

APPLICATION OF MODIFIED SORBENTS BASED ON POLYACRYLONITRILE FIBER IN THE PURIFICATION OF NATURAL WATERS FROM COPPER IONS

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ABSTRACT:

This article presents the methods of analysis that are suitable for use in stationary laboratory conditions, even at the sampling site. Such methods should be accompanied by high sensitivity and selectivity, simplicity and cheapness. Determination of the amount of the following substances, as a rule, their properties related to the concentration of extraction or the phases of ion exchange, etc., is revealed.

Keywords: extraction, solvent, analytical, methods, modified, research, covalent, polymerological

INTRODUCTION:

Nowadays, more and more attention is being paid to methods of analysis that are suitable for use not only in stationary laboratory conditions, but also specifically at the sampling site. Such methods should have high sensitivity and selectivity combined with expressiveness, simplicity and low cost. The determination of the following amounts of substances, as a rule, is preceded by the stages of their extraction concentration or ion exchange separation, etc. It is known that the effective extraction of trace amounts of elements with a small volume of organic solvent from large volumes of the aqueous phase is difficult due to the mutual solubility of the phases and the complexity of their separation.

Sorption concentration in combination with the measurement of the analytical signal

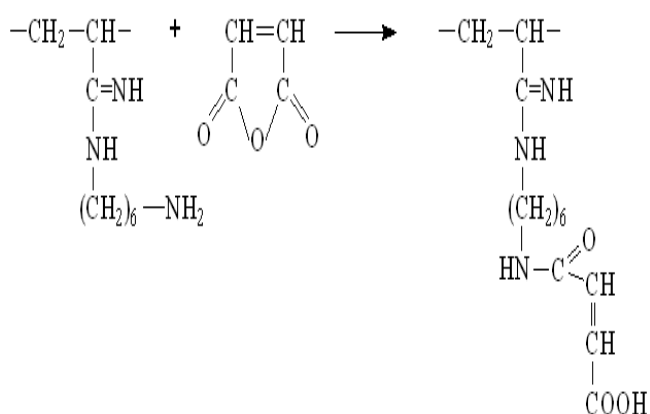
on the surface makes it possible to lower the detection limit of the detected components by several orders of magnitude, and the use of sorbents modified with specific analytical reagents makes it possible to increase the selectivity of the analysis. To transfer the determined compound to the sorbent phase, various methods are used, for example, the analyzed substance is extracted from the solution with a sorbent modified with the corresponding organic or inorganic analytical reagent. The method is the most promising, in particular for environmental control, for two main reasons. First of all, the ionic strength of the solution has less influence on the formation of the colored compound in the sorbent phase than in the solution. Secondly, the reagent that affects the state of chemical equilibrium in the studied ecosystem practically does not pass from the surface of the sorbent to the water phase. Recent studies have shown that the chemical and analytical properties of modified reagents, especially the complexing ability, often differ markedly from their properties in solution. The chemistry of the interaction in the two-phase system "determined substance in solution-analytical reagent", fixed on the surface of a solid carrier, has not been sufficiently studied.

The main advantage of modified sorbents created by covalent grafting of reagents is their chemical and mechanical stability. The disadvantages include the complexity and complexity of the processes of modification and regeneration of such systems. Modified sorbents serve as the basis for a number of composite materials.

As it is known, the natural waters of areas with non-ferrous metal production are contaminated with toxic heavy metal ions, in particular copper ions. The use of these waters in agriculture leads to a deterioration of the ecological situation in the region. These waters can hardly be used to produce drinking water. Therefore, in recent years, complex-forming sorbents obtained by polymeranalogical reaction methods have been widely used in ion exchange and complexation reactions.

In order to expand the arsenal of sorbents based on nitron and .To obtain ion-exchange fibers with complex-forming functional groups capable of forming complexes with metal ions, we performed a chemical transformation of the SMA-1 fiber (a product of nitron modification with hexamethylenediamine) with maleic anhydride.

It is known that the interaction of these functional groups with maleic anhydride (MA) forms complex-forming groups.



By studying the ion-exchange properties of the obtained fibers, it is shown that the fibers modified with maleic anhydride form complexes with Cu⁺⁺ions.

The interaction of functional groups of fibrous materials with low-molecular-weight ions is usually considered as a heterogeneous chemical reaction, which is characterized by thermodynamic features. The sorption of Cu⁺⁺ ions by the resulting sorbent has an

equilibrium character. Therefore, the determination of the values of the sorption equilibrium constant and the change in the thermodynamic parameters of the process allow us to characterize the processes most fully.

When the temperature increases from 20 to 40°C, the rate of sorption of Cu⁺⁺ and its content in the sorbents increases. The increase in the Cu⁺⁺ content in the sorbent with an increase in the process temperature is explained by the fact that the absorption of Cu⁺⁺ occurs due to chemisorption.

Based on the obtained results, the values of the maximum specific sorption at different concentrations and temperatures were determined.

From the dependence of 1/G on 1/S, the values of K_R and R_∞ were found, which are given in the table. Based on the values of the equilibrium constants at different temperatures, the values of changes in the thermodynamic parameters of the sorption process are determined. The results of calculating the changes in the thermodynamic functions of the sorption process are shown in the table, and show that, during the sorption of Cu⁺⁺ with the CMA-1-MA sorbent, the Gibbs free energy, the enthalpy and the entropy of the system decreases. In practice, the spontaneity of the process is ensured mainly by reducing the enthalpy of the system.

Table. Changes in thermodynamic functions during the sorption of Cu⁺⁺ ions by CMA-1-MA fibrous sorbents.

T, K	G _∞ ·10 ³ , mol/g	K, l/mol	- ΔGJ/mol	- ΔHJ /mol	-ΔS _J /mol·K
93	1,0	1333,3	17519,6	800 0	35,8
03	1,4	943,4	17245,5		35,5
13	1,6	877,2	17626,4		33,1

Thus, the found values of changes in the thermodynamic functions allow us to bring some clarity to the thermodynamics of the complexation of Cu^{++} with the sorbent under study. The decrease in the enthalpy of the system indicates Cu^{++} binding mainly due to ionic binding.

The fibrous structure of the obtained chemisorption materials, due to their highly developed specific surface area and high sorption rate, opens up wide opportunities for using them in a number of technological processes of the chemical industry, in particular for cleaning harmful compounds of gas emissions and wastewater, as well as for capturing the valuable substances contained in them. Very effective use of theirs for nature protection and protection of workers from harmful substances and concentration by capturing particularly valuable substances from highly diluted solutions.

In order to recommend a sorbent for the treatment of waste water and technological solutions from copper ions, a technical regime for the dynamic sorption of copper ions from artificial solutions was developed. To do this, the sorbent was stuffed into a column with a density of 0.2 g / cm³, activated with 0.1 N NaOH solution and passed a solution of CuSO_4 with a concentration of 1 g/l. At the same time, the dynamic exchange capacity (DOE) of the sorbent for Cu(II) ions reached 63 mg/g at a solution pH of 4.2 and 113mg/g at pH=12. From the data obtained, it can be seen that the sorption of copper by the sorbent depends on the pH of the solution and is determined by the ionic state of the copper ions. The obtained data show that copper sorption is observed even in acidic environments, where there is no ionization of carboxyl groups. Therefore, under these conditions, the sorption of copper occurs mainly due to chelation. For the practical use of sorption materials, the sorbent regeneration cycle is very important.

The sorbent was regenerated with 0.1 N H_2SO_4 solution. It is established that the sorbent exhibits high chemical resistance and can be used repeatedly. As can be seen from the data in the table, during the ten times sorption-desorption process, the DOE of the sorbent changed only by 25%.

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