ABSTRACT

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Title of thesis: Hydrophobic ion pairing as a strategy to improve the encapsulation efficiency of PLGA nanoparticles.
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The aim of this thesis was to increase the encapsulation efficiency (EE) and capacity of PLGA nanoparticles (NPs) for the hydrophilic antibiotics gentamicin (GEN) and vancomycin (VAN). The method of hydrophobic ion pairing (HIP) and docusate sodium as anionic surfactant (AOT) were chosen. PLGA nanoparticles loaded with VAN or GEN, or their AOT complexes were prepared with optimized methods. Nanoparticles with VAN and GEN were prepared by the double-emulsion method ($W_1/O/W_2$), for GEN-AOT the single emulsion method (O/W) was used, and nanoparticles with VAN-AOT were prepared by suspension-emulsion method (S/O/W). Stable NPs with a size of 108 to 223 nm with a polydispersity lower than 0.2 were obtained. The influence of PLGA concentration on the size of NPs was found. The low zeta potential of the nanoparticles was related to steric stabilization by the non-ionogenic stabilizer Poloxamer 407. SEM images confirmed the spherical shape of the NPs. Encapsulation efficiency and loading capacity (LC) were determined by direct method. VAN and its complex were analysed by HPLC, GEN and its complex by spectrophotometry. The EE of VAN and GEN was increased by hydrophobic ion pairing, however, the highest EE value of VAN-AOT was only 14 % compared to GEN-AOT, where EE reached up to 90 %. In further experiments, it would be appropriate to focus on the low encapsulation efficiency of VAN-AOT, for example, by using a different surfactant or a different method of preparation of the NPs.

Key words: polymeric nanoparticles, PLGA, vancomycin, gentamicin, hydrophobic ion pairing, docusate sodium.