

Study of Heparin/Protamine Complexation by Means of Fluorescence Spectroscopy, Light Scattering and Analytical Ultracentrifugation

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The administration of heparin, a linear glycosaminoglycan, has been used clinically for many years as the standard procedure for anticoagulation treatment. However, the determination of heparin concentration/activity is more or less empirical and therefore does not assure a precise blood coagulation management for the individual patient. This frequently leads to internal bleeding or local coagulations.

Here we present the approach to investigate the complex formation between heparin and protamine. The binding kinetics of the complex formation was examined by means of light scattering methods and quenching of fluorescence dye labelled protamine. Additionally, both multi-angle light scattering technique and analytical ultracentrifugation were used for characterisation of heparin/protamine complex size distribution.

The observed radius of the heparin/protamine complexes was in the range between 10 nm and 200 nm and the complexation process was completed after a time between 5 min and 15 min. Both parameters depended on the type of solution in which the experiments were carried out (physiological saline solution, model HSA solution and blood plasma).

These results can be used for heparin monitoring. On the basis of light scattering studies, we present a simple, quick and precise quantitative method for heparin concentration measurement which will improve blood coagulation management.