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Sindhu Isaac
Electrochemistry has many advantages making it an appealing choice for pharmaceutical analysis. Electrochemistry has always provided analytical techniques characterized by instrumental simplicity, moderate cost and portability. Electroanalytical techniques have introduced the most promising methods for specific applications. Due to similarity in the electrochemical and biological reactions; it can be assumed that the oxidation/reduction mechanisms taking place at the electrode and in the body share similar principles. Biologically important molecules can be investigated electroanalytically by voltammetry in order to determine the molecule in different ways. Additional applications of electrochemistry include the determination of electrode mechanisms. Redox properties of drugs can give insights into their metabolic fate in vivo redox processes or pharmacological activity. Further, the electroanalytical techniques have been shown to be excellent for the determination of pharmaceutical compounds in different matrices. Many of the active constituents of formulations, in contrast to excipients, can be readily oxidized / reduced. The selectivity of this method is normally excellent because the analyte can be readily identified by its voltammetric peak potential. The advance in experimental electrochemical techniques in the field of analysis of drugs is because of their simplicity, low cost and relatively short analysis time as compared to other techniques.

Voltammetric sensors are an important class of electrochemical sensors in which the analytical information is obtained from the measurement of current obtained as a result of electrochemical oxidation/reduction. This current is proportional to the concentration of the
Chemically modified electrodes (CMEs) have great significance as important analytical tools for the electrochemical determination of pharmaceuticals. The modification of electrode results in efficient determination of electro-active biomolecules at very lower potential without its major interferences. The operation mechanism of CMEs depends on the properties of the modifier materials that are used to promote selectivity and sensitivity towards the target analytes. Modified electrodes can be prepared by deposition of various compounds such as organic compounds, conducting polymers, metal oxides, etc. on the various electrode surfaces.

The thesis presents the development, electrochemical characterization and analytical application studies of eight voltammetric sensors developed for six drugs viz., Ambroxol, Sulfamethoxazole, PAM Chloride, Lamivudine, Metronidazole Benzoate and Nimesulide. The modification techniques adopted as part of the present work include Multiwalled Carbon Nanotube (MWCNT) based modification, Electropolymerisation and Gold Nanoparticle (AuNP) based modifications.

The thesis is divided into nine chapters. A brief idea of the chapters is given below.

**Chapter 1** gives a general introduction on the various electroanalytical techniques and their application. The chapter gives an idea of the different types of chemical sensors and discusses in detail about electrochemical sensors. It also gives a brief review of the important voltammetric sensors developed for different drugs.

**Chapter 2** gives a brief sketch of the materials and methods used in the investigation. This chapter explains the procedure for the
fabrication of chemically modified electrodes as voltammetric sensors for the determination of various drugs. It also gives an idea of the general procedure for the analysis of drug content in pharmaceutical formulations and also in real samples like urine. The instruments used in the present study are also discussed.

**Chapter 3** describes the fabrication of multiwalled carbon nanotube-nafion based sensor for the quantitative determination of Ambroxol (AMB). The analytical applications of the developed sensor in the determination of the drug in pharmaceutical formulations and real sample like urine were also investigated.

**Chapter 4** deals with the development of multiwalled carbon nanotube-nafion based sensor for the determination of the drug Sulfamethoxazole (SMX). The electrochemical response characteristics are described in detail and the application study of the developed sensor in the determination of the drug in pharmaceuticals and urine samples have also been dealt with in detail.

**Chapter 5** deals with the development of poly (p-toluene sulphonic acid) based sensor for the determination of the drug PAM Chloride. The response parameters of the newly developed sensor as well as its analytical applications have been discussed in this chapter.

**Chapter 6** presents the fabrication of poly (L-Cysteine) modified glassy carbon sensor for the drug Lamivudine (LAM). The analytical applications of the developed sensor in the determination of
pharmaceutical formulations and real samples have also been discussed in this chapter.

Chapter 7 deals with the development of two sensors for the drug Metronidazole benzoate (MBZ). The sensors fabricated include (i) poly (p-amino benzene sulphonic acid) modified glassy carbon sensor and (ii) AuNP/ poly (p-amino benzene sulphonic acid) modified glassy carbon sensor. Optimization studies of the developed sensors, response characteristics and analytical applications are dealt with in detail in this chapter.

Chapter 8 discusses the development and performance characteristics of two sensors for the drug Nimesulide (NIM) viz, (i) poly (Cystamine) modified glassy carbon sensor and (ii) AuNP/ poly (Cystamine) modified glassy carbon sensor. The application studies of the developed sensors in the determination of the drug in pharmaceutical formulations and urine samples are also explained in the chapter.

Chapter 9 presents the summary and important conclusions of the work done.

References are given as a separate section at the end of the thesis.