Some questions of clearing of a liquid glass from painting extrinsic

V.V. Bagramjan
Scientific-Industrial and Planning Joint-Stock Company "Stone and Silicates "Acharyan str.40[a] Yerevan, Republic of Armenia

Results of researching of clearing of a liquid glass from painting extrinsic are given. The new way of clearing of a liquid glass from oxide iron is developed by preliminary magnetic processing with the further temperature processing at presence precipitant . It is established, that iron in liquid glass is as complex salts of type aegirine NaFe $(SiO_3)_2 \cdot nH_2O$, and after clearing are formed slightly soluble ironscalclum silicates of structure CaFe $(SiO_3)_4 \cdot nH_2O$. Influence of various factors - intensity of an electromagnetic field, temperature of processing, quantity precipitant. time of processing, speed of submission of a solution for a degree of clearing of a liquid glass is investigated. preliminary electromagnetic processing with the further introduction precipitant. results interface of two methods in deep clearing a liquid glass from oxide iron is provisional on two order.

Until recently to cleanliness of liquid glasses $(Na_2O \cdot 3SiO_2)$ it was not showed special requirements. However with development of a hydrothermal way of preparation of complex glass charge on the basis of a liquid glass, its cleanliness becomes one of the basic and determining parameters of its quality. At hydrothermal processing rocks with an alkaline solution in silicate solutions pass connections of iron, which further pass in glass charge and pollute it. The problem of clearing of a liquid glass from iron is pressing question. The decision of the specified problem will allow to expand a raw-material base glass industry. Dissolve silicates of alkaline metals concern to number of difficultly cleared systems. At a parity of silicon dioxide to alkali in solute silicate of sodium =1 clearing of painting extrinsic is realized by crystalline modification. In process of increase silicon dioxide the module, and also in the concentrated solutions clearing even more is at a loss. In works [1-4] ways of clearing of silicate connections and industrial drip are described by their hashing with a cleaning liquid at heating, centrifuging and branches of a liquid phase filtration. It is necessary to note, that the specified methods of clearing are less effective, and decrease of concentration of extrinsic occurs approximately on one order.

Special interest represents found out an opportunity of clearing of solutions of silicates of alkaline metals developed by us the most simple and convenient way preliminary electromagnetic processing with the further sedimentation of extrinsic as silicates. Last years electromagnetic processing of water and water systems has found wide applying in an intensification technological process [5-7]. At magnetic processing water and water systems it is possible to make sedimentation colloidal particles, dispergation in pseudo-solutions.

In silicon dioxide containing rocks iron is basically as α - Fe_2O_3, γ - Fe_2O_3, Fe_3O_4, [8] and aluminum - as in alkaline alum silicate. As authors mark in work [9], reaction between oxides iron and soda proceeds in two-stages with formation ferrite of sodium. Probably, analogical reaction goes at reception of a liquid glass from silicon dioxide containing rocks:

$$2NaOH + Fe_2O_3 = 2NaFeO_2 + H_2O$$

Thus interaction of ferrite of sodium with the formed silicate of sodium is possible:

$$NaFeO_2 + Na_2O \cdot nSiO_2 \rightarrow Na\,[Fe\,(SiO_3)_2] \cdot nH_2O$$

With the purpose of clearing silicates of alkaline metals of painting extrinsic, in particular from iron, the important value has finding - out of a status of iron in silicates. For this purpose solubility oxide iron and silicate of iron in solution NaOH and in liquid glass is investigated. Experiments were carried out in laboratory autoclave to installation at 160 ^{0}C within 1,5 hours (conditions the same, as at reception of a liquid glass from perlite).

The following systems are considered:

1. $NaOH - Fe_2O_3 - SiO_2 - H_2O$
2. $NaOH - Fe_2O_3 \cdot nSiO_2 - H_2O$
3. $Na_2O \cdot nSiO_2 - Fe_2O_3 \cdot nSiO_2 - H_2O$

In first case SiO_2 completely passes in a solution as a liquid glass , which cooperates with Fe_2O_3 and forms натриевожелезистые silicates. At a firm phase is present Fe_2O_3, and quantity Fe_2O_3, passing in a solution, makes 0.3g/l. In second case NaOH cooperates with SiO_2 silicate of iron and liquid glass is formed, and part NaOH with silicate of iron forms natriumferruterous silicate, according to the chemical analysis. The quantity dissolved silicate of iron in the formed solution of silicate of natrium makes in about 0.9 g/l (in recalculation on Fe_2O_3).In the third case the quantity of the dissolved silicate of iron in a solution of silicate of sodium makes in about 0.5 g/l (in recalculation Fe_2O_3).Rentgenographic and in IR - the spectroscopic analysis of the substances allocated from solutions centrifuging , has shown that in the first system iron passes in a solution as aegirine which dissociates cation on Na + and complex anion $FeSi_2O_6^-$ [10,11] .In two others systems are formed amorphous natriumferruterous silicates. In table 1. frequencies of maximal of strips of absorption in IR-spectra in comparison with the literary data are given. Intensive strips absorb with maximum at 1025 - 1030 sm^{-1} are a little bit displaced from the value of 1100 sm^{-1} peculiar silicon dioxide and testify to presence of connection Si-O-Me, in this case about connection Si-O-Fe. 975 sm^{-1} is caused valent fluctuation connections Si - O - H. From the above-stated data it is possible to draw a conclusion, that at reception of a liquid glass from perlite iron passes in a solution as aegirine, thus concentration of oxides in liquid glass does not exceed some iron 0.05 g/l.

Table 1. Frequencies of maximal of strips absorbed in IR spector
Researched systems (sm^{-1})

Our given			Literary given (11)
Systems			
NaOH-Fe_2O_3-SiO_2-H_2O	NaOH-$Fe_2O_3nSiO_2$-H_2O	Na_2OnSiO_2-$Fe_2O_3SiO_2$-H_2O	$NaFeSi_2O_6$ aegirine
1050	1050	1025	1059
1003	1005	1005	1004
965	955	945	950
892	897	897	897
725	725	735	725
630	640	660	639
565	570	560	560
530	545	540	545
503	505	504	507
470	460	450	467

To clearing a liquid glass were applied physic - chemical methods of sedimentation of painting extrinsic. Sedimentation of extrinsic carried out two-stages: at the first stage carried out ionization of a solution passing it through electromagnetic installation, and in the second stage entered into a solution in quality precipitant just prepared carbosilicate calcium, and temperature of a reactionary mix lifted up to 90 - 95 ^0C carbosilicate calcium received as follows: on heated up to 90 - 95 ^0C liquid glass added a solution of soda and oxide calcium. The part oxide calcium, reacting with natriumferruterous silicate, forms calciumferruterous silicate:

$$2NaFe\,(SiO_3)_2 + CaO \rightarrow CaFe_2\,(SiO_3)_4 + 2Na^+$$

Other part oxide calcium forms carbosilicate calcium according to reaction

$$Na_2CO_3 + 2CaO + Na_2O^{\cdot}\,3SiO_2 \rightarrow CaCO_3^{\cdot}\,CaSiO_3^{\cdot}\,nH_2O + Na_2O^{\cdot}\,2SiO_2$$

Formed carbosilicate calcium, having the big specific surface with high adsorptive ability, adsorbs on the surface formed slightly soluble calciumferruterous silicate, particles are integrated, grow heavy and become possible seperate them from a solution. Formation silicate calciumferruterous silicate confirms rentgenographic and IR-spectroscopic analyses. Researches on clearing a liquid glass were carried out by us developed multisection to electromagnetic installation stationary a current tension 1500 kA/m. Liquid glass subjected electromagnetic processing, pumping over it through a pipe from a not magnetic material, converging between poles of the device. Experiences carried out with various modules and concentration of a liquid glass in which contents Fe_2O_3 changed from 0.025 - 0.04 g/l, and at different values of intensity of a magnetic field. In table 2. optimum conditions and results clearing of a liquid glass from Fe_2O_3 by a method electromagnetic processings at presence precipitant are given.

Table 2. Results clearing of a liquid glass from Fe_2O_3 a method of electromagnetic processing.

N	Initial contents Fe_2O_3, g/l	Tension of magnetic field, kA/m	Speed of submission, m/s	Quantity CaO, g/l	Residual contents Fe_2O_3, g/l	Coefficient clearing
1.	0.028	-	-	0.5	0.008	3.5
2.	0.030	-	-	0.4	0.007	4.2
3.	0.032	1080	4.5	0.6	0.0008	40.0
4.	0.030	1100	3.9	0.5	0.0004	75.0
5.	0.035	1050	4.0	0.8	0.0007	50.0
6.	0.030	1100	4.2	0.5	0.0005	60.0
7.	0.042	1100	3.9	0.5	0.0005	84.0
8.	0.038	1100	4.3	0.6	0.0005	76.0
9.	0.032	1100	3.9	0.5	0.0005	64.0
10.	0.030	1100	4.0	0.5	0.0004	75.0

Shown, that conjugative two methods - electromagnetic processing of a water solution with further introduction CaO owing to deep clearing in results of formation slightly soluting calciumferrurerous silicate and carbosilicate calcium - a collector, is direct in clearing solution. Thus the contents painting extrinsic iron, in liquid glass is reduced on two order. Influences of various factors (intensity of an electromagnetic field, speed of submission of a liquid, quantity preciptant etc.) on a degree of clearing of initial solutions is investigated. It is known, that in the basic connections silicon is included into structure of inorganic polymers where structural units are connected with each other covalent by connection only through one atom of oxygen. These rather simple structural units in turn may be united in polymeric chains, tapes, grids. In water solutions of connections of silicon structural units also are connected with each other covalent by connection only on donor - acceptor to the mechanism due to one electron hydrogen owing to what it is formed hydrogen chains. Octahedrons FeO_6 or tetrahedrons FeO_4 take part in formation polymeric alkaline natriumferruterous silicate alongside with tetrahedron SiO_4. Under influence of a magnetic field on silicate solutions it is possible depolymerisation natriumferruterous silicate from - for weak hydrogen connections. In a result it is formed monomeasures natriumferruterous silicate, which dissociates on ions Na^+ and $FeSiO_6^-$. At addition precipitant (CaO) ferruterous silicate is formed slightly soluted calciumferruterous silicate.

[1] Movsisyan M.S., Gevorkyan A.T. "*Research on rational use raw and fuel-power resources in the glass industry* ", M., 1984, pg. 109-119.

[2] Tohyama I., Ueda T., Nakamura T. Processing of the sewage containing toxic extrinsic with the help of silicate calcia. R M Chemistry, 1974, 17 and 520.

[3] Mesropyan R.A. A way of clearing of silicate connections. A.s. USSR N 686997, B.I.35, 1979.

[4] Danilova L.K., Ivchenko K.P., Shchevchenko I.K., Dubova N.D.Way of clearing of a solution silicate of a block. A-s. USSR   N 783226. And 44,1980.

[5] Meliksetyan L.A., Aroyan G.A., Meliksetyan F.Z. a way of reception glass charge   for manufacture of colourless glasses. A-s. USSR N 808381, B.I.8, 1981.

[6] Klassen V. I. Magnification of   water systems. M., " Chemistry", 1982, 295pg.

[7] Questions of the theory and practice of magnetic processing of water and water systems under ed. Klassena V.I., M., 1971, 316pg.

[8] Bershov L.V., Marfuny A.S., Minaeeva R.M., Nasedkin V.V. About stabilized roles of iron in structure of natural glasses. RAS USSR, 1983, m.268, N 4, pg. 960 - 963.

[9] Lileeev I.S. Chemistry and technology oxide aluminium. Leningrad, 1940, 166pg.

[10] Litvin B.N., Poiolitov V.I. Hydrothermal synthesis of inorganic connections. Science, M., 1984,183pg

[11] Lazarev A.N. Oscillatory spectra and a structure of silicates. Science,L.,   1968,346pg.