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Poli-ε-caprolactone nanospheres: development and characterization

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Abstract – Poly-ε-caprolactone nanospheres were developed from emulsification/solvent diffusion method using poloxamer as a surfactant. The average diameter and size distribuition of nanospheres were evaluated by photon correlation spectroscopy and the surface morphology by scanning electron microscopy. The formed nanospheres presented average diameter of 160 nm, homogeneous size distribution, smooth surface and probably deformation after centrifugation process.

Polymeric nanoparticles, nanospheres and nanocapsules, are promising nano-sized drug delivery systems interesting for controlled drug release and drug targeting. Poli-ε-caprolactona (PCL) is a biodegradable and biocompatible polymer having a slow degradation. It's suitable for long-term delivery extending over a period of more than one year [1]. In this study, PCL nanospheres were prepared from the emulsification/solvent diffusion method. Nanospheres average diameter and size distribution were evaluated by photon correlation spectroscopy. The morphological examination of nanospheres surface was performed by scanning electron microscopy (SEM).

In the emulsification/solvent diffusion method, PCL dissolved in ethyl acetate saturated with water was emulsified with a poloxamer solution under stirring (13.000 rpm for 12 min.) Sufficient amount of water was added to the emulsion to allow ethyl acetate diffusion and consequent precipitation of the polymer and formation of nanospheres. Organic solvent was eliminated by evaporation under reduced pressure. The formed nanospheres were isolated by centifugation for 30 min at 50.000 x g. Finally, the particles were washed with water to remove the residual surfactant and then lyophilized.

The surface morphology of nanoparticles in the suspension and lyophilized powder were observed by SEM. The nanoparticles suspension was dropped on the glass support and dried under room temperature for 2 h. After, the suspension excess was removed. The dried suspension and lyophilized powder were coated with gold and examined by SEM at 15 kV.

The developed nanospheres presented an average diameter of 160 nm and homogeneous size distribution (fig.1). SEM photomicrographs (fig.2 and fig.3) show that the nanoparticles present a smooth surface. In the nanospheres suspension photomicrograph (fig.2) it is observed isolated higher diameter particles probably because only these particles had deposited on the support in the 2 h period. In the nanospheres lyophilized powder photomicrograph (fig. 3) it is observed aggregates nanoparticles and it suggests that some deformation occurred as a consequence of the centrifugation process. Other studies are underway to evaluate the centrifugation effect using others surfactantes and also the feasibility of these systems for therapeutic applications in drug delivery.

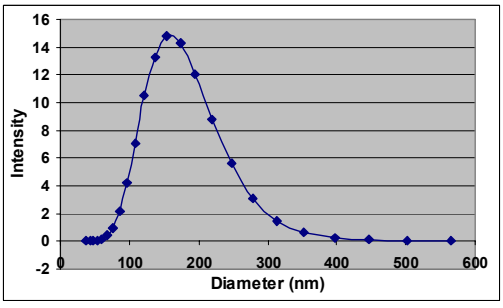

Figure 1: Nanospheres size distribution.

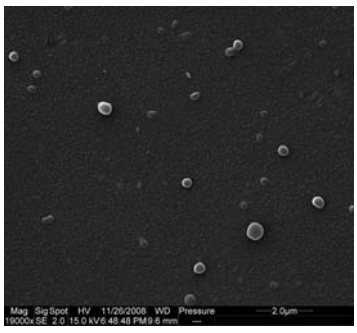

Figure 2: Suspension nanospheres SEM image.

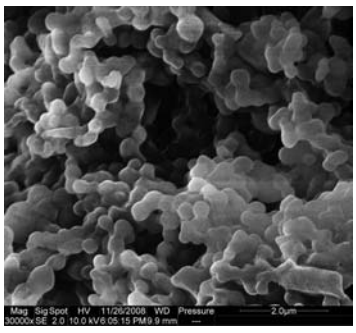

Figure 3: Powder lyophilized nanospheres SEM image.

Reference

[1] V.R. Sinha, K. Bansal, R. Kaushik, R. Kumria and A. Trehan. Int. J. Pharm. 278 (2004) 1-23.