POLY (LACTIDE-CO-GLYCOLIDE) NANOPARTICLES: TRANSMUCOSAL PERMEATION, STABILISATION AND SUSTAINED RELEASE OF DRUGS

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By

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in fulfillment of the requirements of the degree of

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Dedicated

to

My beloved Parents

&

Family

CERTIFICATE

This is to certify that the thesis entitled "**Poly (lactide-co-glycolide) nanoparticles: transmucosal permeation, stabilization and sustained release of drugs**", being submitted by **Mr. Raju shankarayan** to the Indian Institute of Technology, Delhi, for the award of degree of **Doctor of Philosophy**, is a record of bonafide research work carried out by him, which has been prepared under my supervision and guidance in conformity with the rules and regulations of "Indian Institute of Technology, Delhi". The research reports and the results presented in this thesis have not been submitted in part or full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

PLGA based micro/nanoparticles have emerged as new drug delivery vehicles due to their controlled and sustained release properties, subcellular size and biocompatibility with tissues and cells. The advantage with these drug delivery vehicle is that the polymeric matrix encapsulating the drugs prevent the degradation of the drug and the toxic effect of drug to the tissues is avoided by overcoming the direct interaction of the drug with the mucosal surface. However for the successful development of these delivery vehicles it is necessary to study the various aspects of drug delivery which includes from loading the drug with maxium encapsulation efficiency with minimum size of the particle, stabilization of the drug with its sustained release, to its successful delivery through the mucosa. All these aspects should be considered for the various types of the drug differing in their nature of solubility and the molecular weight. In view of these issues the present work was undertaken taking piroxicam among low molecular weight hydrophobic drug and the lysozyme as a model protein. Lysozyme is hydrophilic in nature and being an enzyme it gave an ease of determination of the stability of the drug after its release from these vehicles. Piroxicam, a non-steroidal anti-inflammatory drug (NSAID), is widely used for the treatment of inflammatory arthritis and has been in clinical practice as an analgesic. However, long term treatment of piroxicam is known to cause ulcers, bleeding, or holes in the stomach or intestine. The present work has demonstrated for the first time formulation of piroxicam-loaded PLGA nanoparticles. The permeation study have suggested clear advantage of nanoparticles based formulation and their ability to cross mucosal membrane. Preliminary studies indicates the cellular mode of delivery of PLGA nanoparticles. In addition, various formulation conditions for

lysozyme-loaded nanoparticles suggests role of lactulose as a potential excipient for stabilization of lysozyme. Thus the present study clearly indicates role of nanoparticles in sustained drug delivery and excipient based formulations for long term sustained delivery of native protein.

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