

Preparation and evaluation of poly (caprolactone fumarate) nanoparticles containing doxorubicin HCL

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Background and Aims: Biodegradable Poly(caprolactone fumarate) (PCLF) has been used as bioresorbable sutures. In this study, doxorubicin HCl (Dox) loaded PCLF nanoparticles were prepared and characterized.

Methods: PCLFs were synthesized from PCLdiol (Mws of 530, 1250 and 2000) with fumaryl chloride. The degradation of PCLF in NaOH, water and phosphate buffer saline, was determined. Nanoparticles (NPs) were prepared by two methods. In microemulsion polymerization method, dichloromethane containing PCLF and photoinitiator were combined with the water containing surfactants and then the mixture was placed under light for crosslinking. In nanoprecipitation method, the organic solvent containing PCLF was poured into the stirring water. The effect of several variables including concentration of PCLF, polyvinyl alcohol (PVA), Dox and Trypan blue (Trb) and the Mw of PCLF and PVA on NP size and loading were evaluated.

Results and Conclusions: PCLF in PBS or water were not degraded over 28 days. Nanoprecipitation method gave spherical (revealed by SEM images) stable NPs of about 225 with narrow size distribution and a zeta potential of -43 mV. The size of NP increased significantly by increase in Mw or concentration of PCLF. Although PVA was not necessary for formation of NPs, but it decreased with NP size. Dox loading and EE were 2.5-6.8% and 15-20%, respectively. Increasing the drug concentration increased the drug loading (DL) and NP size. The entrapment efficiency (EE) for Trb ranged from 1% for PCLF530 to 6% for PCLF2000. An increase in PCLF concentration resulted in an increase in EE. Dox and Trb release showed a burst followed by 80% and 78% release during 3 and 4 days respectively. PCLF possessed suitable characteristics for preparation of nanoparticulate drug delivery system such as desired NP size, stability and degradation time. Although PCLF530 NPs were the smallest, but their DL were lower than PCLF1250 and 2000 NPs.

Keywords: PCLF nanoparticles; Copolymer molecular weight; Nanoprecipitation method