

POLAROGRAPHIC METHODS IN MEDICINE FOR DIAGNOSTICS

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ABSTRACT	KEYWORDS
The article examines existing methods for diagnosing polarography in diagnostics. Shown that this method is used in medical laboratories, therapeutic dentistry, express diagnosis of tick-borne encephalitis, as well as to determine the pathology of the maxillofacial area.	

Introduction

The polarography method was proposed by the Czech chemist J. Heyrovsky in 1922, when he studied the effect of voltage applied to a mercury drop immersed in an aqueous solution on the value of surface tension. J. Heyrovsky noticed that the amount of current flowing through a drop depends on the composition of the solution.

Based on this discovery, J. Geyrovsky developed an analytical method based on measuring the dependence of current on voltage on a mercury drop electrode. The resulting current-voltage curves or voltammograms allow one to draw conclusions about the composition of the solution and simultaneously carry out a qualitative and quantitative analysis of the microimpurities contained in the solution [1]. In 1959, Heyrovsky was awarded the Nobel Prize in Chemistry for his polarography method.



Fig. 1. Laboratory research using polarography

Polarographic method (volt-amperometry) - consists of studying the dependence of the current flowing through the cell on the voltage (potential) applied to the electrodes located in the test solution. The potential typically ranges from a positive value of a few tenths of a volt to a negative value of approximately two volts [2].

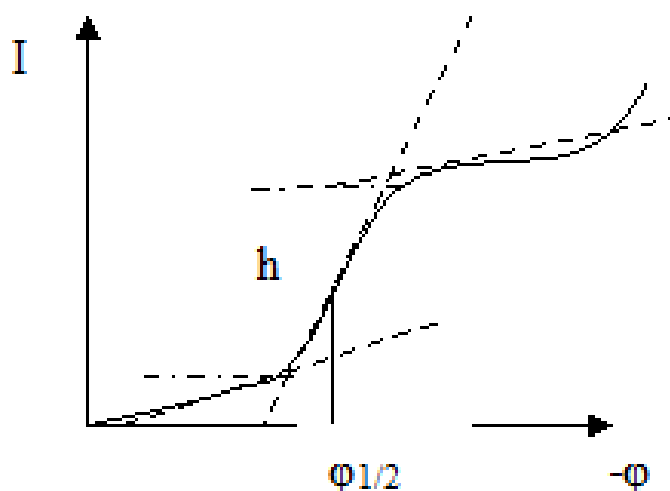


Fig. 2 Polygram of an electrochemically active substance

This curve is called polarogram and is recorded with a device called a polarography. At the working electrode, the molecule of the substance under study is reduced (gains an electron), less often oxidized (loses an electron), which ensures the passage of electric current in the circuit. The measurement conditions are selected so that the current value is determined by the rate of diffusion of molecules to the electrode, i.e. ultimately, their concentration.

The molecule of each substance is characterized by a threshold electrode potential at which it can give or receive an electron. When this value is reached, the current in the circuit increases, since a new type of molecules or ions is included in the process. With gradual increase in the electrical potential, a

characteristic increase in current strength in the circuit occurs, called a polarographic wave. The half-wave potential is a value characteristic of a given substance.

The height of the polarographic wave is proportional to the concentration of the substance involved at the electrode. Electrodes are usually made of noble metals or graphite [3]. Polarographic electrodes sensitive to oxygen and hydrogen peroxide are used in special analyzers to determine the concentration of one or many components: glucose, uric acid, cholesterol. In two-channel analyzers for determining glucose with another component (uric acid, urea, lactate). The devices are used in all laboratories performing both routine and urgent analyses. The method is also implemented in devices that use biosensors and make it possible to determine the glucose level at the patient's place of treatment or at home.

Methods for use in Diagnostics:

1. The polarographic method for therapeutic dentistry was used to determine the oxygen balance in periodontal tissues [3]. The method is based on the restoration of oxygen on a platinum electrode, which is fixed on the surface of the gums by contact method. The polarograph device is used in the pulsed mode of supplying polarizing voltage. Analysis of the polarogram allows us to determine the state of microcirculation and transcapillary exchange, the rate of oxygen absorption by periodontal tissues. This method is used both for diagnosis and in the dynamics of treatment to assess the effectiveness of periodontitis therapy.
2. The polarographic method of studying blood serum has gained wide recognition in the field of medicine, as well as for the diagnosis of malignant neoplasms. The use of the Brdicka polarographic filtrate method made it possible to identify qualitative changes in serum seromucoids of patients with various pathologies of the maxillofacial region, which can serve to diagnose signs in the clinic of these diseases [4].
3. The polarographic method for determining the antigen-binding activity of erythrocytes in the early express diagnosis of tick-borne encephalitis made it possible to identify a blood reaction specific to tick-borne encephalitis within 15-20 minutes from the start of the patient's examination, which can be used for differential diagnosis from clinical signs similar to tick-borne encephalitis diseases, significantly increasing the productivity of the researcher [5].

Conclusions:

The proposed methods make it possible to identify diseases specific to different diseases and can be used for differential diagnosis based on clinical signs of the disease.

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