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AMPEROMETRIC METHOD OF ANALYSIS AND ITS ADVANTAGES OVER OTHER METHODS

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Abstract: *In addition to directly determining the concentration of the analyte for the experiment, it is also used to find the equivalence point in the titration process. An amperometric titration is used. The essence of amperometric titration is to measure the values of the diffusion current, which changes as a result of a change in the concentration of the analyte or titrant (reagent of known concentration). This method is called amperometric titration because the amplitude to be determined is the current measured in microamps (μA).*

Key words *- Amperometric titration, equivalence point, microampere, indicator.*

In the 21st century, in which we live in the era of globalization, one of the most important tasks of modern chemistry is the rapid development of industry, the synthesis of new organic and inorganic compounds and the study of their electrochemical, physicochemical and other properties. and biological activity has been and remains a hot topic for mankind.[1] Until recently, it was sufficient to detect and limit additives in a substance at a concentration of 10-2 -10-3% or 0.001%. For example, the sensitivity of chemical methods to the detection of certain additives in test substances may not be sufficient. In addition, although gravimetric determinations are time consuming, the use of titrimetric assays is also limited. Therefore, the current focus is on the development of new, more sensitive and faster methods of analysis. Amperometric titration is a titrimetric form of voltammetry that measures the saturated diffusion current, which changes during the titration, to find the end point of the titration. Previously, it was shown that there is a dependence Idqkc between the saturated diffusion current and concentration. In the first version of amperometric titration, proposed by Ya.[2;3] It takes a long time to find the end point of the vibration. Therefore, Meyer (1936) changed the order of amperometric titration. He used the diffusion current coefficient of the depolarizer concentration.

To carry out amperometric titration, a weighed portion of the solution of the tested polyarographically active substance is taken, to which the necessary reagents and background are added, and then connected to an amperometric (polarographic) device. A potential slightly higher than the half-wave potential is applied, and the substance in the cell is titrated using a titrant. In the amperometric titration process, the current strength is determined by the voltage corresponding to the current limit value after the gradual addition of the reagent.[4] Based on this information, an

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amperometric titration curve is built in the coordinates of the current-titrant volume and the equivalence point is found graphically. Rotating platinum, graphite and other solid electrodes are used as indicator electrodes in amperometric titration. Solid electrodes are made from inert materials such as platinum, gold, tantalum.

Recently, electrodes made of non-porous types of graphite - pyrographite (glassy carbon, carbon-citrate) have become widespread. The second electrode may be any reference electrode with a larger surface area that is not current polarized. Silver chloride or calomel electrodes are often used. The reference electrode potential does not change during the titration.[5]

Amperometric titration curves. The form of amperometric titration curves varies depending on which component of the titration reaction - analyte, titrant or reaction product - is involved in the electrode reaction. Three types of chemical reactions can be used in the amperometric titration method: 1) sedimentation reactions, 2) oxidimetric reactions, and 3) complexometric reactions. It must meet the requirements for reactions of titrametric methods in terms of the speed and completeness of the reactions occurring during amperometric titration. CI-, Br-, J-, SO42-, CO32-, MnO4- and b. Most anions are titrated with a lead salt at a potential value of -0.4 V, at which the Pb2+ ions return to the dropping mercury electrode. Oxidation of the feracyanide ion [Fe(CN)6]-4 on a rotating platinum electrode at 0.7…1.0 V leads to Zn2+, Cu2+, Pb2+, Ca2+ and b. Used in amperometric titration of cations. Amperometric titration methods often use precipitation by the action of organic reagents.[6]

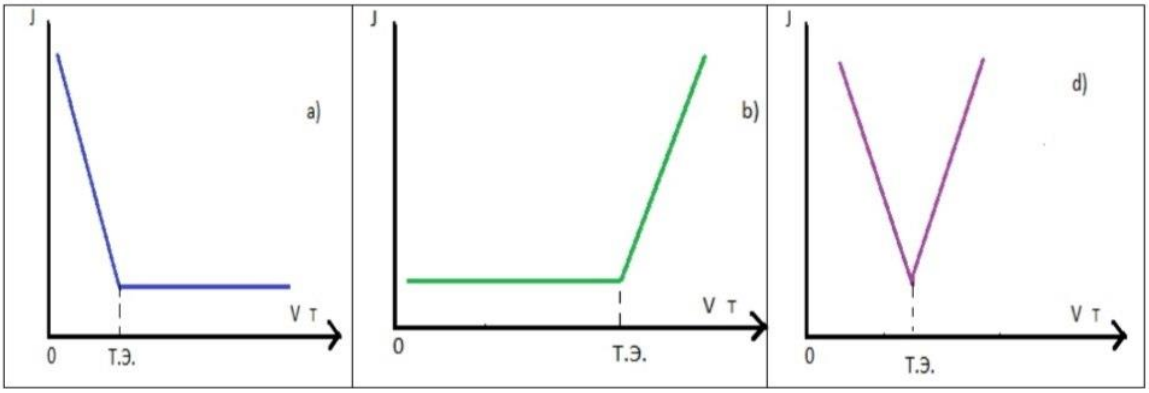

Figure 1. View of the ampermetric curve

Depending on the system of electrodes used, amperometric titration methods are divided into the following:

1) amperometric titration with one indicator (polarized) electrode;

2) amperometric titration with two indicator (polarized) electrodes (abbreviated as biamperometric titration).

In amperometric titration using a chemical reaction that meets the requirements of titrimetry, the amount of polyarographically active component in the solution varies in the volume of the solution. The amperometric titration curve consists of two straight lines, the intersection of which corresponds to the equivalence point. The shape of the curve depends on the polyarographic activity

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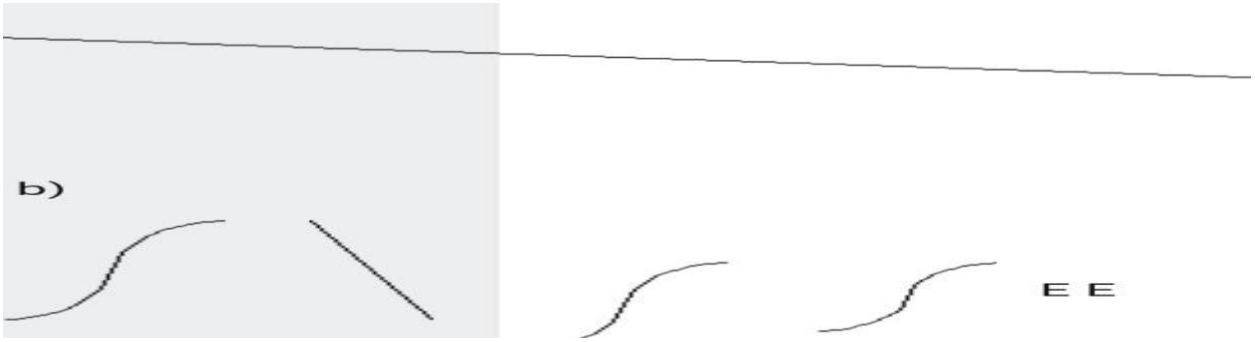
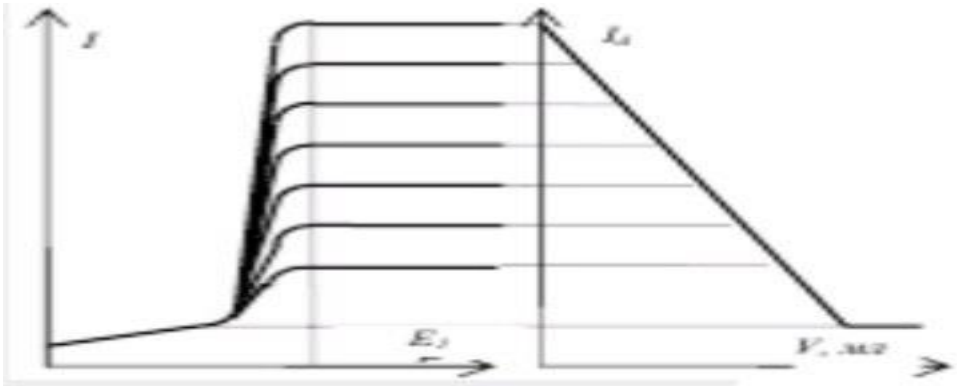
of one of the components that participate in the chemical reaction (the equivalence point is determined by the current); in other words, which component of the titration reaction - analyte, titrant, or reaction product - depends on whether the electrode reacts?

Practical use. Volt-amperometry is used to detect most metals. This method determines the content of ancient, cobalt, copper, lead, manganese, nickel, tin, zinc, iron, bismuth, uranium, vanadium and many other metals in ores, concentrates, alloys and other natural and technical objects.[7]



It is also possible to identify most organic compounds. With a significant difference in half-wave potentials (ΔE1 / 2≥1.0V), several components in a mixture can be quantitatively determined without separating them from each other. Biologically important materials: widely used in the study of blood, serum, etc.



Relationship between polygraphy and ammetric analysis.

Amperometric titration uses cations and anions in various natural and industrial waters, mineral raw materials and products of their processing.

Since the voltammetric method is much more versatile, it can be used to examine a wide variety of objects. In polyarographic analysis, the error is ±2% for solutions with a concentration of 10-3-10-4 mol/l under normal conditions and up to ±5% when processing with more dilute solutions.[8]

Thus, the amperometric method of analysis differs from other analytical methods in the following advantages:

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1. Amperometric titration is characterized by speed, selectivity, sensitivity and can be carried out in dilute solutions of 10-5 mol/l or more, in cloudy and colored solutions.

2. The amperometric titration device is cheaper than others and requires less time for analysis;

3. Unlike other electrometric methods, this method allows you to determine the amount of a substance in highly dilute solutions (more dilute than in the polyarographic method) due to low mu.

4. The possibility of using various electrodes for titration, for example: platinum, gold, silver, tantalum, etc. to.;

5. Possibility of carrying out amperometric titration in three different media: aqueous, anhydrous and mixed; 6. Ability to use different reactions; (reactions of precipitation, complex formation, oxidation-reduction, and in some cases, neutralization). In a word, the accuracy of amperometry is high (10-6 and higher), and the error does not exceed 1%.

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