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Studying the degradation of poly(L-lactide) in presence of magnesium hydroxide

Mobedi, H.[a] , Nekoomanesh, M.[b], Orafaei, H.[c], Mivehchi, H.[a]

[a] Novel Drug Delivery Systems Department, Iran Polymer and Petrochemical Institute, P.O. Box: 1497713115, Tehran, Iran

[b] Petrochemical Department, Iran Polymer and Petrochemical Institute, P.O. Box: 1497713115, Tehran, Iran

[c] School of Pharmacy, Mashad University of Medical Sciences, Mashad, Iran

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Abstract

Controlling the rate and behaviour of the biodegradable polymer matrix is important in the development of drug delivery systems. In this project, we succeeded to control the speed of degradation and changing the degradation site from the bulk to the surface by addition of excipients. Antiacid excipients, such as $Mg(OH)_2$ have significant effects on rate and behaviour of biodegradation, by neutralization of the acidic microclimate pH in polymer. We synthesized high molecular weight poly(L-lactide) by using tin-2-ethyl hexanoate as catalyst. The polymer has been characterized by GPC, DSC and SEM. Mixtures of the polymer with $Mg(OH)_2$ at 1, 3 and 5% w/w were prepared and the degradation of the samples, kept at in vitro condition after 3 and 6 months, were studied. The results of average molecular weight changes, thermal characteristics and morphology of samples after 3 and 6 months revealed that it is possible to redirect the bulk degradation towards surface degradation. It is found that the ratio of bulk degradation to surface degradation and speed of degradation has reverse relationship with the additives concentration and when $Mg(OH)_2$ increases, the speed of degradation decreases as well. In samples with Mg $(OH)_2$, the polymer degradation rates were reduced by 2-3 folds and the percentage of crystallinity increased by maximum 90% (3% $Mg(OH)_2$) after 6 months.

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