New Biocompatible Nanoparticles Based on Fractionized Gelatin as Drug Delivery Systems for Nucleic Acids and Peptides

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Abstract

In 1978 Marty et al. described for the first time the preparation of gelatin nanoparticles using desalting or desolvating agents. The desolvation process using acetone or other non-solvents works only with very low concentrations of gelatin (0.1%) [1]. By increasing the gelatin concentration in the solution the formation of aggregations during desolvation and cosslinking also dramatically increases.

In 1985 the molecular weight of gelatin was described to be between 60000-90000 Da [2]. With improved analytical equipment, the specification of the molecular weight of one of the largest gelatin producers worldwide (DGF Stoess AG, Eberbach, Germany) is today from below 20000 to over 400000 Da. This shows the heterogeneity of gelatin and makes it more understanding why there are many difficulties in the preparation of nanoparticles from this substance.

In 2000, for the first time, it was published that molecular weight distribution of gelatin (type A, Bloom 175, Sigma-Aldrich) was analysed being between 1000 and 1000000 Da and by separation of the low molecular weight fraction using a two-step-desolvation technique. It was also possible for the first time to prepare stable, uniform gelatin nanoparticles in a size of 200 nm and in concentrations up to 5% [3]. Because most size exclusion chromatography columns have their cutting point at a molecular weight of about 1000000 Da our group used the semi chromatographic method of field-flow fractionation to analyse the same type of gelatin again with the result that the largest fragment are even 10 fold higher, up to 10^7 Da [4].

The topic of the presentations will be focused on new techniques in cooperation with the gelatin manufacturer DGF Stoess AG, to establish new extraction techniques for approved gelatin types and to obtain the high molecular gelatin fractions that are narrow in molecular weight distribution and can be directly used for the preparation of nanoparticles. These nanoparticles prepared from an approved excipient shows to be a very promising biodegradable carrier for the delivery of nucleic acids and peptides and could become an approved colloidal drug delivery system without expensive toxicity studies as necessary for synthetic polymers.

References

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