

## POLAROGRAPHY\*

WHEN nearly 40 years ago Heyrovsky for the first time used the dropping mercury electrode to study electrolytic processes, few could foresee that a versatile analytical technique and an entire science with great potentialities would grow out of it. Today the science of polarography, originally regarded as a narrow branch of electrochemistry, has spread across the fields of industry, biology and medicine, and there is a voluminous literature on the subject comprising literally of tens of thousands of journal articles besides quite a few monographs and standard text-books. The book under review alone contains more than 800 pages and more than 2,000 references.

What is polarography? It is the technique of investigating cathodic phenomena during electrolysis of solutions, and is essentially based on the study of the current-potential curves obtained by using a dropping mercury electrode. It is well known that the use of solid metal electrodes such as platinum, lead, etc., has the disadvantage that the surfaces change during the process, due to deposition or chemical reaction with the products of electrolysis, and as such the results are not reproducible and their interpretation consequently becomes difficult and dubious. The dropping mercury electrode, which is the basis of the success of the polarographic method, consists of a very fine bore (0.04-0.08 mm.) capillary glass tube connected by a flexible tube to an adjustable mercury reservoir. Mercury flows through the tube and tiny drops of mercury are formed (every 2-5 seconds) beneath the surface of the electrolytic solution kept in one of the limbs of the, usually, H-shaped polarographic cell. The anode or the reference electrode is a layer of mercury of large area at the bottom of the other limb. As the applied voltage between the electrodes is increased, electrolysis proceeds on the dropping electrode and the current (of the order of microamps) through the cell is measured with a sensitive galvanometer. In the polarograph devised by Heyrovsky and Shikata, automatic recording of the current-voltage curves is obtained. These curves known as the polarographic curves containing characteristic 'waves' enable one to establish qualitatively and quantitatively the substances which are

present in the solution. The value of the potential at which the wave is formed identifies the substances and the height of the wave gives the amount of the substance present in the solution.

The chief advantages of polarographic analysis are (1) it is possible to determine several constituents simultaneously, (2) 0.5 ml. of the solution to be investigated is sufficient and the limits of determination are between  $10^{-5}$  and  $10^{-6}$  M solutions. (3) The polarographic recording takes only 2-8 minutes and on the average a dozen samples can be analyzed per hour. (The time for the preparation of the solution depends on the kind and complexity of the sample, and generally it takes several minutes to one hour.) (4) the method provides a permanent record of the analysis.

The book under review, *Polarography in Medicine, Biochemistry and Pharmacy*, although it is based on the Czech edition of 1952, is not a mere English translation of it but a completely revised and enlarged edition. The new literature, that has accumulated in the intervening years, has necessitated the rewriting of more than half the Czech text. The contributions from Prof. Brdicka and his school have played an important part in this field. The volume comprises of eight parts, each divided into appropriate chapters dealing systematically with the polarographic analysis of related groups of substances.

After a very brief Introductory Chapter which forms Part I of the book, Part II deals with the polarographic determination of inorganic compounds, metal-wise, in different substances, in the organs of the body and in their secretions. Part III, which forms the major bulk of the book, covering as it does about 400 pages, deals with the determination of organic compounds under Quinones, Redox systems, Halogen derivatives, Aldehydes, Ketones, Sugars, Nitrogen compounds, Alkaloids, Vitamins, Hormones, etc. Parts IV and V deal respectively with Proteins and Enzymes. Part VI deals with the analytical applications of Polarographic Maxima. Part VII gives a Table of important Buffers followed by Tables of Half-wave Potentials for ready reference. The Final Part gives the Bibliography, Index of Materials and subject index.

The book is amply illustrated and almost every other page contains the actual polarographic curve for the substance studied. Polarographic cells to be used in special cases

\* *Polarography in Medicine, Biochemistry and Pharmacy*, by M. Brezina and P. Zuman. (Interscience Pub., New York.) Pp. xviii + 862. Price \$ 19.50.