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SYNTHESIS AND RESEARCH OF CHELATE PRODUCING SORBENTS BASED ON MELAMINE, FORMALINE AND DICARBONIC ACIDS

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Abstract. This article conducted the synthesis of SORBENT on the basis of Melamine, Formalin and Lemonic acid (MFL) and MFL, formalin, and sadronic acid (MFQ). At the same time, the ratio of original substances from the main parameters in the process of synthesis, 2: 3: 6, the effect of important parameters such as 100-120 02C and environment PH = 8. Also during the polyconencing process, temperatures and time effects, as well as the structure of the Sarbent obtained using the ionic exchange and static infliction of the temperature, and the structure of the sorbent. According to the results, productivity of raction field is 92%.

Keywords: Melamines: Formalin, citric acid, polyconindation, Raman spectrommetry.

Introduction.

Most heavy metals are toxic at low concentrations. Although Mn, Cu, Zn etc. are elements needed by biological activities at parts per million levels, they are essential to maintain the metabolism of the human body. As we know, one of the main tasks of sorbents is intermediate cleaning of sorption of various metal ions in different solutions. For this purpose, the prospects of using triethylenediamine $N(CH_2\text{-}CH_2)_3N$ (TEDA) sorbents based on silica gel with slightly high porosity for cleaning 137Cs, ^{90}Sr, ^{90}Y and d-element ions (Cu^{2+}, Ni^{2+}) from aqueous solutions have been studied[2] . The results show that ^{90}Sr, ^{90}Y radionuclides, as well as Cu^{2+}, Ni^{2+} ions are well sorbed in KSKG containing 0.01-6.72 wt% TEDA [3]. In addition, the equilibrium time of sorption of these sorbents was reached within 3 hours, while the capacity of sorbents for copper Cu^{2+} varied from 63 to 320 mg, and it mainly depends on the conditions of sorbent synthesis, researchers S.A. Kulyukhin and M.P. Gorbacheva noted. Krasavina E.P. and others determined that the sorption capacity of these sorbents for Ni^{2+} does not exceed 130 mg per gram of sorbent [4]. In this study, a novel nanobiomaterial based on (3-aminopropyl)triethoxysilane (APTES)-coated iron oxide. The adsorption isotherms were electrochemically investigated and it was shown that the adsorption capacity of the nanoparticles towards heavy metals decreased in the following order: $Cu^{2+} > Pb^{2+} > Cd^{2+}$[5].

Purpose of work. The purpose of the research is to study the synthesis of sorbent obtained by polycondensation based on melamine, formalin and citric acid (MFL), as well as melamine, formalin and succinic acid (MFQ).

Materials. For the synthesis of these sorbents, substances such as melamine, formalin and citric acid (MFL), as well as melamine, formalin and succinic acid were obtained. In the experiment, "pure" and "chemically pure" reagents were used. Reagent solutions were prepared by dissolving a specific sample in a certain volume of solvents.

Methods. The results of the research were analyzed using devices such as HORIBA Scientific Raman spectrometer (range 400–4000 cm-1). was held. The interpretation of the spectra was carried out with the help of basic software that performs automatic measurement of spectra, has tools for graphical display of spectra and their parts, and organizes work with the user's spectrum library.

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2. Experimental part

Synthesis of sorbents. 2.52 g (0.02 mol) of melamine was dissolved in 5 ml (0.06 mol) of formalin and NH4OH solution was added until pH=8. The temperature was heated at 80-90 0C until a viscous mass was formed. 3.54 g (0.03 mol) of citric acid (a separate experiment was conducted for succinic acid in the same mole ratio) was added dropwise to the resulting viscous mixture in 5 ml of NH4OH and mixed. When the temperature increased to 100-120 0C, a solid or gummy mass was formed. The resulting resinous mass was placed in a porcelain bowl and dried in a drying cabinet at a temperature of 95 0C for 20 hours. After the dried polymer was crushed, the low molecular weight substances were washed first with 5% NaOH solution and then several times with distilled water until it became neutral. As a result, a white granular mass consisting of small pores was formed. Product yield was 92%.

Moisture content of the obtained sorbent according to GOST 10898.1–84, mass density according to GOST 10898.2–84, density of the sorbent in the hydrated state according to GOST 10898.3–84, specific volume of the swollen sorbent according to GOST 10898.4-84, static exchange capacity - GOST 20255.1-89 was determined.

3. Results and Its Discussion

A polycondensation reaction type sorbent (ion exchanger) was obtained, which is aimed at systematizing the properties of sorbents and providing them with effective performance.

Studies on the influence of alternative temperatures on the process of polycondensation of melamine, formalin and citric acid (MFL) were conducted. The polycondensation process was studied at temperatures of 100, 110, 120 and 130 ^{0}C. At the same time, the time dependence of the reaction, the specific volume of the sorbent in water and the value of static exchange capacity (SAS) for 0.1 n NaOH solution were determined. Data are presented in Table 1.

Table 1.

Effect of temperature on ion exchange properties during polycondensation

	Reaction temperature T, °C	**Reaction time τ, hours**	**Specific volume of sorbent H form in water, ml/g**	**SAS, in mg-eq/g of 0.1 N NaOH solution**
		MFL		
.	100	5-6,5	1,6	2,9
.	110	4,5-5	1,4	3,2
.	120	2,5-3	1,1	4,0
.	130	1,5-2	1,0	3,9
		MFQ		
.	100	5-6,5	1,7	2,8
.	110	4,5-5	1,5	3,2

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.	120	2,5-3	1,2	3,9
.	130	1,5-2	1,1	3,8

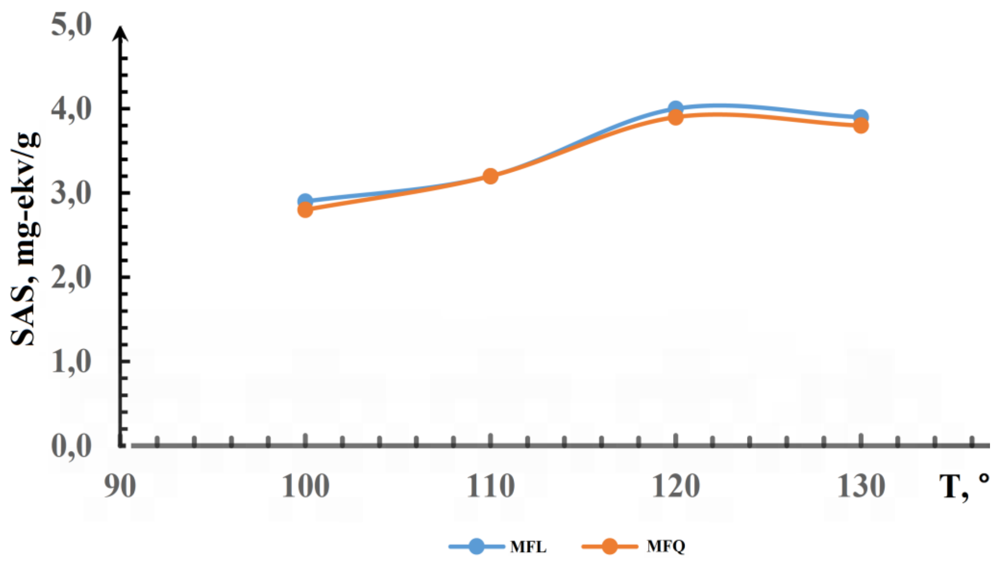

Figure 1. Graph of static exchange capacity of synthesized MFL and MFQ sorbents as a function of temperature.

The results presented in Table 1 and Figure 1 show that the duration of the polycondensation reaction at 100°C is 5-6.5 hours, and the exchange capacity of the ion exchanger is 2.9 mg-eq/g for MFL and 2.8 for MFQ mg-eq/g. This is due to the low activity of reactants at a certain temperature. As the reaction temperature increases to 130 °C, the polycondensation reaction proceeds rapidly, and the reaction time decreases to 1.5-2 hours, while the value of the exchange capacity and the level of ion exchanger swelling also decrease. It seems that the structure of the ion exchanger formed at a certain temperature is more dense, as a result of which the mobility of ionogenic groups becomes difficult.

120 °C was taken as an alternative temperature for polycondensation, the reaction time was 2.5–3 h, the reaction was homogeneous, and the exchange capacity for 0.1 N NaOH solution was 4.0 mg-eq/g for MFL and 4.0 mg-eq/g for MFQ and it was determined to have a value of 3.9 mg-eq/g.

Along with chemical analysis methods, the use of physico-chemical methods is also important in studying the structural structure and main properties of the synthesized ionite. A Raman spectrometer was used to establish the structure of the obtained ionites.

Analyses of Sorbents. The Raman spectrometer results of the obtained sorbent show that in Figure 2a, the valence vibration frequency of the -OH bond in the MFL sorbent is in the area of 3128.42 cm^{-1}, the valence vibration frequency of the -NH bond is in the area of 3055.95 cm^{-1}, -C The vibrational frequency of the =O bond is in the area of 1667.83 cm^{-1}, the deformational vibration frequency of the -NH bond is in the area of 1568.20 cm^{-1}, the asymmetric vibrational

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frequency of the -COO- bond is in the area of 1725.93 cm^{-1}, and the ether bond The symmetric vibrational frequency of 1176.01 cm^{-1} was formed in the field.

In Figure 2b, the valence vibration frequency of the -NH bond in the MFQ sorbent is in the area of 3073.29 cm^{-1}, the vibration frequency of the -C=O bond is 1619.23 cm^{-1} in the area, and the deformational vibration frequency of the -NH bond is 1563.94 cm^{-1} area, the asymmetric vibrational frequency of -COO- bond was formed at 1730.19 cm^{-1} area, and the symmetric vibrational frequency of ether bond was formed at 1175.84 cm^{-1} area.

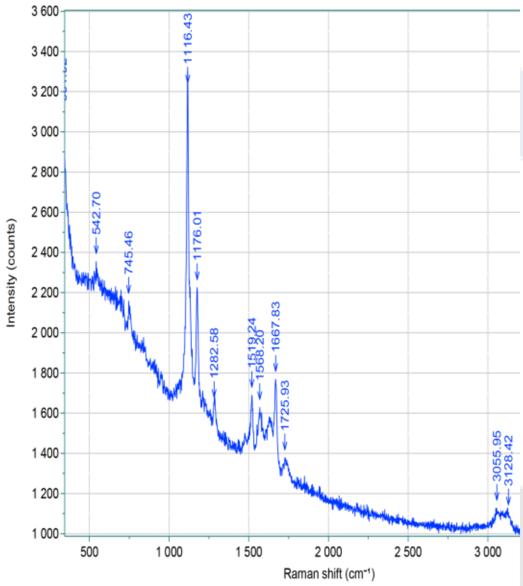

Figure 2a. Raman spectrum of MFL sorbent.

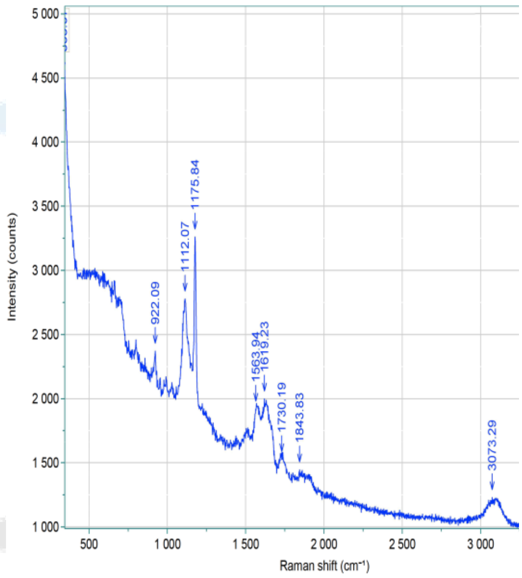

Figure 2b. Raman spectrum of MFQ sorbent.

4. Conclusion

Chelating sorbents were obtained as a result of the polycondensation reaction of melamine, formalin and citric acid, as well as melamine, formalin and succinic acid. Alternative conditions for the synthesis of the obtained sorbents were determined. The structure of the obtained ion exchangers was studied using a Raman spectrometer.

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