Licensing Opportunity

Metal Nanoparticles for the Early Diagnosis and Detection of Disease Utilizing Pico and Femtomolar Concentrations of a Biomarker

Advantages
• Easy to use, accurate and inexpensive
• Allows detection of ultra low concentrations of biomarkers into the pico and femtomolar range
• Can be utilized for the early detection and diagnosis of any disease which has known biomarkers

Invention
The invention represents the composition and methods for generating the metal nanoparticle-bioreceptor reagents, separating non-conjugated from conjugated nanoparticles, decomposing the conjugated nanoparticles and lastly the means of determining the concentration of metal atoms present and relating it to the concentration of biomarkers in the sample solution.

Background
One of the most important aspects of medicine is the fast and correct diagnosis of a disease. Cancer and many other diseases, if diagnosed early are much more treatable than when diagnosed at later stages. Many of these diagnoses are based on the detection of certain biomarker molecules, such as proteins, antibodies, enzymes, DNA or RNA that are uniquely associated with a particular disease. For example, diagnosis of prostate cancer is based on the concentration of a protein called PSA; while high levels of an enzyme called carbonic anhydrase is an indicator of breast cancer. There is continuous research effort to detect these biomarkers at much smaller concentrations. Emerging techniques involve fluorescent dyes, quantum dots and metal nanoparticles combined with polymerase chain reaction techniques. These techniques either require expensive reagents and instrumentation or can be strongly affected by their chemical environment, making such diagnostics commercially unattractive. Easy, inexpensive methods that allow for detection of a wide range of biomarkers at low concentrations are needed and would have immediate commercial applications.

Scientists at UCF have created a method for the detection of ultra low concentrations of biomolecules using conjugated metal nanoparticles as probes. A particular bioreceptor (molecule which binds to a specific biomarker) is first attached to the metal nanoparticles. They are then introduced into a biological sample, and any biomarkers present are bound to the attached bioreceptor. The bound nanoparticles are separated from the unbound through ultra filtration, and then deconstructed into their respective metal atoms. By breaking down said particles, which can contain up to 2 million atoms each, you change your highly difficult to detect picomolar concentration of nanoparticles to a very manageable micromolar concentration of metal cations. The concentrations of these atoms can now be measured easily and accurately by utilizing common instrumental methods, such as atomic absorption or mass spectrometry. A direct correlation between the amount of metal present and the concentration of the biomarker of interest is made, thus creating a quick and relatively inexpensive method which allows for the detection of a wide range of biomarkers in the pico and femtomolar concentration range.

Application
The technology can be utilized for the early and accurate detection of ultra low levels of biomarkers in biological samples and systems. It has instant commercial potential for the pharmaceutical and diagnostics industries to create products which can easily and inexpensively detected diseases before they become untreatable.

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Selected References