PREFACE

Sensor is a transducer that converts a measurement (a quantity and parameter) into a readable signal that carries some information. In present time, we observe various types of sensor like pH meter in laboratory and glucose meter in hospital. Generally, sensors are of three types: physical, chemical and biosensor. Physical sensor measures physical quantities like distance, mass, temperature and pressure etc. Chemical sensor measures chemical substances by chemical responses. Biosensor measures chemical substances by using a biological sensing element. A sensor is composed of an active layer or recognition layer and a transducer. The active layer represents the main part of the sensor. Many materials such as organic, inorganic or hybrid organic-inorganic polymers can be used as an active layer, providing that analyte can diffuse into the matrix and be trapped, thus modifying the physical or chemical properties of the material. The active layer can also be doped by using some specific probe-molecules that have the ability to react selectively with the targeted analyte, thus providing the selectivity to the sensor.

The role of transducer is to convert the variation of a physical property (i.e. refraction index.), or a chemical interaction (i.e. H-bond formation, electrostatic interaction) or a chemical reaction (covalent bond formation) into a measurable signal (optical, electrical, electrochemical, piezoelectric etc.) proportional to the analyte concentration.

On the basis of transduction, there are three types of sensors: Physical, chemical and electrochemical. Electrochemical sensors are very sensitive, easy to operate, portable, economical, highly reproducible and highly stable. In electrochemical sensors, materials used to fabricate electrode surface play a crucial role. Now a days, various types of materials are used for electrode fabrication like polymeric material, composite, metal complex and nanomaterials. Among all, nanomaterials offer high sensitivity due to their large surface area to volume ratio, fast electron transfer kinetics, biocompatibility, catalytic activity and easy functionalization. However, the aggregation of nanoparticles

restricts their usage as an active material for sensors. Therefore; stabilization of these nanomaterials by incorporation of some organic and inorganic materials like polymer or macromolecules is one of the most common choices to reduce its aggregation.

The focus of present thesis is to synthesize nanomaterials and their extensive investigation using various characterization techniques like UV-Vis., FT-IR, HRTEM, FESEM and Zeta potential measurement studies and application of such type of nanomaterials for electrode fabrication and sensing of analytes like drugs which are specific to certain diseases.

There are various types of drugs which are used for the treatment of life threatening diseases like Cancer, AIDS or HIV infections. Drugs specific to these diseases offer several side effects which are not manageable, for example long-term adverse effects of anti-HIV drugs are bone or renal toxicity, dyslipidemia, insulin resistance, or accelerated cardiovascular disease. When their concentration in patient's serum is more than their permissible range, it can cause adverse side effects. So, there is a need to develop a simple, sensitive and portable sensor for the onsite measurement of drugs, so that one can monitor the concentration of drugs and its by-products in patient's serum.

Due to above reasons, drugs are selected as analyte and the main objective of thesis is to develop portable sensors for such type of drugs. I have chosen anti-HIV drugs and antibiotics which are specific to HIV-1 infections and bacterial infections, prolonged use of which can cause various adverse effects on patient's health. The thesis work is divided into seven chapters as follows.

Chapter 1 gives an introduction to some basic concepts about sensors, types of sensor, classification, advancement in sensors and generation of electrochemical sensors.

Importance of nanomaterials based sensors, need to develop sensor for drugs related to harmful diseases and their portability. Some literature survey is also listed.

Chapter 2 includes characterization of chitosan stabilised silver nanoparticles by UV-Vis., FT-IR, FESEM, HRTEM, Zeta potential measurement and CV. This nanostructure platform is used for electro-sensing of AZT (azidothymidine, anti-retroviral drug) on commercially available electrodes and further SPGE (chip type electrode) for developing portable sensing probes.

Chapter 3 contains characterization of MoS_2 QDs, Pd@rGO and its composite by UV-Vis., FT-IR, HRTEM and Zeta potential measurement. Further, electro-sensing of Nevirapine (NNRTI, anti-retro viral drug) using 2D materials modified electrodes are performed by CV and DPV.

Chapter 4 deals with the simultaneous detection of AZT and NVP using Pd@rGO decorated with MoS_2 QDs modified SPGE.

Chapter 5 includes characterization of Pd nanoparticles stabilised by tetrathiafulvalene by UV-Vis., FT-IR, XPS, HRTEM, and EDAX. Further, this platform is used for electro-chemical detection of ceftazidime using commercial electrodes in buffer and ceftazidime injection.

Chapter 6 includes conclusion of the thesis work and some future plans.