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IONOMETRIC DETERMINATION OF ALKALOIDS

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Nitrogen-containing bases, which include alkaloids, are determined chromatographically and by extraction-photometric methods. As a rule, these methods are laborious and time-consuming and require complex sample preparation. The use of ion-selective electrodes (ISEs) permits the rapid determination of organic bases in various media rapidly and with an adequate degree of accuracy. Most frequently used as electrode-active substances (EASs) are ionic associates of organic bases with tetraphenylborate, dipicrylamine, diphenylacetic acid, etc. [1-3].

We have investigated the electrode properties of film membranes using as ISEs mixed-ligand complexes (MLCs) of alkaloids (papaverine, pachycarpine, and atropine) with bismuth iodide, which have been used previously in the development of extraction-photometric methods [4, 5].

Membranes based on poly(vinyl chloride), dioctyl phthalate, and MLCs exhibit the properties of cation-selective membranes, giving a gradient of electrode functions close to theoretical for singly-charged cations (55-58 mV/pC).

We have studied the electrode characteristics of the membranes: time of establishment of the equilibrium potential, influence of the acidity of the solutions on the electrode function of the membrane, range of linear concentration dependence of the potential, and steepness of the electrode function (Table 1).

The equilibrium potentials of the electrodes investigated in the concentration range of $1 \cdot 10^{-4}$-10^{-2} M were reached in 1-2 min.

The calculated coefficients of potentiometric selectivity for the papaverine-selective electrode show the possibility of determining papaverine in the presence of novocaine (−2.47), analgine (−1.46), aspirin (−1.28), and other components of

TABLE 1. Some Working Characteristics of the ISEs

Index	Alkaloids		
	papaverine	pachycarpine	atropine
Range of linearity of the response, M	1.10^{-4} 1.10^{-2}	3.10^{-5} 2.10^{-2}	5.10^{-4} 1.10^{-2}
Slope, mV/pC	58.0	56.5	56.0
Limit of detection, M	1.10^{-5}	1.10^{-5}	1.10^{-4}

TABLE 2. Results of the Determination of Papaverine in Medicinal Forms ($n = 3$, $P = 0.95$)

Preparation	Papaverine content, mg	Papaverine found $\bar{X} \pm \Delta X$ mg	$Sr \cdot 10^2$	Error, %
1. Tablets of papaverine hydrochloride	40.0	40.33–1.05	1.41	0.80
2. Injection solution of papaverine hydrochloride	2.0%	1.98–0.07%	2.05	1.00
3. Papazol	30.0	29.90–1.03	1.87	0.33
4. Teodibaverin	20.0	20.55–0.92	2.48	2.50

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drug mixtures, which permits ISEs to be used for monitoring the papaverine content at individual stages of production and in the waste waters of pharmaceutical enterprises.

A number of pharmaceutical preparations have been analyzed by direct ionometry with the aid of the ISE developed (Table 2).

Procedure for Determining Papaverine. Tablets of the preparation were ground and dissolved in 10-25 ml of distilled water at 50-60°C, the solution was filtered into a 50-ml measuring flask, the filter was washed with hot water, and the filtrate was cooled and made up to the mark with distilled water. In the analysis of injection solutions, 1-2 ml of the medicinal form was transferred to a 50-ml measuring flask and was made up to the mark with distilled water.

The potentiometric cell was charged with 20 ml of the solution under investigation (pH 5.3), 20 ml of 0.01 M acetate buffer solution was added, and the e.m.f. was measured. The papaverine content was found from a calibration graph plotted under analogous conditions.

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