Controlled drug release of PLA/PLGA microspheres

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Drug release of ibuprofen encapsulated biodegradable polymer microspheres have been studied in many works [1,2,3]. In the present study, ibuprofen release profile from microspheres based on blend of poly(lactic acid) (PLA) and poly(lactic-co-glycolic acid) (PLGA) with poly(vinyl alcohol) as emulsifier within a phosphate buffer solution (PBS) is determined and compared to drug release profile of PLGA microspheres. PBS was selected as media since buffer anions seemed to regulate drug release, it was prepared using 0,2 M monobasic and 0,2 M dibasic sodium phosphate to achieve pH 8 at 37 ºC [1]. PLGA-Ibuprofen and PLA/PLGA-Ibuprofen microspheres were prepared by oil-in-water emulsion solvent evaporation method, the blend of 50 wt.% PLA and 50 wt.% PLGA is formed by physical interactions between them. Once the aqueous solutions of microspheres were prepared, a centrifugation process following by a drying process at 40 ºC during 4 h were carried out to obtain microspheres ready for drug release experiments. Figure 1 shows both PLGA-Ibuprofen and PLA/PLGA-Ibuprofen drug release profiles determined by UV-Vis spectroscopy, results indicate that microspheres with blended polymers as shell material exhibit lower release rate, whereas PLGA-Ibuprofen achieve its full release at about 5 min, PLA/PLGA-Ibuprofen does at approximately 10 min from the beginning of experiment, which hints that polymer hydrophobicity is a key factor to explain ibuprofen release rate; the presence of methyl groups in PLA interferes with water penetration into the matrix and consequently, reduces rate of polymer degradation [4]. Thermogravimetric analysis (TGA) was performed from 30 to 700 ºC under nitrogen atmosphere on ibuprofen, PLA/PLGA-Ibuprofen, PLA/PLGA-Ibuprofen after drug release experiment in PBS media and PLA/PLGA without ibuprofen, first derivative of TGA (DTG) was applied to obtain curves in Figure 2. Results state that after drug release, signal of degradation stage corresponding to ibuprofen diminishes to unnoticeable, which corroborates that drug release was successfully completed while PLA/PLGA/PVA structure remains and exhibits a signal similar to blank PLA/PLGA microspheres.

References

[1] Laura J. Waters and Evangelos V. Pavlakis, Journal of Pharmacy & Pharmaceutical Sciencies, In vitro controlled drug release form loaded microspheres – dose regulation through formulation (2007) 464-472.

[2] Cory Berkland, Martin King, Amanda Cox, Kyekyoon (Kevin) Kim, Daniel W. Pack, Journal of Controlled Release, Precise control of PLG microsphere size provides enhanced control of drug release rate (2002) 137-147.

[3] Aragón, Marcela & Rosas, J.E. and Martínez, Fleming, Latin American applied research Pesquisa aplicada latino americana = Investigación aplicada latinoamericana, Effect of the ibuprofen solubility in acetone and dichloromethane on its release profiles from PLGA microspheres (2014) 87-92.

[4] Makadia HK and Siegel SJ., Polymers, Poly Lactic-co-Glycolic Acid (PLGA) as Biodegradable Controlled Drug Delivery Carrier. (2011) 1377-1397.

Figures

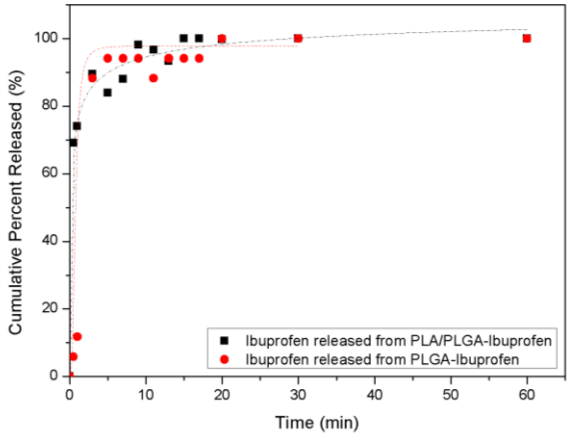

Figure 1. Drug release profiles of PLGA-Ibuprofen and PLA/PLGA-Ibuprofen.

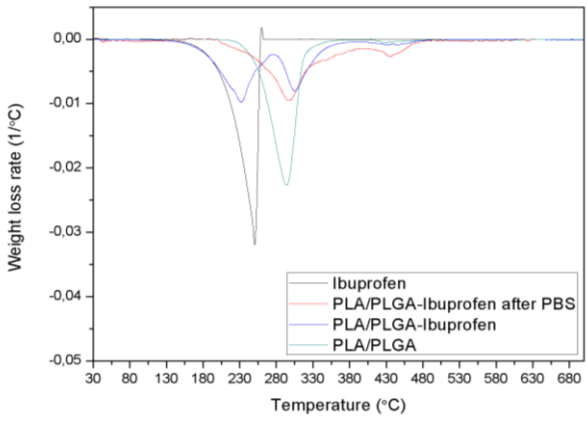

Figure 2. DTG of Ibuprofen, PLA/PLGA-Ibuprofen, PLA/PLGA-Ibuprofen after drug release experiment in PBS media and PLA/PLGA microspheres without active principle.