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Spectrophotometric Determination of Heparin Based on Aggregation of Gold Nanoparticles

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ABSTRACT

Heparin is a widely used anticoagulant in medicine that prevents the formation of blood clots. Excessive levels of heparin in the body can lead to severe circulatory diseases [1]. For this reason, it is very important to monitor the level of this drug in the blood during surgery and its regular use. From the structural point of view, it is a highly sulfated and negatively charged linear polysaccharide [2]. This property can be successfully applied for the development of an analytical systems based on an aggregation of gold nanoparticles for sensitive heparin determination [3].

In this work, 13 nm gold nanoparticles were synthesized by reducing hydrogen tetrachloroaurate(III) with trisodium citrate in the presence of tannic acid [4]. Positively charged polymer poly-L-lysine can be used to aggregate gold nanoparticles in the solution. However, if negatively charged heparin is present, poly-L-lysine binds to heparin instead, resulting that gold nanoparticles aggregation is being stopped (Fig. 1). This interaction was successfully applied for the sensitive detection of heparin. It was determined that the limit of detection is 0.0018 units/ml of heparin. The absorbance ratio at A_{650nm}/A_{520nm} has a linear dependence in heparin concentration range from 0.0031 to 0.04 units/ml allowing heparin in the sample to be quantified using the calibration curve.

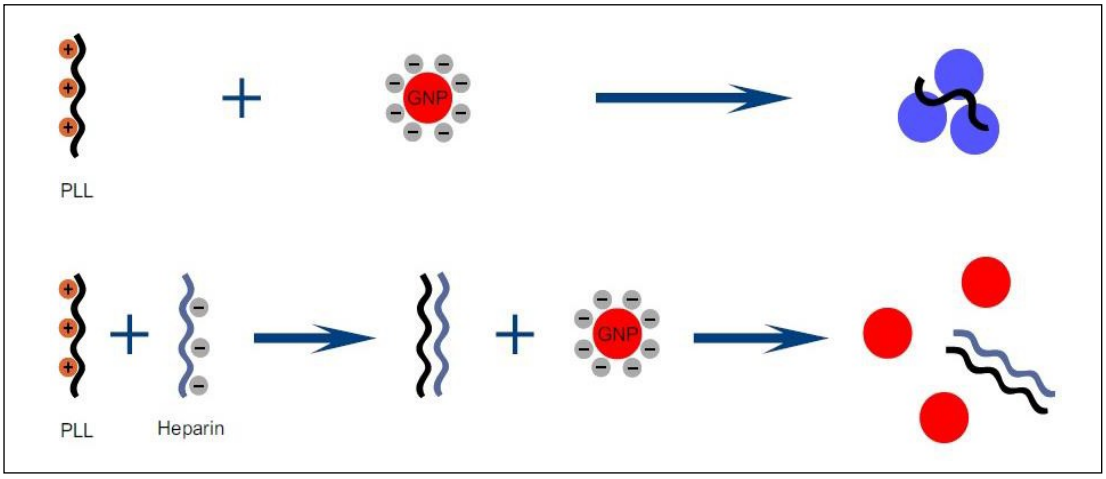

Fig. 1. Scheme representing the analytical system for heparin detection using gold nanoparticles and positively charged poly-L-lysine.

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