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Multifunctional nanoparticles combined with magnetic immunoassay for biomarker detection- C Bor Fuh - National Chi Nan University

C Bor Fuh
National Chi Nan University, Taiwan

Biomarkers are widely utilized in clinical research and practice as references for medical diagnoses and coverings of cancers. the number of biomarkers are generally very low in healthy persons. A detection method with high sensitivity and selectivity is important to biomarker applications. An enzyme-linked immune-sorbent assay (ELISA) has been a widely used method for biomarker detections. However, it's a time consuming and laborious method even with its high sensitivity and selectivity. Thus, it's desirable to enhance it with an alternative method. Magnetic immunoassay can provide an alternate method of ELISA with advantages of rapidity, sensitivity, and selectivity for biomarker detections. the main advantages come from the simple and fast response of magnetism with high selectivity of antibody. Magnetic immunoassay using multifunctional nanoparticles has great potential in biochemical analysis. This presentation would show several biochemical analyses using bio-functional nanoparticles with emphasis on magnetic immunoassay in thin channels and micro-plates. Several model biomarkers would be wont to demonstrate the applications of this system. This detection limit is substantially lower and therefore the linear range is considerably wider than those of ELISA and other immunoassay methods. The differences between this method and an ELISA in biomarker measurements of serum samples were but 12%. The proposed method demonstrates favorable detection of biomarkers with advantages of speed, sensitivity, selectivity, and throughput.

The discovery of varied biomarkers and therefore the emergence of their clinical significance has given impetus to further changes within the constantly evolving field of health care. Specifically, biomarkers became active players instead of mere catalysts within the paradigm shift from treatment-based medicine towards preventative medicine. With the latter placing stress on the first detection and monitoring of diseases, biomarkers are being employed during a sort of methods and standards. In fact, consistent with the National Institutes of Health, biomarkers are “a characteristic that's objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention”. the first detection of cancer and development of personalized detection and treatment modalities, as an example, could become possible through the utilization of such biomarkers, thereby underscoring their crucial role within the continuing development of drugs. including recent developments within the field of nanotechnology, biomarkers and their use within the detection of varied diseases will only still grow.

Immunomagnetic assays, especially, ask for the identification of the target analyte (eg, antigen) via capture moieties (ie, antibodies, ligands, nucleotides) conjugated onto the surface of magnetic particles. Specifically, the capture moieties detect the specified target (ie, protein biomarker, DNA, RNA) for subsequent separation from the remaining solution via an easy magnet, and consequently, for various methods of analysis. The noninvasiveness and straightforward nature of this method continue to enable the widespread use of magnetic particles. Furthermore, the high surface-area-to-volume ratio of the particles confers a correspondingly high probability of interaction with target biomarkers and essentially increases the efficiency of the system. the steadiness of the particles in various chemical environments works to further increase their use across a good range of applications. Additionally, the three-dimensionality of particles in a solution is often wont to increase the gathering and separation efficiency of biomarkers; the utilization of conventional enzyme-linked immunosorbent assay (ELISA) kits, on the opposite hand, is restricted by their two-dimensional approach to biomarker targeting. Finally, magnetic particles are often surface-functionalized and conjugated with other nanomaterials, including gold particles, quantum dots, and protein nanocages, to get a platform for the highly-sensitive quantification of biomarkers.