomer-based composite for comparison purposes.

The durability of the coating composition prepared using acetamide as a binder from the first modified epoxy sooligomer and as a filler from bauxite sludge from industrial wastes was tested in different environments (in sea water, produced water, oil, gasoline) and positive results were obtained [3 - 11].

EXPERIMENTAL PART AND DISCUSSION.

In the process of chemical modification of the epoxy oligomer (copolycondensation) 1 mole of diphenylolpropane, 3 moles of epichlorohydrin and 0.4 moles of acetamide, NaOH calculated as a catalyst were obtained. It is maintained in the reaction medium in the range of pH = 8 - 9. Dipheniolpropane is first mixed until completely dissolved in the alkaline solution, then epichlorohydrin is gradually added to the mixture from a dropping funnel, the reaction mass is stirred continuously at 70-75 ^{0}C for 30 minutes, and acetamide (modifier) is added in portions. After administration of the modifier, the temperature is raised to 85 ^{0}C, stirred for 30 min and the pH of the reaction mass is checked again. If necessary, alkaline solution is added and the temperature is raised to 90-95 ^{0}C. At this temperature, the reaction mass is stirred for 60 minutes. The resulting sooligomer is transferred from the laboratory reactor to the porcelain bowl, washed several times (until a neutral reaction) with water and dried in a vacuum drying cabinet to a constant weight. The resulting sooligomer is dark yellow.

The main parameters of acetamide-modified sooligomer and unmodified oligomer have been studied by known methods [12-14]. It is clear from Table 1 that the main values of acetamide-modified oligomer are about 1.0 to 1.4 times higher than those of unmodified oligomer.

Table 1. Main indicators of modified co-oligomer and unmodified oligomer

№	Indicators	Unmodified epoxy oligomer	Modified co-oligomer by acetylamide
1.	Amount of epoxy groups, %	18.6 - 19.4	14.2 -16.8
2.	Amount of hydroxyl groups, %	0.8 - 1.0	1.4 - 1.8
3.	Molecular weight	350 - 420	450 - 560
4.	Adhesive strength, MPa	20 - 23	30 - 35
5.	Heat resistance, ^{0}C	118 - 120	142 - 156
6.	Density, kq/m^3	1240 - 1250	1280 - 1320
7.	Softening temperature, ^{0}C	65 - 70	74 - 80
8.	Degree of hardening, %	94 - 96	97 - 98

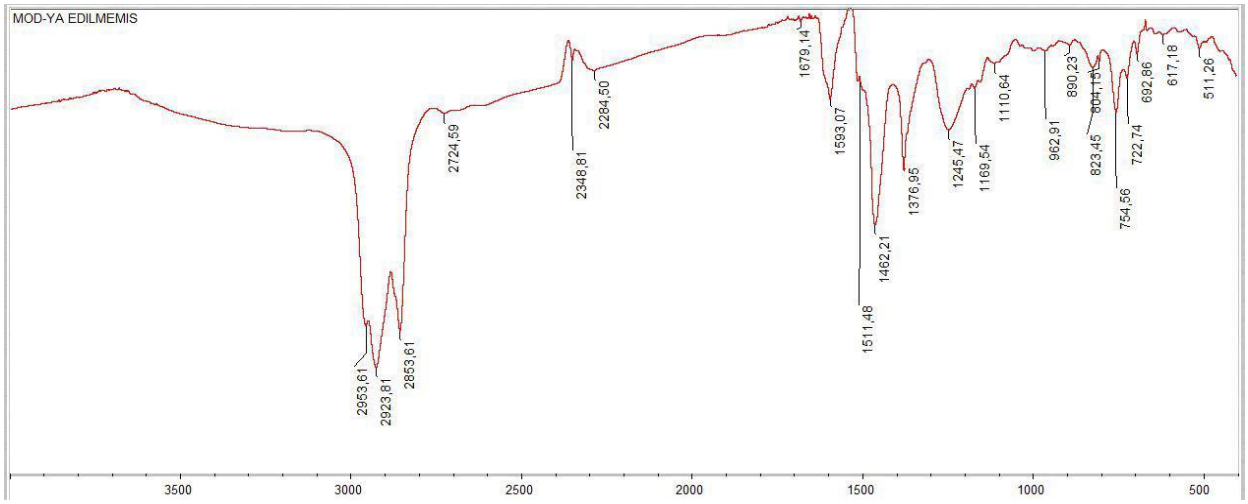
Molecular weight distribution (MWD) of acetamide-modified epoxy co-oligomer was studied by liquid chromatography (exclusive) by the method of chromatography of Rovo firm (Czech Republic). The MWD values of compounds obtained both by the method of polycondensation and copolondication are given in table 2 [15].

Table 2. Molecular mass distribution of acetamide-modified epoxy co-oligomer

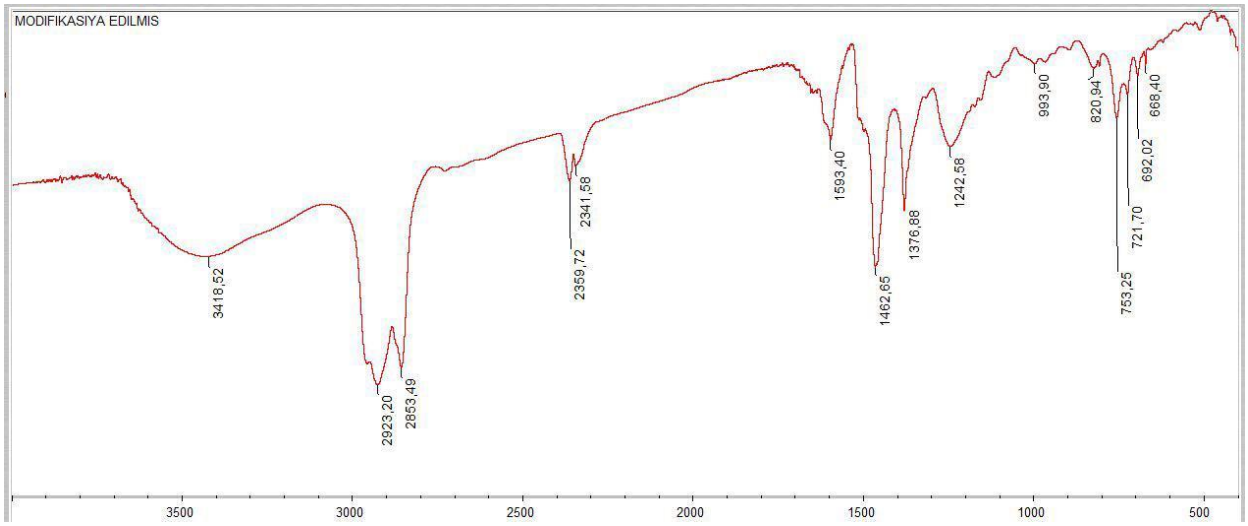
№	Samples	Fraction, %	Molecular mass distribution			V_{Rmax}
			M_w	M_n	M_w/M_n	
1.	Oligomer	76	2389	1370	1.74	11.5 (1680)
2.	Co-oligomer	24	1862	316	2.6	15 (400)

It was found that the molecular weight distribution of the unmodified epoxy oligomer Mw / Mn is 1.74, and the molecular weight distribution of the acetamide-modified epoxy soligomer Mw / Mn is 2.6, ie the fraction with a higher molecular weight is the epoxy oligomer modified with acetamide. Analysis of the IR, NMR, DTA and TQA spectra of the modified epoxy oligomer also showed that as a result of chemical modification, the heat-resistant sooligomer retains functional groups that have been synthesized [16].

Picture 1.



Picture 2.



The composition of the coating composition is given in Table 3.

Table 3. The composition of the coating composition

№	Components	Amount of component, m.f.
1.	Modified epoxy oligomer	45 - 50
2.	Bauxite slime	3 - 5
3.	Polyethylene polyamine	2 - 3
4.	Acetone	50 - 42

Bauxite sludge, which is a waste of alunite processing during the preparation of the coating composition, is a disperse compound with a density of 3700 kg /m^3 and its composition is as follows:

Fe_2O_3 - 48.75 %; Al_2O_3 - 25.56 %; MgO - 5.0 %; SiO_2 - 4.98 %; SO_2 - 1.62 %; CaO -1.32 %; Na_2O + K_2O -1.26 % and 11.51 % volatile compounds.

The metal oxides in the bauxite sludge have a certain effect on the strength of the intermolecular interactions, resulting in a composite with high performance. The effect of the filler on the composite depends on many factors, such as the shape, size, amount of particles in the system, compatibility with the binder, and so on. The presence of filler in the composite contributes to the strengthening of interfacial connections and the increase of its complex physical-mechanical and operational performance. Particles with dimensions of 100 ÷ 1000 nm were used in the research. The particle size of the filler is determined in the "MASTERSIZER-3000" device.

The drying time of the coating composition is 3 days at room temperature and 3-5 hours at 140-150 ^{0}C.

The main parameters of the coating composition were studied (Table 4).

Table 4. The main parameters of the coating composition

№	Parameters	The composition based on unmodified epoxy oligomer	The composition based on modified epoxy oligomer
1.	Viscosity with VZ-4 device, sec.	45 - 50	58 - 60
2.	Adhesive strength, MPa	32 - 34	36 - 38
3.	Hardness, (c.u.)	0.85 – 0.88	0.89 – 0.92
4.	Flexibility, mm (ШГ-1)	2 - 3	4 - 5

The durability of the acetamide-modified epoxy oligomer-based coating composition after 30 days was 0.058 % in seawater, 0.325 % in produced water, 1.045 % in oil, and 1.024 % in gasoline.

Conclusion

1. The main parameters of the chemically modified epoxy oligomer with acetamide were studied for the first time.

2. Using the modified soligomer as a binder, a coating composition was prepared and the main parameters were determined.

3. The durability of the coating composition in different environments was tested.

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