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APTASENSORS FOR OCHRATOXIN A DETECTION IN FOOD PRODUCTS

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Introduction. Ochratoxin A (OTA) is a prevalent mycotoxin that contaminates various agricultural commodities, posing a significant threat to human health due to its nephrotoxic, carcinogenic, and immunosuppressive properties [1]. Traditional methods for OTA detection, such as chromatography and immunoassays, often require expensive equipment, skilled personnel, and time-consuming procedures. Aptamers, single-stranded DNA or RNA oligonucleotides with high affinity and specificity for target molecules, have emerged as promising recognition elements for the development of rapid, cost-effective, and sensitive OTA detection methods [2]. The unique advantages of aptamers, including their ease of synthesis, stability, and modifiability, make them ideal candidates for replacing antibodies in OTA detection assays. Aptamers are selected through the SELEX process, which involves multiple rounds of selection and amplification, wherein a diverse library of oligonucleotides is subjected to binding assays with the target, gradually enriching the population for high-affinity aptamers. However, this multistep process is also the major drawback of SELEX because it introduces inherent complexity, heavy time-consumption, high variability with increased likelihood of errors, and low predictability in the results.

Main part. Development of rapid and cheap detection systems of not only OTA but also other food contaminants, would notably improve the quality control processes in the food industry [3]. To this end our team is developing a data driven approach for in silico design of aptamers against small molecule targets, which will revolutionize the traditional in vitro SELEX and make aptamers more popular in the biosensing market. Subsequent to the *in silico* design is the experimental validation of the developed aptamers. For this we have opted to target OTA as a significant contaminant of food products.

The literature showcases a variety of aptasensors designed for OTA detection. These systems leverage different detection principles, including electrochemical, optical, and mass-based methods, to transduce the aptamer-OTA binding event into a measurable signal [4]. Electrochemical aptasensors, for example, utilize redox-active labels or electroactive nanomaterials to amplify the signal generated upon OTA binding, offering high sensitivity and the potential for miniaturization. Optical aptasensors, on the other hand, rely on changes in fluorescence, absorbance, or surface plasmon resonance (SPR) upon aptamer-OTA interaction, enabling real-time and label-free detection.

Believing in the advantages of optical aptasensing methods we chose to use detection in fluorescence change for the validation step in our project. Fluctuations in the fluorescence of simple intercalating fluorescent dyes, such as SYBR Green, will be used to determine the binding capacity and affinity of our novel aptamers to OTA. Reaction buffers and other conditions will be determined during the *in silico* design.

Conclusion. Simplicity or use, cost effectiveness and rapid results are the reasons why such a technique is advantageous for us but also will be valued in the quality control sectors of food industry. Optical assays often require less preparation time since they involve fewer steps and simpler protocols. In contrast, techniques currently used by the food industry, like HPLC or MS involve extensive sample preparation and calibration processes. Moreover, while some advanced techniques may require lengthy analysis times, optical assays can often provide results in a matter of minutes to a couple of hours. A method such as fluorescence change can be later enhanced with innovative approaches such as aptamer-functionalized nanoparticles to enhance the sensitivity of the fluorescence assay.

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