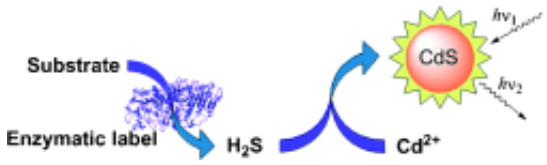
Dot Products: Analytical Applications of Enzymatic Growth of Quantum Dots

June 16 2010



(PhysOrg.com) -- The search for time and cost effective as well as sensitive methods for bioanalytical assays is currently of great interest. At the center of Biofunctional Nanomaterials in San Sebastian (Spain), Valery Pavlov and his co-workers are undertaking research in the area of the design and preparation of new biomaterials for such applications. They report on a new analytical approach in which the enzymatic generation of quantum dots can be applied to the detection of enzymatic activities in *Chemistry -- A European Journal*.

Bioanalytical assays based on the enzymatic generation of nanoparticles are not very common and mostly are limited to biochemical growth of nonfluorescent metal nanoparticles. The main drawback of such systems is that only UV/Vis spectroscopy can be utilized for the optical reading of a signal. Fluorescence spectroscopy, on the other hand, provides an alternative and more sensitive method of analysis.

Valery and and co-workers utilise the fact that alkaline phosphatase

(ALP) can induce the formation of H_2S. In the presence of cadmium cations, H_2S reacts to yield CdS quantum dots that show a characteristic fluorescence, dependent on the concentration of enzyme or substrate. The formation of CdS quantum dots can be measured by fluorescence spectroscopy and represents an alternative to other analytical methods.

ALP is an enzyme that removes phosphate groups from biomolecules, such as alkaloids, proteins and nucleotides and finds wide application in bioanalysis. This enzyme is broadly used as a label in enzyme-linked immunosorbent assays (ELISA). Another important application of ALP is the monitoring of pasteurization in cows' milk—well-pasteurized milk should not demonstrate any phosphatase activity due to enzyme deactivation at elevated temperature.

In addition the measurement of ALP activity in human blood serum is used for the diagnostics of viral acute and chronic hepatitis and cirrhosis. The disadvantages of the current methods include high costs, special storage conditions, and maximum fluorescence of the reaction product at alkaline pH.

This new assay based on the enzymatic generation of quantum dots and detection by fluorescence spectroscopy represents a step in the direction of finding a method that can significantly reduce time and costs related with these important tests.

More information: Valery Pavlov, Analytical Applications of Enzymatic Growth of Quantum Dots, *Chemistry - A European Journal* 2010, 16, No. 21, 6187-6192, dx.doi.org/10.1002/chem.200903373

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