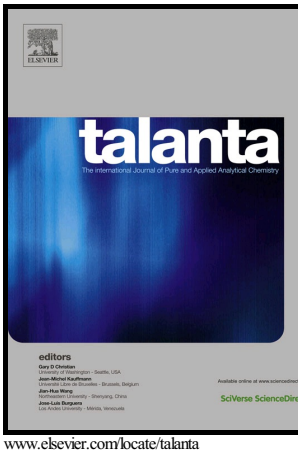

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Development of a fast and simple test system for the semiquantitative protein detection in cerebrospinal liquids based on gold nanoparticles

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Abstract

The fast and simple detection of increased protein concentrations in cerebrospinal liquids is preferable in the emergency medicine and it can help to avoid unnecessary laboratory work by an early classification of neurological diseases. Here a test system is developed which is based on the electrostatic interaction between negatively charged gold nanoparticles and proteins at pH values around 5. The test system can be adjusted in such a way that protein/nanoparticles aggregates are formed leading to a red shift in the absorption spectrum of the nanoparticles suspension. At concentrations above 500 mg/l the color of the suspension changes from red via violet toward blue in a rather small concentration range from 500 to 1000 mg/l. Furthermore the influence of various parameters such as gold nanoparticle concentration, pH value and varying ion concentration in the sample on the test system is examined. Finally cerebrospinal liquids of a larger number of patients have been analysed.

Introduction

In the diagnosis of neurological diseases the analysis of the punctuate liquid from the spinal marrow (liquor cerebrospinalis) is an essential tool for the treating neurologist. A raised or abnormal protein concentration in the liquor indicates several disorders of the central nervous system. Normally the total protein content of liquor cerebrospinalis is between 150-450 mg/l [1,2]. An increased protein concentration from 500-1000 mg/l indicates a viral meningitis or an encephalitis [3], while a bacterial or a fungal meningitis causes more than 1000 mg/l total protein [4].

Recent laboratory diagnostic techniques allow the comprehensive analysis of all the parameters necessary for a reliable diagnosis. The actual standard methods for protein quantification in the cerebrospinal liquid are the staining with Coomassie Brilliant Blue G-250, the pyrogallol red method and the precipitation with trichloroacetic acid followed by a