

# The Developed Nanosensor Was Successfully Used To Detect Tartrazine in Foods

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## Description

For the purpose of selective tartrazine analysis, a fluorescent assay was developed. Tartrazine is a dangerous food additive that is frequently used as fake saffron. Using the molecular imprinting method, Carbon Dots (CDs) as fluorophores and tartrazine as a template molecule were embedded in a Molecularly Imprinted Polymer (MIP) matrix to create an optical nanosensor. Different techniques were used to define the CDs-MIP, or synthesized CDs embedded in MIP. In comparison to other food color additives that are comparable to tartrazine, the fluorescence intensity of (CDs-MIP) was selectively quenched in the presence of tartrazine. In the end, the developed nanosensor was successfully used to detect tartrazine in foods like samples of fake saffron, saffron tea, and saffron ice cream. Sirtuin 1 is a crucial histone deacetylase that controls everything from metabolism to DNA repair in biology. Numerous diseases, including diabetes, inflammation, aging-related conditions, and cancers, are linked to the alteration of SIRT1. As a result, the therapeutic significance of SIRT1 activity detection cannot be overstated. The deacetylation-activated construction of a single Quantum Dot (QD)-based nanosensor for a sensitive SIRT1 assay is presented here for the first time. A streptavidin-coated QD and a Cy5-labeled peptide substrate make up this nanosensor. The peptide with one lysine acetyl group serves as SIRT1's substrate and the Cy5 fluorophore carrier at the same time. The acetyl group in the acetylated peptide is removed in the presence of SIRT1, and the deacetylated peptide that results can react with the NHS-activated biotin reagent (sulfo-NHS-biotin) to form the biotinylated peptide.

## Rapid Nano systems Capable of Specific Viral Illness Detection

Through the biotin-streptavidin interaction, multiple biotinylated peptides can assemble on a single QD surface. This causes efficient Fluorescence Resonance Energy Transfer (FRET) from the QD to Cy5, resulting in a distinct Cy5 signal that can be easily quantified using total internal reflection fluorescence-based single-molecule detection. This single QD-based nanosensor can measure enzyme kinetic parameters and screen for SIRT1 inhibitors by sensitively detecting SIRT1 with detection limit as low as 3.91 pM. Additionally, this nanosensor can be utilized to detect SIRT1 activity in cancer cells, making it an

effective platform for epigenetic research and the development of SIRT1-targeted drugs. The global demand for the design and fabrication of precise, sensitive, and rapid nanosystems capable of specific viral illness detection with almost negligible false-negative results has increased due to the rapid spread of airborne contagious pathogenic viruses like SRAS-CoV-2 and their severe negative effects on various aspects of human society. We have developed a fast, ultra-precise diagnostic platform that can detect the trace of monoclonal IgG antibody against the S1 protein of SARS-CoV-2 in blood samples from COVID-19-infected patients in approximately one minute to meet this essential requirement. A highly activated graphene-based platform and Au nanostars make up the newly developed electrochemical-based nanosensor, which can detect SARS-CoV-2 antibodies in human blood plasma samples despite the presence of a large quantity of interfering compounds or antibodies with excellent Detection Limits (DL) and sensitivity.

When compared to the gold standard, the nanosensor also exhibited remarkable sensitivity and specificity. Pesticide overuse in agriculture has negative health effects and the potential to pollute the environment. As a result, there has been a growing demand for analytical techniques that can identify pesticide residues in food products, soil, etc. That is precise, sensitive, simple, and selective. A novel electroactive and electropolymerizable group-bearing hybrid nanomaterial was used to develop an electrochemical method for the simultaneous determination of chlorantraniliprole and parathion pesticides in this study. As an electrochemical nanosensor, the novel hybrid ferrocene-thiophene modified by carbon nanotube was made by using Click chemistry to modify the surface of the carbon nanotube with thiophene-ferrocene moieties. Prior to the electrochemical determination of parathion and chlorantraniliprole pesticides in tomato, apple, and soil samples, the experimental conditions, such as the pH and concentration of the nanosensor, were optimized. Spike/recovery and HPLC analyses of food and soil samples were used to assess the electrochemical methods' accuracy. When compared to other analytical methods for determining pesticides, the electrochemical method was found to be not only fast and easy to use but also highly sensitive and selective for simultaneously determining parathion and chlorantraniliprole residues in food and soil samples. The hybrid material had high sensitivity to chlorantraniliprole and parathion pesticides in addition to excellent stability. For ultrasensitive biosensing and

imaging, a novel Metal Enhanced Chemiluminescence (MEC) nanosensor based on silver nanoparticles (AgNPs), proximity-dependent DNAzyme, and Functional DNA Dendrimer (FDD) was developed.

## Protein Analysis and Clinical Diagnosis

An enzyme-free and step-by-step assembly method was used to prepare the FDD, which contained two split G-quadruplex structures. After that, the FDD easily reacted with AgNPs and hemin molecules to form the FDD/hemin/AgNPs. There were three modules in this kind of MEC nanosensor: FDD, which is a scaffold, AgNPs, which are a chemiluminescence enhancer and a signal reporter created from the G-quadruplex/hemin DNAzyme. By controlling the length of DNA sequences between AgNPs on the FDD's periphery and DNAzymes within it, the MEC effect was achieved. A disposable protein immunoarray can easily be used for the trace detection of multiple protein markers thanks to this nanosensor's 9-fold amplification and another 6.4-fold metal enhancement in chemiluminescence intensity. For cardiac troponin T and carcinoma antigen 125, the FDD/hemin/AgNPs-based multiplex MEC imaging assay demonstrated promising potential in application to protein analysis and clinical diagnosis with wide linear ranges exceeding 5 orders of magnitude. In addition, the MEC nanosensor offers a novel instrument for the

detection of intracellular targets and suggests numerous bioassay applications due to its outstanding stability and ability to effectively enter cells. High quantum efficiency, size-dependent emission from visible to near-infrared, and robust photostability are some of the unique optical properties of colloidal silicon crystallites, also known as "silicon nanocrystals." Silicon is an appealing option for use as signal transduction components in bioanalytical sensors due to these characteristics, as well as its high earth-abundance and good biocompatibility. A Silicon Nanocrystal NanoSensor (SiNC-NS) is created by combining silicon nanocrystals, a sodium-selective ionophore, and a charge-balancing additive in polymeric nanosensors in this study. Without the pH-sensitive absorbing dye that is typically included in analogous sensors for signal gating, the SiNC-NS's fluorescence intensity decreased in response to sodium, resulting in a sensor design with more photostable components. The SiNC-NS has a reversible response between 0 and 2 M Na<sup>+</sup> for at least three cycles, is selective against potentially interfering cations, and has a biologically relevant dynamic range of 4–277 mM Na<sup>+</sup>. The first sodium-responsive silicon nanocrystal-based sensor, the first application of silicon nanocrystals in polymeric nanosensors, and an intriguing ionophore-mediated response in silicon nanocrystals will be investigated further in the future are all presented in this work.