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Integrated Expendable Sensor Based for Hyper Reactive Retinal Binding Protein Determination

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Introduction

Retinol Binding Protein belongs to the globulin family of human plasma proteins and has a single chain glycoprotein structure. RBP is the primary transporter of retinol in plasma. RBP binds retinol in a 1: 1 stoichiometric ratio, which also serves to solubilize retinol for easy transport. Retinol plays an important part in the development and differentiation of numerous bodily tissues. Furthermore, previous research has shown that embryos are extremely sensitive to changes in retinol levels, which can result in malformations during development. As a result, retinol deficiency should increase morbidity and mortality, particularly among women and children [1].

About the Study

Retinol levels are an indication of vitamin A in serum because retinol is the most prevalent circulating form of vitamin A in the blood. It is released from the liver in a 1:1 ratio with its carrier protein, retinol-binding protein, in response to tissue need. However, retinol is neither a light or heat stable molecule. As a result, RBP should be used instead of retinol. The serum RBP level has been suggested as a proxy assay for serum retinol levels. Furthermore, RBP is more resistant to light and heat than retinol. RBP levels fall with protein deficiency or inflammation. Furthermore, quantifying RBP in liver illness, protein-calorie malnutrition, and vitamin A deficiency should be highly beneficial [2].

The majority of modern RBP tests are frequently used.based on traditional immunoassay techniques, such as ELISA stands for enzyme-linked immunosorbent assay. All of these methods allow for reliable detection. However, these treatments have inherent downsides, such as time investment and active exposure. Antigen-binding sites, as well as the fact that antibodies, as Temperature variations may quickly denature proteins [3].

In the case of ELISA, a sandwich structure is required to quantify the quantity of a disease marker, which requires at least two antibodies to bind a single specific spot, and repeated washing processes may wash away antibodies and diminish detection rates. Furthermore, the ELISA of the user should be enhanced. In addition to traditional immunoassay approaches, an immunosensor based on electrochemiluminescence has recently been published. For a simple immunosensor setup, two distinct antibodies, primary and secondary, multiwalled carbon nanotubes, and SiO2 nanoparticles were required. As a result, the manufacture of an immunosensor should be time-consuming. Furthermore, the immunosensor responded to RBP concentrations ranging from 78 to 5000 ng/mL. The detection limit of RBP was significantly greater than that of our biosensor described here. However, the concentration range of our approach is smaller than that of the preceding literature [4].

The goal of this research was to create a novel biosensor based on indium tin oxide substrates for ultrasensitive and easy RBP measurement. ITO-based applications are gaining popularity due to their unique qualities, including as strong electrical conductivity and acceptable electrochemical properties. Many biosensor devices based on ITO substrates, such as DNA biosensors and microfluidic systems, have been published. To build biosensors based on ITO substrates, many immobilisation approaches were used, such as self-assembled gold nanoparticles or a poly(dopamine) layer coated surface for biomolecule immobilisation. However, significant advancements in appealing immobilisation techniques are required for more reliable and stable biosensor devices based on ITO substrates [5].

Conclusion

To produce an immunosensor, a silane reagent was applied to the activated ITO surface under well-controlled conditions to immobilise anti-retinol binding protein antibody. SEM characteristics of the surfaces of each layer were obtained based on a combination of electrochemical impedance spectroscopy in the presence of $[Fe(CN)_6]$ 3/4 as a redox couple. After every bio-recognition event, charge transfer resistance in a conventional EIS-based biosensor normally increases, and this change in Rct can be employed for detection. In this work, however, a unique impedance approach was used on the immunosensor.

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