Preface

Chemotherapy remains the preferred frontline strategy used for the treatment of most types of cancer. The treatment strategy of conventional chemotherapy is based on killing of cancer cells or inhibition of their growth and reproduction. During the process of killing of cancer cells, chemotherapeutic agents also damage healthy tissues, causing systemic toxicity and adverse side effects such as hair loss, loss of appetite, nausea, vomiting, anemia, fatigue, loss of taste buds, destruction of the immune system etc. It is therefore desirable to develop chemotherapeutics that can either passively or actively target cancerous cells to reduce the adverse side effects while improving therapeutic efficacy of anticancer agents.

Layered double hydroxide (LDH) recently emerges as a promising two dimensional (2-D) nanocarrier due to its unique properties such as excellent anion exchange capacity, excellent biocompatibility, high drug loading efficacy, full protection of the loaded therapeutics, excellent endosome escape, stability in wider pH range, ease of preparation, low cost and biodegradability. Anionic therapeutic molecules (negatively charged drugs, genetic materials, peptides, proteins etc.) can easily be intercalated into the interlayer gallery, which provides full protection against enzymatic degradation during flowing in biological fluids and can deliver therapeutics to the targeted site.

The thesis presents synthesis, characterization and evaluation of various layered double hydroxides based nanocarriers for drug and gene delivery to treat cancer. This thesis has been categorized in following outlines: Introduction, Experimental, Results and Discussions and Conclusions. The brief description of different chapters is given below:

Chapter 1: This chapter briefly describes about the various controlled release vectors used for the delivery of therapeutic molecules and their structural characteristics that allow improving the therapeutic efficacy of these bioactive molecules, as well as offers an overview of recent scientific advances in the area chemotherapy and emphasizes on the current challenges in cancer treatment.

Chapter 2 describes the experimental section, methodology used to prepare various LDHs and characterization details.

Chapter 3: This chapter describes the synthesis of a series of Mg-Al based LDHs with varying interlayer anions (NO_3^-, CO_3^{2-} and PO_4^{3-}) followed by successful intercalation of a model antitumor drug (raloxifene hydrochloride) into the interlayer gallery of LDHs. *In vitro*

controlled drug delivery has been achieved by using drug intercalated LDHS. *In vitro* and in *vivo* anticancer efficacy studies have been performed using the developed materials.

Chapter 4: This chapter deals with the development of a new anticancer drug delivery vehicle after intercalating anticancer drug within the interlayer galleries of Zn-Fe based LDHs followed by embedding them in a polymer matrix to obtain polymer nanoconjugate (PN–R). *In vitro* controlled drug delivery has been achieved using drug intercalated LDHs which has been sustained further in the polymer nanoconjugate. Various *in vitro* and *in vivo* investigations have been performed confirming the enhanced therapeutic efficacy of anti-cancer drug while reducing its adverse side effects.

Chapter 5: This chapter deals with development of Li-Al based LDH for the delivery of plasmid gene into mammalian cancer cell.

Chapter 6: This chapter includes the conclusion and future scope of the present work.

List of books and journals used in these studies has been given at the end of the thesis under the References heading.