Thermoanalytical testing of microspheres containing Diltiazem hydrochloride and Tolperisone hydrochloride

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A preformulation study was made of the influence of the temperature parameter as an important factor in drug stability, drug polymorphism, and the drug-polymer interaction in the spray-drying technique for the preparation of microspheres. Material used for the preparation of the microspheres: Diltiazem hydrochloride (Ph.Eur) and Tolperisone hydrochloride (Ph.Eur), with low molecular weight chitosan (poly(D-glucosamine); Sigma-Aldrich) as a hydrophilic, biocompatible and biodegradable polysaccharide of low toxicity, in different drug-polymer ratios. The physical state of the active agents, the spray-dried active agents, the blank and the drug-loaded microspheres was characterized by thermoanalytical methods (DSC and TGA), and the morphological testing was performed with a scanning electrone microscope (SEM, Hitachi S-2400).

An aqueous solution of chitosan containing 1% acetic acid or 1% hydrochloric acid was prepared for spray drying. It was applied with a spray-dryer apparatus (Mini Spray Dryer Büchi B-191) with a standard 0.5 mm nozzle. As a standard condition, the inlet temperature, the spray flow and the compressed spray air flow (represented as the volume of the air input) were set at 150 ºC, 3.5 ml/min and 10 l/min, respectively. The loaded chitosan microsphere were prepared by dissolving the model drug (drug-polymer ratios of 1:1, 1:1.5 and 1:2) in the chitosan solution prior to spray-drying. The yield was from 50 to 70% depending upon the chitosan concentration used.

The results indicated that under the given experimental conditions, the broadened and shifted peaks was suggest of the presence of the crystalline form of the active agents were not observed for the drug-loaded chitosan microspheres, as an indication of the molecular dispersion of the drug in the matrix. This information was help in the choice of spray-dryer parameters at which the drug did not decompose. The preparation conditions also influenced the morphology and size of the particles. The sphericity of the microspheres was good, The proportion of microspheres with a slightly wrinkled surface morphology, the extent of aggregation formation and the size range distribution for the different samples were investigated to choose the most suitable ratio of chitosan and active agent.

References

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