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Thesis Abstract

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DESIGN OF BIODEGRADABLE POLYCAPROLACTONE AND ITS NANO-COMPOSITES FOR CONTROLLED DRUG DELIVERY SYSTEM

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ABSTRACT

Polycaprolactone (PCL), semi-crystalline and resorbable aliphatic polyester has found various biomedical applications such as sutures, drug delivery systems and scaffolds in tissue engineering, due to its soft- and hard-tissue compatible properties and biodegradation characteristic. This is the only Petro-based Biopolymer and FDA approved biomaterial, currently used in drug delivery and sutures. But PCL is very costly and in order to reduce its cost it was blended with other biodegradable polymer like chitosan, PLA, Gelatin etc. Blending two polymers is an effective way to develop new material with combinations of properties not possessed by individual polymers. The PCL, PCL blended with other polymers like Chitosan, PLA and Gelatin and their nanocomposites were characterized by various methods like FTIR, XRD, SEM and TGA. Controlled drug delivery systems of using PCL and blended polymers were also studied by using broad spectrum antibiotics like Ofloxacin, Doxycycline, Cefadroxil and anticancer drug like Paclitaxel. The Kinetics of the drug delivery systems have been evaluated using a model equation developed by us and the various kinetic parameters like k and n values have been computed and the mechanism of *in-vitro* drug release of the model drugs have been postulated. A new class of nanocomposites from Polycaprolactone blend and an organoclay has been fabricated by blending. XRD Studies indicate that the polymer chains are intercalated into the gallery of the organoclay. The nanocomposite showed great enhancement in toughness and strength, as compared to the unfilled blend, even though each layer of the clay was not perfectly delaminated. The majority of biodegradable polymers have been used in the form of micro-particles, from which the incorporated drug is released to the environment in a controlled manner. The factors responsible for controlling the drug release rate are physicochemical properties of drugs, degradation rate of polymers, and the morphology and size of micro-particles. Considering the various properties associated with this wonder material, PCL, can be used as a good carrier for controlled drug delivery (CDD) systems.

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