Preface

One of the important class of biomaterials is polymeric materials. They are extensively used in biomedical field. These polymeric systems include acrylics, polyurethane, polyester, polyethylene, acrylics, polyamides, polyester, polyethylene, polysiloxanes, polyurethane and a number of biological materials. Some example of polymeric materials having biomedical applications are bone cement, catheters, contact lenses, heart valves, implantable pumps, joint replacement, artificial skin and sutures.

Among some frequently used polymers, Poly(vinyl chloride) (PVC) finds its special place because of its widespread applications in medical field. In long term use of PVC, it causes some health problems due to leaching out of plasticizer. To eradicate this problem, it was planned to functionalize polymer with different functional groups. Further polymer composites were made with incorporation of nanoclay. Modified polymers were exposed to different characterization techniques to study the altered properties of polymers. The present thesis has been divided into following chapters according to work.

Chapter 1 starts with general introduction briefly describing PVC and its biomedical applications. Absolute description has been given for PVC, its applications, shortcomings and possible solutions. A small prologue has been given for synthetic and natural, layered nanoparticles and its importance in biomedical applications. A review of literature has been studied and included in each section for understanding of different crucial properties of PVC, nanoparticles, nanocomposites, and earlier studies done on them. The scope and objectives of the present investigation has been highlighted at the end of this chapter.

Chapter 2 covers the specification of materials used in present investigation, experimental procedures including functionalization of PVC, synthesis of nanoparticles and preparation of functionalized polymer nanocomposites. Nuclear Magnetic Resonance (NMR), Fourier Transform Infrared (FTIR) spectroscopy and UV-Vis (UV-Vis) spectroscopy technique has been used to study the presence of functional groups in polymer chain and their interactions with

nanoparticles and polymer composites. Wettability of polymer identify through contact angle. Scanning Electron Microscopy and Transmission Electron Microscopy has been performed to understand the morphology and structure of the polymer, nanoparticles, and polymer nanocomposites. Thermal properties of pure PVC and functionalized PVC with their composites have been examined through Thermo Gravimetric Analysis. Studies of Mechanical properties of pure PVC and functionalized PVC with their composites have been carried out. Bacterial viability assay was done on modified and unmodified polymer films. Blood biocompatibility that was performed through haemolysis assay and thrombogenicity assay. Cellular biocompatibility was done on samples through cell culture studies via cell adhesion, cell viability, nuclear staining etc. All the data obtained were subjected to statistical analysis using one way and two way analysis of variance.

Chapter 3 deals with the chemical modification of PVC with thiosulphate, thiourea and sulphate for blood and cellular biocompatibility. All functionalized PVC was prepared by the nucleophilic substitution reaction using a phase transfer catalyst method. Here, the results obtained via Nuclear Magnetic Resonance (NMR), Fourier Transform Infrared (FTIR) spectroscopy, UV-Vis (UV-Vis) spectroscopy, Thermal analysis (TGA), Contact angle, Scanning electron microscopy (SEM) and biological assays including antibacterial activity, haemolysis with thrombogenicity, cell adhesion, cell cytotoxicity have been reported and discussed.

Chapter 4 consists about the details of functionalized PVC/LDH nanocomposite - functionalized poly(vinyl chloride) / layered double hydroxides was prepared by solution intercalation method. The prepared product were confirmed and characterized by X-ray diffraction (XRD); Fourier transformed infrared spectroscopy (FT-IR). Incorporation of LDHs in functionalized PVC matrix has been confirmed through FTIR, UV-visible, XRD and TEM. The effects of LDHs on thermal stability of synthesized polymer compopsites analyzed by thermogravimetric analysis (TGA) and results showed that although all functional groups decrease the dehydrochlorination temperature of PVC, incorporation of LDH tend to increase the temperature, thereby stabilizing as well. Tensile testing was performed and obtains the Young modulus was obtained revealing enhanced Mechanical properties of the synthesized polymer composites had mechanical properties that need to be enhanced.

Chapter 5 illustrates about the blood compatibility along with hemolysis and thrombogenicity of functionalized polymer composites. The biocompatibility has been confirmed using cell adhesion, cell viability and fluorescence image to understand the cell health on different polymer.

Chapter 6 describes and summarizes all the results obtained in the present work with its biomedical applications. It also covers the future work on the basis of the present results.