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DETERMINATION OF COPPER(II) ION TOGETHER WITH CADMIUM FROM WASTEWATER BY INVERSION-VOLTAMPEROMETRIC METHOD

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Abstract:
Development of convenient methods for determining copper ions in micro-quantities from the composition of wastewater by inversion-voltammetric method with the participation of cadmium ions. Evaluation of metrological characteristics of determination of copper ion by inversion-voltammetric method was improved.

Key words: trace element, wastewater, cadmium, background electrolyte, inversion voltammetry, adjacent cations, buffer mixture, electrochemical sensor.

Copper, an important metal for the health of humans, animals and plants, is present in various amounts in many food products. From the past to the present, copper is used in many fields, from handicrafts to jewelry, from musical instruments to coating materials, in developed countries it has increased to 10 kilograms per person. Copper has been available as an indispensable metal for industry, industry and machinery.

Copper is used in almost all industries in some way and its consumption reaches thousands of tons. It is a raw material for many products due to its main properties such as high thermal and electrical conductivity, corrosion resistance and easy processing [1].

Usually, copper ions enter the human body through food and drinking water. In most cases, it is observed that the amount of copper in the human body exceeds or falls short of REM. Lack of copper in the human body is often caused by natural characteristics or metabolic diseases. The role of copper in the body is very large. First of all, it actively participates in the construction of many proteins and enzymes that we need, as well as in the processes of growth and development of cells and tissues. Copper is necessary for the normal process of hematopoiesis and the functioning of the immune system. In general, copper ion is of great importance in

the development of humans, animals and plants. Taking into account the above, we focused our research on the development of convenient methods for the voltammetric determination of copper ions.

Today, it is possible to determine copper using various physico-chemical methods, and in most cases, cadmium ions, which occur side by side with it in nature, help to determine copper. For this reason, it is necessary to take into account cadmium when determining copper. In this research, we have reduced the effect of cadmium ions on copper determination by choosing the correct background electrolyte and buffer solution and by optimizing the analysis conditions [2].

The results of the analysis were recorded using a graphite-based electrochemical sensor, a reference electrode with saturated potassium chloride, and an electrolyzer made of an auxiliary graphite electrode with a large surface area, as well as an ABC-1.1 device equipped with a computer.

When conducting the research, we chose favorable conditions for determining copper ion by inversion voltamperometric (IV) method using an electrochemical sensor (ES). First of all, the influence of the background electrolyte was studied in the determination of copper ion by the IV method.

Control of the electrochemical reaction requires control of the role of the background electrolyte and buffer mixture in the proton-donating activity of the medium and the concentration of the detectable ion within strictly defined limits throughout the electrolysis. During the experiments, the following solutions are used as background electrolytes: 0,1 M H_3PO_4; 0,2 M HCl; 0,1 M H_3PO_4 +0,1 M KNO_3; 0,2 M NH_4OH+0,2 M NH_4CI; 1,0 M LiCl; 1,0 M KNO_3 and 0,2 M HNO_3. We used different volumes and concentrations of these background electrolytes and buffer mixtures. The obtained results are presented in Figure 1 and Table below.

Effect of background electrolyte in determination of copper ion by inversion voltamperometric method (amperage= 2,0 mkA; t=100 s; C_{Cu}= 10,0 mkg/dm^3)

Background electrolyte nature and concentration	Cu(II)	
	E, mV	I, mkA
0,2 M NH_4OH+0,2 M NH_4CI	-100,0	25
0,2 M HCl	-250,0	45
0,1 M H_3PO_4+0,1 M KNO_3	-200,0	31
0,2 M $HClO_4$	-180,0	27
0,1 M H_3PO_4	-190,0	22
0,2 M HNO_3	-140,0	55
1,0 M KNO_3	-220,0	32
0,4 M HCOOH	-230,0	35

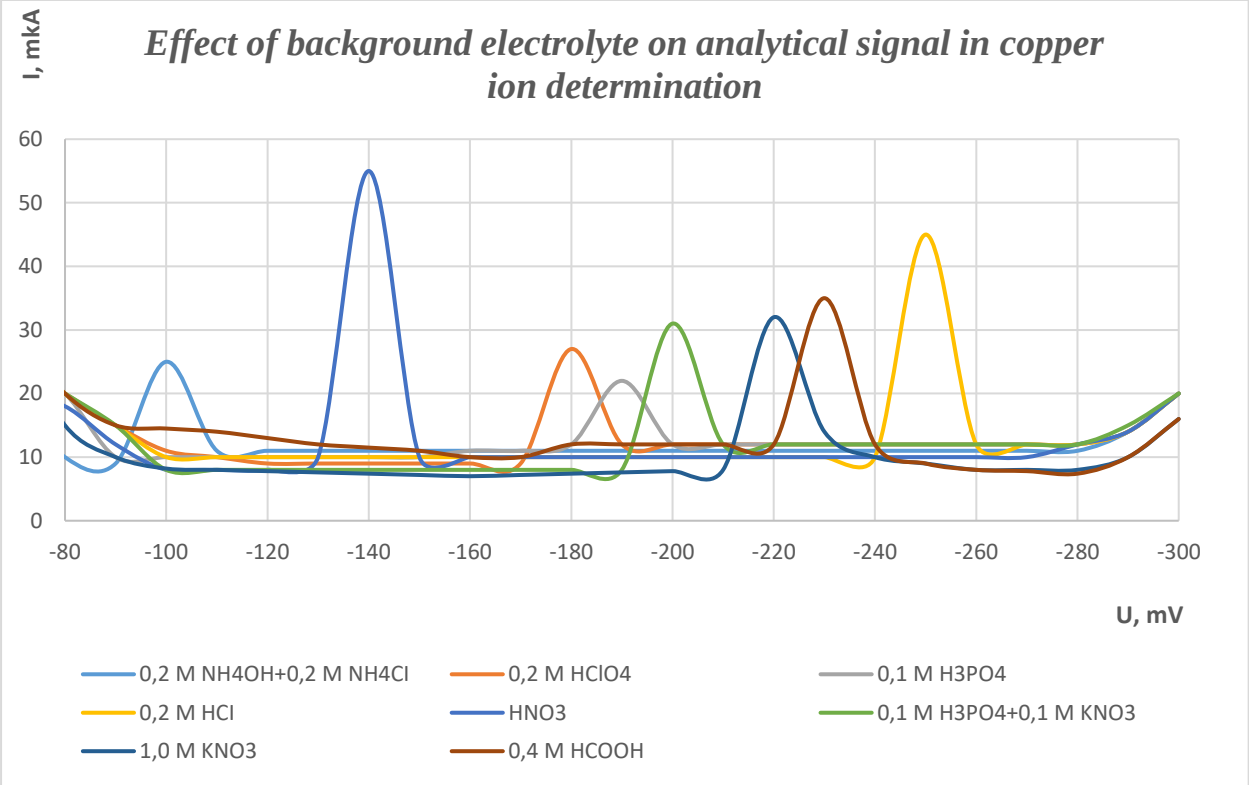

Figure 1. Effect of background electrolyte in inversion voltamperometric determination of zinc ion

As can be seen from the above results, the best results were observed when the copper ion was determined in 0.2 M HNO_3 background electrolyte. Therefore, all subsequent studies were carried out in accordance with the established optimal concentrations of this background electrolyte.

In our further studies, optimal conditions for the determination of copper ions using the ES voltamperometric method were selected [3] and a convenient method of determination was developed.

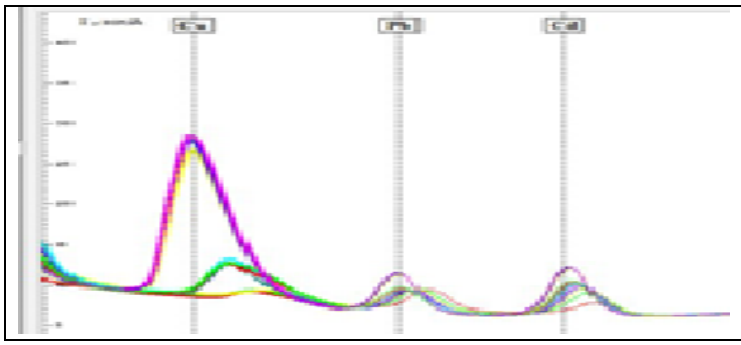

Figure 2. Determination of copper from a standard solution in the presence of cadmium ions

From the graph in Figure 2, we can see that at first, the analytical signal of copper was not good when determining copper ion in the presence of cadmium, and this

was due to the influence of cadmium ions. In the next measurements, when 0.2 M HNO3 acid, current strength 2.0 μA, and analysis time 100 seconds were selected as background electrolyte, we observed a sharp increase in the analytical signal of copper, which indicated that we had lost the effect of cadmium.1.

REFERENCES

1. https://cheminfo.uz
2. Sayfiyev M.N., Boqiyev Q.S., Rustamov E.M., Nazarova M., Ziyayev D.A. Kadmiy ionini inversion voltamperometrik usulda oqava suvlar tarkibidan elektrokimyoviy sensor yordamida aniqlash // Фундаментальные и практические аспекты функциональных полимеров: Сбор. матер. науч.-практ. междун. конф. – Ташкент, 2023. 17-18 марта. –С. 937-940.
3. Зияев Д.А., Сайфиев М.Т., Атакулова Н.А., Ахмаджонов У.Г. Инверсионное вольтамперометрическое определение меди (II) и цинка с применением графитсодержащих электродов, модифицированных ЭДТА // Ўзбекистон кимё журнали № 5. 2021. –С. 71-76.