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Perspective

Importance of Peptide Based Biosensors in Molecular Modeling

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DESCRIPTION

The ability to get food and feed outside of one's immediate geographic area has significantly improved over the past two to three decades due to growing globalization. Because of its vulnerability to possible dangers at each level of food-feed production the lengthening of food-feed supply chains from the farm to the plate has also increased worries about food-feed safety. The growth of storage fungi like Aspergillus ochraceus and Penicillium verrucosum can be stimulated by factors like climatic shifts in various geographic locations the use of unsafe water in food cleaning and processing, and the absence of adequate infrastructure for food-feed storage which can affect the risk associated with food-feed safety by mycotoxin contamination. The chemical structure of the mycotoxins commonly found in food and feed. Many of these mycotoxins frequently co-occur with other mycotoxins that are occasionally physically unrelated. Chronic low-grade exposure to these mycotoxins through oral and transdermal routes can result in endocrine disruption, allergic and hypersensitive reactions and an increased risk of developing cancer. Such mycotoxin overexposure may potentially be fatal in rare circumstances. Furthermore it is known that simultaneous exposure to a number of mycotoxins can have both additive and synergistic impacts on both human and animal health. It is now more crucial than ever to monitor and control the level of mycotoxin contamination in food and feed products using analytical technologies like biosensors because the risk to food safety from this contamination is rising.

Any biomolecular structure that can recognize a target mycotoxin can theoretically be utilized as a bio-receptor. The gold standard for detecting mycotoxin levels in various food matrices during the past ten years has been molecular recognition by immuno-chemical techniques. These immunochemical detection techniques might range from a straightforward immunoassay to an extremely complex immune-biosensor. However the fundamental idea behind these immunoassays depends on the capacity of Monoclonal Antibodies (Mab) to bind to target mycotoxins with high specificity. When the mycotoxin concentrations in the food or feed matrices are very low the affinity of antibodies to certain mycotoxins becomes even more crucial. Low-molecular-weight mycotoxins make it difficult, expensive and laborious to produce mycotoxin-specific antibodies. The service-life of these bio-receptors can also be shortened by matrix effects and a number of environmental factors that are involved in daily operational processes such as buffers, salts, temperature, inhibitors, storage conditions, and others, as the ordered structure of antibodies is essential for its function. Maintaining the functional stability of the antibody-based molecular recognition bioreceptor under such operating circumstances raises the expense of operation and forces the fabrication process to rely on educated trial-and-error methods. Despite these challenges, antibodies to the majority of mycotoxins are commonly utilized in immunoassays and are readily accessible on the market. However, the limited availability of antibody-based sensing components has impacted the ability of producers and regulatory organizations from low-income economies to mycotoxins at danger of entering the supply chains for food and feed.

The considerable heterogeneity in mycotoxin contamination across various supply chain origin points necessitates enhanced awareness and continual mycotoxin surveillance. Giving low-income groups access to more reasonably priced mycotoxin monitoring equipment would not only help them to comply with regulations but also open up a wider range of export markets with a variety of regulatory requirements. Over time this would help to decrease food loss and hunger worldwide boost local economies and protect human and animal health. Therefore worried producers and regulatory agencies are looking for innovative, quicker, more practical, and less expensive ways to identify and monitor mycotoxins in a variety of food matrices in real time. The main problem in creating any biosensor for mycotoxin monitoring is to be able to predict and control the mycotoxin-binding characteristics of the molecular recognition receptor of the bio transducer. This is in addition to increasing the mycotoxin binding properties of the peptide receptors. When a peptide is chemically modified for immobilisation, chemically conjugated for labelling or physicochemical immobilized on a solid support, it is frequently assumed that the peptide's mycotoxin binding behaviour in solution is replicated.

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