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PROSPECTS FOR THE USE OF GALVANIC CASTINGS IN THE PRODUCTION OF GLASS PRODUCTS

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Abstract
It is possible to practically use galvanic coatings as high-quality dyers in obtaining decorative glass products. The Institute of Glass Research, has been proven to obtain coloured glass products by using zinc sulfate, nickel sulfate, sodium hyposulfite, copper chloride and iron oxide preservative wastes in the glass production process.

Keywords: Galvanic castings, glass products, chemical production enterprises, production of colored glass.

Introduction

This type of waste is generated in the process of evaporation and filtration in chemical production enterprises. When a radiographic analysis of the crystal space of the solid residue formed in sodium oxide beneficiation is obtained, the composition of the waste in this form is as follows;

$CuCl_2 \cdot 2NH_4C1 \cdot 2H_2O, NH_4Cl$ *and* $CuCl_2 \cdot 2NH_4C\mathrm{l}_n \cdot nH_2O, Na_2SO_4$ *and* $K_2Zn_2(SO_4)_3$

Such components can be used as high-quality raw materials in the preparation of omixta in the traditional way. They can be cooked in gas and electric ovens. When studying the physico-chemical, optical and technological properties of the obtained product, it was found that this type of solid waste can be used instead of traditional raw materials [1-3].

In particular, colored glass, painted on the basis of such waste, which preserves transition element oxides, can be used in construction and industry. In research institutes, by adding 0.5 to 1% of dry and 2% moisture content of galvanic deposits to the mixture, it is possible to obtain flat glass, mosaics and three-component glass. Depending on the chemical composition of galvanic deposits, it has been proven that it is possible to obtain glass products of green (bottle), light blue, dark brown and dark gray (tiles) colors [4-9].

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The Main Part

"Yakor" scientific and industrial association with the following composition (%), 10Sa; 9.09 Cr; 3.4 Ni; 6.8 Zn; 11.36 Fe; 4 Cu; 3.5 Pb; 5.45 A12O3; 2.27F; Gray colored glass was obtained by mixing 2.27W galvanic capacitor. In the scientific and production association named "Salyut" with the following content (%), 15 Cr; 0.001W; 2.1 Al; 11.1 Fe; 1.2 Zn; 0.42 Mg; Green and grey glass blocks and tiles were produced by adding Ni-containing galvanic paste to the mixture [10-13].

It has been proven that it is possible to use chrome-preservative waste generated in the production of galvanic products in the painting of decorative glass products [14-20]. The advantage of the obtained product is that, in addition to the blowing method, it is possible to produce products by casting and pressing [15-19]. Usually, this mixture is made based on quartz sand, soda, potash, kaolin, boron, sodium sulfate, and clay. Due to the presence of Cr, Ni, Fe, Zn, Cu, and Ti when analyzing the composition of the dried Galvanic casting, it is possible to paint glass products by adding them to traditional raw materials. Clear glass can be obtained by changing the amount of chromium (%) in the mixture. In this case, the glass is coloured from colourless to dark green:

By adding 10% galvanic acid to the mix, you can get black-coloured tiles with a metallic surface. These products can be obtained in glass baking furnaces at 1410-1460 °C.

Forming glass products at 1160-1240 °C by various methods, for example by pressing - glass blocks; decorative tiles and marbles by rolling and pouring; transparent lighting parts for fittings are obtained by blowing. This type of glass product has quite important physical and mechanical properties: density 2470-2700 kg/m3, heat resistance 83-120 °C, bending strength 39-45 MPa, microhardness 765.5-893.0 MPa.

The use of chromium-preserving wastes of electrolysis enterprises creates the opportunity to obtain high-quality dyes that give colour to glass, and to save precious and rare raw materials. Employees of the Institute of Glass Research synthesized phosphate glass resistant to aggressive environments and hydrofluoric acids by the cementation method based on copper waste from galvanic products manufacturing enterprises. By adding up to 8% of this type of component to the glass, it is possible to reduce the temperature during the glass baking process and increase the tendency of copper cations to recover.

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Due to the regenerative ability of the atomic state, copper can be used in a wide range of applications in the production of decorative marble and glass products.

It was proved in that it is possible to obtain a green glass container by using the used electrolytes of electrolysis plants with the help of dyers who give colour to the glass. Based on the indicators determined in the research, this type of liquid electrolyte waste can be added to the glass mixture in an optimal amount.

Physico-chemical properties show that it is possible to obtain coloured glassware by adding liquid electrolyte waste to the obtained glass products.

It was found in practice that it is possible to paint glass through the coagulation processes of electrochemical production enterprises]. The pulp is in the form of pulp in an acidic environment with a pH of 4. When using this form of powder, it is first neutralized in a weak solution of sodium carbonate and dried at 373 K, then ground in a porcelain mortar. A decorative glass product can be obtained by adding the resulting dark brown fine dispersive powder to the glass mixture. It is possible to use the solids formed in the coagulation equipment as a dye in the production of coloured glass, as well as in painting the surface of glass marbles.

In recent years, several types of research have been carried out on the use of blast furnace slags, iron smelting, non-ferrous metallurgy, and chemical production, as well as waste generated in thermal power plants (IES) on a large scale in the production of building materials. In the production of cast iron, 40-60% of waste is generated in the blast furnace. This waste consists of 30-35% magnesium compounds, iron, manganese, magnesium ferrite, 15-30% silica, and 3-10% lead [20-24].

It is possible to obtain nickel, copper, zinc, lead and other types of metals as well as sulfate ores from non-ferrous metallurgical deposits. Non-ferrous metallurgical deposits contain a mixture of Fe_2O_3 with 15-48% FeO, up to 10.5% MgO, 17% Al_2O_3 and 23% CaO.

It is formed during the processing of chemical production deposits, apatite and phosphorites. The composition of waste in such Wrinish consists of CaO, SiO_2, and P. The chemical composition of fuel deposits includes SiO_2, Al, Fe, Ca, and Mg.

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Blast furnace waste is completely recycled in the USA and Germany, and 90-95% in other countries. Blast furnace slag is used in the production of binders, ceramics, glass and other types of products in Japan and Slovakia. In the production of glass products, blast furnace slags are used [25-27].

Babashev D.A. conducted research on the possibility of synthesizing white slakosital based on phosphorus deposits.

It has been proven that solo sites with high physical and chemical properties can be obtained based on zols [26-29]. It was shown in the work that it is possible to obtain a glass crystal product based on the ingots formed during the production of chromate products.

Most of the waste generated in the chemical industry is generated in the production of mineral fertilizers, soda, chlorine, and rubber technical products. Phosphogypsum is one of the wastes that pollute the environment by many tons. Today, 100 million tons of phosphogypsum waste is generated worldwide. The possibility of using phosphogypsum in obtaining glass and glass crystal products was determined in [25-30].

Determined Physico-chemical indicators show that such waste contributes to the formation of aluminosilicates. Glass crystal products can be obtained by changing the heat treatment conditions. By forming an artiste and wollastonite, they increase chemical and thermal resistance and increase mechanical strength. By using such waste in the process of glass baking in the production of glass crystal products, today there is an opportunity to use rare and valuable raw materials as replacement raw materials for alumina and alkaline components: soda, sulfates, nitrates, and carbonates.

One of the ways to solve these tasks is to replace scarce and valuable products with cheap waste and secondary raw materials, the possibilities of introducing methods and using raw materials at a minimum value are presented in the source.

Spatial representation of metallic inclusions in glass and other crystalline compounds is shown, the resulting crystal space is similar to that of melilite and gelenite. The crystallization process of several solids can be observed only in spinel by immediate cooling.

In obtaining homogeneous glass, the fluorite beneficiation enterprise (FBE) determined the new composition of glass, heat treatment temperature and time, and glass formation fog based on the use of flotation waste-less-slag.

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The glass firing process was carried out at 1400-1450 °C.

By replacing traditional raw materials with metal production waste, it is possible to reduce costs in glass production, as well as solve several problems of environmental protection. It has been proven that the waste generated in the production of low-carbon ferrochrome can be used in the production of green glass. Also, the process of producing brown glass containers from blast furnace wastes of metal-producing enterprises was implemented.

Ferrochrome slag is enriched and processed, blast furnace slag is cleaned using magnetic separators. These types of castings contain quality oxide modifiers. It is included in the mixture together with dolomite. Quartz sand, slag, soda, sodium sulfate, calcium and magnesium oxides are cooked together in the mixture for obtaining green and brown glass.

Ferrochrome slag contains Cr_2O_3, and blast furnace slags contain Fe_2O_3 and other impurities, which can be used to obtain green and brown glass based on such dyes. Inexpensive castings of this type not only produce oxides necessary for coloured glass, and high-quality dyes, but are also convenient from an economic point of view.

The baking process is carried out in 3.5 hours at a temperature of 1350-1400. Holding time in the oven is 1.5 hours. Traditional methods are used to check some properties of dark green and brown glass samples.

Viscosity by the MVOxotin method, the specified indices in the glass composition: the temperature range of formation $T_o = (T_s - T_a)$, the relative speed of the bottle forming machine $Vn = (Ts - 450)/(Ts - TA) + 80$ and the crystallization index $Ki = (T_s - Ta) - 170$ can be determined.

The obtained indices must correspond to the predetermined interval. The moulding temperature range is 170-180 °C, the relative speed of the glass moulding machine is 104-110%, and the crystallinity index should be positive. Thermal properties of the obtained glass: the thermal expansion of the glass from room temperature to the softening temperature of the glass is determined in a vertical quartz dilatometer. In the dilatometer, Tg (glass transition temperature) and Tw (starting melting temperature) are determined by the MVOxotin method. The chemical resistance of the glass has been determined in practice to be water resistant at 98 °C, and this type of green and brown coloured glass belongs to the III-hydrolysis class of the water resistance class. The properties of the obtained sample meet all requirements.

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Results

Based on research results and theoretical calculation books, it is possible to produce green and brown transparent glass containers with properties that meet all requirements by adding up to 10% of additives to the glass mixture.

A number of discoveries have been made in the application of chemical industry waste to increase the heat resistance of coloured glass products. One of them is the composition of the mixture proposed for obtaining coloured glass as follows (%), soda 7.0-11.0; quartz sand 73.0-75.0; boron 3.0-5.0; Burnt red powder consists of 11.0-15.0.

Table 1. The composition of the coloured glass obtained on the basis of red ink

Raw materials	***Content, (%);***		
	1	**2**	**3**
Soda	**7.0**	**9.0**	**11.0**
Quartz sand	**73.0**	**74.0**	**75.0**
There is	**5.0**	**4.0**	**3.0**
My red heart	**15.0**	**13.0**	**11.0**
Heat resistance of glass, ⍰	**80-85**	**80-85**	**80-85**

Usually, the composition of the mixture for obtaining coloured glass is as follows (%), soda 5,020.0; quartz sand 30.0-80.0; colouring additives 0.01-8.0. Red slag is a byproduct of bauxite (Al2O3*nH_2O), aluminium oxide Al_2O_3 production. The chemical composition of this mixture (%), SiO2 9.5-11.1; TiO2 4.4-5.6; Al_2O_3 17.0-19.0; Fe_2O_3 39.0-42.9; CaO 7.6-9.5; Na_2O consists of 6.2-6.9 and other additives.

Products of this appearance can be obtained in all types of glass baking furnaces at 1450 °C. The colour of the resulting bottle is green.

In the production of coloured glass products, the mixture with the following composition Sh.Y. It was discovered by Alekseevna. The composition of the solution he discovered (%): soda 15.0-20.0; quartz sand 54.5-64.5; dried chromium preservative 20.0-25.0. The amount of raw materials in the following composition (%): CrO_3 total-9.8; CrO_3 dissolved in water-3,4; CrO_3 dissolved in acid-1.6; CaO active-2.37; CaO total -21.4; MgO-35.7; Fe_2O_3- 19.2; ACO_3-2.85; SiO_2-4.8; technical sulfur consists of 0.2-0.5. This type of coloured glass can be obtained in electric furnaces at 1400 °C.

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Table 2. The composition of the glass obtained based on chromium-containing waste

Raw materials	*Content, (%);*		
	1	**2**	**3**
Soda	**20.**	**17.5**	**15.0**
Quartz sand	54.5	59.8	64.5
Dried chrome	25.0	22.5	20.0
Technical sulfur	0.5	0.2	0.5

The composition of the mixture consists of sulfur, a toxic chromium(III) preservative, and chromium(III). The glass obtained on the basis of this type of dye is green to brown in colour.

The mixture for obtaining coloured glass consists of soda, quartz sand, dye additive-dry galvanic powder and boron. Amount of raw materials (%): soda-7.0-11.0; quartz sand-46.0-58.0; boron-3.0-5.0; galvanic pressure-30.0-40.0.

The chemical composition of the galvanic alloy was analyzed and the number of additives in it (%: SiO_2-10.78; AbO_3-2.73; Fe_2O_3-12.9; FeO-0.33; TiO_2 -0.21; Cr_2Ob-1.08; NiO-0.46; CuO-7.09; ZnO-1.42; CaO-27.85; MgO-2.12; SOs-1.75; K_2O-0.88; Na_2O- 2.18 and the rest the percentage of additives was 28.21. These kinds of deposits are formed in the process of neutralization and cleaning of enterprises producing galvanic products. The waste itself forms an ultradispersed and microheterogeneous colloidal dispersed system, it does not dissolve in water. The dry powder is galvanic The appearance of the powder is black, and the size of the powder is 0.38 μm, it consists of calcite, quartz, heavy metal hydroxides, hematite, and chromium oxides.

Table 3. The composition of coloured glass obtained on the basis of galvanic waste

Raw materials	*Composition, (%)*		
	1	2	3
Soda	7.0	9.0	11.0
Quartz sand	58.0	52.0	46.0
There is	5.0	4.0	3.0
Dried galvanic deposit	30.0	35.0	40.0

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Glass with this composition can be obtained at 1400 °C in various types of glass baking furnaces. The resulting glass product is green in colour.

The new composition of decorative tiles discovered by the author of the composition of the mixture he proposed is as follows: crushed glass 56.0-69.9%, natural volcanic deposits 25.0-35.0%, kaolin 3.0-7.0%, boron is 2.0-3.0%. The resulting mixture is pressed at 9-10% humidity and baked at 850-970 °C.

Obtaining decorative tiles by mixing 92.0-63.0% crushed glass, 35.0-0.5% waste from nickel and copper production, 3.0-2.0% sodium chloride the author of the work suggested that the chemical composition (%) of the waste generated in the production of nickel and copper is as follows SiO_2 35-40; FeO 31-35; Fe_2O_3 2.5-4.5; MgO 7-11; non-ferrous metals; nickel; It consists of copper and 0.3-0.2 cobalt oxide and is ground to 0.5-2.0mm. All raw materials are mixed and baked at 800-950 °C.

The authors justified the production of coloured glass crystal products based on chemical industry waste. The composition (%) of the mixture they proposed is as follows: SiO_2 15; AbO3 71.66; CaO 1.76; MgO 5.51; MnO_2 0.05; N_2O 1.58; Fe_2O_3 1.93; K_2O 2.20; TiO_2 0.31, high alumina preservative 0.5-25, boron oxide 20-60, soda 10-50, liquid glass 5-10.

The following content (mass.%) in the production of coloured slag based on the waste of the metal production industry: SiO_2 - 16.5; AkO_3 -6.21; MgO - 9.57; CaO - 44.85; MnO - 7.33; FeO -14.67; SO_3 - 0.37; P_2O_5 - 0.5 and again in the following ratio (mass.%): broken glass - 44.5-65.0; blast furnace deposits - 0.5-40.0; boron - 10.0-20.0; Li_2CO_3 - 2.0-5.0; K_2CO_3 - 3.0-6.0; They discovered ZnO - 0.5-3.5. The glass firing temperature is 1250-1300 °C.

The mixture composition (mass.%) in obtaining grey glass is as follows: SiO2 6775, Na_2O 10-20, CaO 5-15; MgO 0-7, M_2O_3 0-7, and K_2O 0-7 were discovered. Iron oxide from 0.20 to 0.40%, selenium from 0.0002 to 0.0020%, cobalt oxide from 0.0025 to 0.0060%, and titanium oxide from 1% were used for painting.

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