CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1. CONCLUSIONS

Design of experiments employing statistical and mathematical approaches is a reliable scientific tool in developing “smart” drug delivery systems. Suitable experimental designs can be selected to achieve the desired experimental outputs.

Polymers do not possess most of the properties required of them to function optimally as devices for drug delivery purposes. Therefore, an extension of their applicability can be achieved by innovative modifications of their physicochemical and physicomechanical qualities based on manipulation of the relevant chemical interactions during synthesis. This was evident with the modification of polyamide 6, 10 utilizing variations in reaction stoichiometry, volume ratio and solvent phase adjustments guided through efficient experimental designs. The modification strategy employed in the study modification strategy was simple, highly adaptable and efficient in generating different drug release characteristics as well as a physicochemical and physicomechanical properties).

Statistical optimization of polyamide 6,10 for rate-controlled drug delivery that can serve diverse delivery purposes hinged on the various routes of drug administration was achieved by using a higher performance Box-Behnken design. Based on this, slow, intermediate and controlled release monolithic matrix formulations were developed. These monolithic matrix systems are simple, flexible and suitable for large scale manufacturing purposes with reduction in formulation costs.

The differences in the release of both model soluble and insoluble drugs from the respective optimized polyamide 6, 10 monolithic matrices is negligible indicating that drug release from these polyamide 6,10 matrices is independent of drug solubility.

The slow release formulation demonstrated the potential to function as an implantable drug delivery system. Also, the controlled release formulation showed some capability to function as a system for prolonged oral delivery of drugs thereby reducing the frequency of dosing as well as a site-specific gastroretentive drug delivery system. Polyamide 6,10 monolithic matrix system showed significant sensitivity to changes in pH of the release medium, formulation variables and inclusion of both hydrophilic and hydrophobic excipients. However, the release characteristics of the existing hydrophilic and hydrophobic FDA polymers were also influenced by the addition of the optimized polyamide 6,10.

Mathematical modeling of the dissolution data of the optimized polyamide 6,10 monolithic matrix systems revealed that drug release kinetics from these devices were predominantly by matrix relaxation complemented with Fickian diffusion and followed zero-order kinetics. A close correlation existed between the experimental and fitted data.

Characterization of the optimized monolithic matrix systems revealed consistency in the chemical structural backbone but changes in the physicochemical and physicomechanical properties of which was also observed to influence the drug release behaviour. Furthermore, the optimized polyamide 6,10 monolithic matrix systems displayed the inherent potential to bio-erode under.

6.2. RECOMMENDATIONS

With regards to upcoming investigations, it is recommended that the polyamide 6,10 monolithic matrix systems developed in this study be assessed for their *in vivo* performance first in animal models and if successful then in healthy human volunteers. This is necessary to ascertain the drug delivery potential of these monolithic matrix

systems when subjected to *in vivo* conditions. This will establish the efficiency of these delivery systems which are anticipated to function as drug delivery systems for chronic disease conditions such as HIV-AIDS, diabetes, tumours and malignancies, joint disabilities (e.g. arthritis), central nervous system disorders (e.g. parkinsonism, depression) and upper gastrointestinal disorders (e.g. peptic ulcerations) as well as contraceptives implanted over prolonged periods. Although the *in vitro* evaluations may supply valid information regarding their drug release characteristics, they cannot completely simulate the conditions in the biological systems.

It is also proposed that extensive research is conducted to ascertain the toxicity of the polyamide 6,10 matrices by exploring the biochemical processes involved during its metabolism.

Detailed research relating to the chemistry of polyamide 6,10 with its drug delivery potentials may be conducted. In addition, other polyamide types can be explored for their abilities to function as drug delivery devices. Scale-up of the synthesis and manufacturing procedures developed in this study should be explored.

These research findings are novel and overall the results may be of significant value to pharmaceutical and polymer scientists working in the field of drug delivery.