Ultrasensitive aptasensor using electrospun MXene/polyvinylidene fluoride nanofiber composite for Ochratoxin A detection

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ABSTRACT

Ochratoxin A (OTA) has harmful effects to human and animal health; therefore, sensitive and selective detection of OTA is highly demanded. Herein, an ultrasensitive electrochemical aptasensor electrode comprising electrospun MXene/polyvinylidene fluoride ($Ti_3C_2T_x$/PVDF) nanofiber composite is presented. Addition of $Ti_3C_2T_x$ up to 13% effectively increased the fiber diameter and lowered the β-phase of PVDF nanofibers, consequently lowering the charge transfer resistance. The nanofiber composite is then coated on the screen-printed carbon electrode to chemically functionalized with saline and aldehyde groups for efficient aptamer loading. The optimized aptasensor demonstrated sensitive detection of OTA over the dynamic concentration range from 1 fg mL^{-1} to 1 ng mL^{-1} with a limit of detection of 2.15 fg mL^{-1} and quantification limit of 6.52 fg mL^{-1}, with high selectivity. The aptasensor could detect the OTA at femtogram per milliliter concentration in grape juice samples, demonstrating its enormous potential for OTA detection in food industry.

KEYWORDS

Biosensor design; Electroactive materials; Food samples; Mycotoxin contamination; Piezoelectric sensor; Titanium carbide

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