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SOME PROPERTIES OF CADMIUM COMPLEX OF GLYCERIC ACID

Dildora Suyarova
Graduate student of Gulistan State University
Shahnoza Bekhnazarova
Graduate student of Gulistan State University
O'zNU, Professor of the Faculty of Chemistry
d.o.h., prof. Nurmanov S.E. based on the review

Abstract: The article studies the reaction of cadmium with glycyrrhizic acid and mentions methods for obtaining a complex compound (Cd-R). The results of studying the physicochemical properties of the resulting complex compound were also presented and the structure of the Cd-R complex was studied by IR spectroscopy.

Key words: glycyrrhizic acid, cadmium, ecotoxicants, structure, spectral characteristics, IR - spectroscopy, complexation.

Enter. Today, one of the most urgent environmental problems in the world is environmental pollution with ecotoxicants. The emergence of ecotoxicants is also related to the accumulation of toxic organic compounds in the environment and the production of new substances that pose a threat to the ecosystem.

Therefore, in recent years, food safety problems caused by the contamination of water, air and soil with heavy and toxic metals are becoming more and more serious. Taking into account the presence of heavy and toxic metals in food and their strong carcinogenicity, it is necessary to develop effective methods for the analysis of their content in water, air and soil, as well as in food and products.

The results of studying the adverse effects of heavy and toxic metal compounds on the environment confirmed their high toxicity.

Literature review

Currently, there is increasing interest in the methods of physico-chemical analysis using plant substances to concentrate and extract heavy metal ions, radionuclides, organic and other ecotoxicants from wastewater and surface water [1-3]. At the same time, it is noted that the use of expensive synthetic sorption materials for the extraction of heavy metals at low concentrations is not always economically feasible. One of such plant substances is glycyrrhizinic acid and its derivatives, the chemical mechanism of their effect on cadmium ion is considered to be an effective way to study by spectroscopic methods.

In view of this, the development of express, selective, highly sensitive spectrophotometric methods for the analysis of cadmium ions using new effective combined methods for the isolation, concentration, and determination of analytical reagents from plant objects individually, glycyrrhizin the combination of acid with cadmium was obtained.

First, 2 g of glycyrrhizic acid and 0.2 g of cadmium chloride salt are weighed on an analytical scale and dried in a muffle furnace for 2.5 hours. Then 25ml of each solution was taken and mixed together. The resulting mixture was mixed in a magnetic stirrer for 5 hours. Then it was separated from its solvent and dried in a lyophilizer.

Glycyrrhizic acid is a physiologically active compound, and its solution in freshly prepared ethyl alcohol was used as a ligand. In the course of our research, the structure of the salt of GK obtained with cadmium was studied spectroscopically.

It should be noted that the development of biosorption technologies helps to enrich the analytical methods of pre-concentration, which is especially necessary for the determination of ultra-micro amounts and residual trace concentrations of ecotoxicants. Thus, the use of renewable raw materials to create effective reagents or biosorbents for analytical purposes is of particular importance [3-6].

The interest of ecologists and analytical chemists in the determination of cadmium ion, as well as its content in drinking and industrial waters, is strictly regulated by the relevant GOST O'zR. [7-8].

Research Methodology

To carry out the research work, solutions of the following substances were used: freshly prepared organic solvents (ethyl alcohol, acetone, benzene), as well as solutions of $Cd(NO_3)_2$ salt. An initial solution of the reagent was prepared by dissolving an accurately weighed portion of it in ethyl alcohol, which had previously been recrystallized twice in an aqueous ethanol solution.

For transport, it was processed with ethyl alcohol, acetone, benzene (2:1:1) systems. 10% alcohol solution of sulfuric acid (H2SO4) was controlled in iodine chambers to reveal chromatographic spots.

Continuous stirring during the reaction was carried out in a MM-5 TU 25-11834-80 magnetic stirrer. Organic solvents were removed from the system by evaporation in an IR-1M2 rotary evaporator. A lyophilic device (AutomaticFREEZE-Dryer10-010) was used for drying, and a PTP TU 25-11-1144 device was used to measure the liquid temperature of substances.

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Analysis and results

Since glycyrrhizic acid is a tribasic acid, it forms trisubstituted salts. Its lithium, sodium, cadmium, potassium and ammonium salts are obtained. They are mainly obtained by treating the solution of technical glycyrrhizic acid in acetone or alcohol with the alcohol solution of the above metal hydroxides and ammonia. When the formed salts are dissolved in glacial acetic acid, they change to a substituted salt state. In this case, the carboxyl group in the carbohydrate part changes from the salt state to the acid state [4-5].

Glycyrrhizic acid forms water-soluble salts with some heavy and non-ferrous metal ions (manganese, cobalt, nickel, copper I, II). In particular, a pale yellow compound is formed with cadmium without the presence of a buffer solution. Physicochemical constants of the initially obtained substance were determined.

The IR-spectroscopy method was used to analyze the molecular complex formation. IR spectroscopy is the most widely used analytical method of analysis because it is simple, easy to analyze, and available in most laboratories. This method is one of the most widely used physical methods for the analysis of molecular complexes of substances, and allows to characterize the connections between functional groups during the formation of a molecular complex.

The IR spectrum of GK includes signals associated with valence vibrations of C=O bonds connected to carboxyl groups (1719 and 1701 cm–1) and double bond (1640 cm–1). The region of asymmetric valence vibrations of the C=O bond in COO was determined at 1587 cm-1. Valence vibrations of CO bonds in the C–O–C and C–OH groups of the carbohydrate part of GK are manifested in the form of many absorption signals in the region of 1200–1000 cm–1, with the main maxima at 1035 cm–1 (Fig. 1).

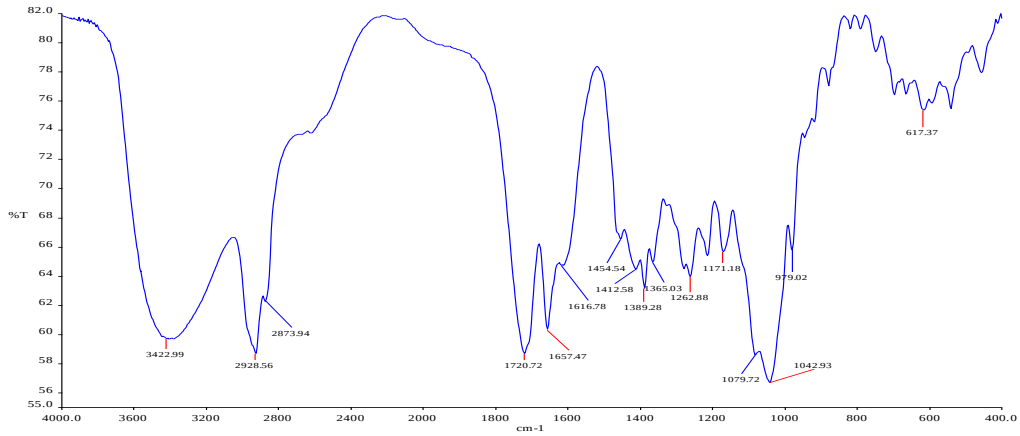

Figure 1. IR spectrum of glycyrrhizic acid

The obtained IR-spectrum of cadmium diglycyrrhizinate was analyzed by comparison with the IR-spectrum of GK (Fig. 2).

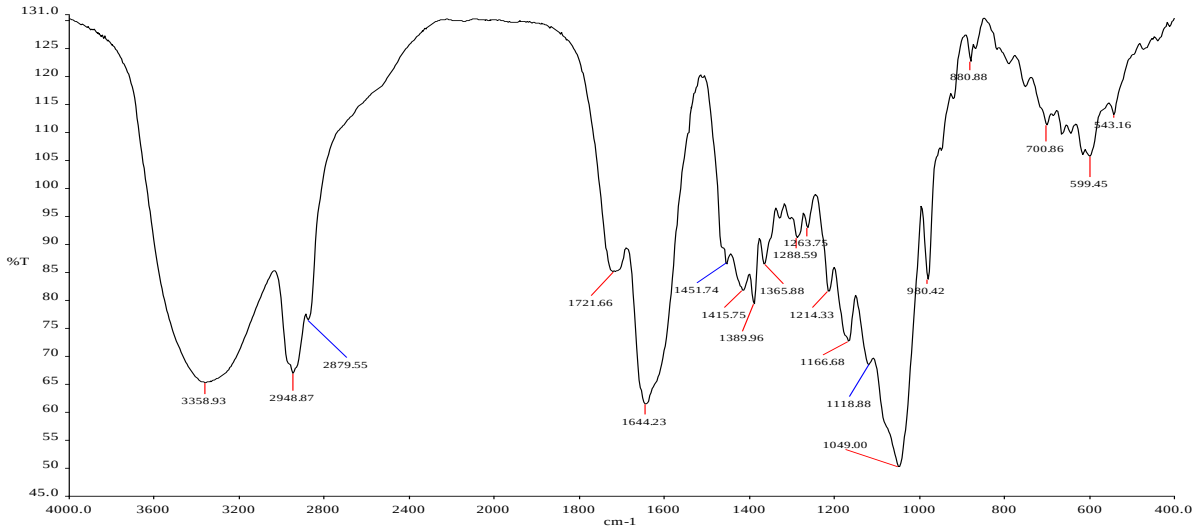

Figure 2. IR spectrum of glycyrrhizic acid complex with cadmium.

When comparing the results of the study, it was noted that the results are consistent with each other. Cadmium (II) ions were separated from the artificial mixture using a reagent in the form of pale yellow cadmium diglycyrrhizinate Cd-R. The obtained cadmium diglycyrrhizinate is very poorly soluble in water and other organic solvents. This feature is characteristic of divalent and trivalent metal salts of saponin acids. Cd-R is very soluble in alkaline solutions. To determine the amount of cadmium (II) ions in the studied complex compound, the calibration curve of the emission spectra using the AES method was used.

Conclusiov/Recommendations

Based on the obtained results, the following conclusions can be drawn: The method of obtaining a complex combination of cadmium with glycyrrhizic acid (Cd-GA) was studied. The results of studying the physico-chemical properties of the obtained compound are presented. The structure of the Cd-GK complex was studied by IR-spectroscopy, and the obtained results were confirmed by the atomic emission spectroscopy (AES) method.

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