biosensors

MDPI

Supplementary Materials

Duplex EIS Sensor for *Salmonella Typhi* and *Aflatoxin B1* Detection in Soil Runoff

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Table S1. Maximum limit of *Aflatoxin B1* by food product as per EU standards [1].

Food Product	**Maximum Limit (ppb)**
Peanuts, dried fruit, nuts for human consumption	2
Peanuts before being processed or peanuts added as an ingredient to a food for human consumption	8
Nuts or dried fruit before being processed or peanuts added as an ingredient to a food for human consumption	5
Cereals and their processed form or as an ingredient in food for human consumption	2
Feed material from peanuts, palm-kernel, corn, copra, cottonseed, and their processed forms	20
Feed for dairy cattle	5
Feed for mature pigs and poultry	20

Table S2. Comparison of the developed immunosensor with other studied label-free detection of *S. Typhi* and AFB1.

Device Type/ Detection Method	**Mycotoxin Detected**	**Sample Type**	**LoD**	**Assay Time**	**Reference**
Chronoamperometry	*Aflatoxin*	Milk	0.01 ppb	15 minutes for sample preparation Time for reading not given	[2]
Aptameric	*Aflatoxin*	Corn	0.1 ng/mL	20 minutes for sample preparation 20 minutes for incubation and reading time	[3]
Fluorescence (Smartphone Camera)	*Aflatoxin*	Maize	20 ng/mL	16 minutes sample preparation 1 minute for reading	[4]

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Aptameric	*Aflatoxin*	Red wine and Beer	0.4 nM	13 minutes sensor preparation time 6 minutes total runtime for reading	[5]
Cyclic Voltammetry and Square Wave Voltammetry	*Aflatoxin*	Corn Powder	3.5 pg/mL	15.5 hours for sensor and sample preparation 1.5+ hours total runtime for reading	[6]
Aptameric with Fluorescence	*Aflatoxin*	Corn + peanut + oatmeal + rice mixture And Peanut Oil + Corn Oil mixture	0.13 ng/mL	41.5+ hours for sensor and sample preparation Time for reading not given	[7]
EIS	*S. Typhi*	chicken rinse water	3.4×10^2	105	[8]
SPR	*S. Typhi*	romaine lettuce	4.7×10^5	<6	[9]
SPR	*S. Typhi*	buffer	1.7×10^3	22	[10]
Portable SPR	*S. Typhi*	buffer	10^7	60	[11]
Ω-shaped fiber-optic LSPR	*S. Typhi*	buffer	<128	100	[12]
Hartman interferometry	*S. Typhi*	assay buffer	10^4	10	[13]
EIS	*S. Typhi*	buffer	1×10^3	30	[14]
EIS	*S. Typhi*	Milk	1×10^3	20	[15]
Fiber-optic	*S. Typhi*	Milk	247	100	[9]
DPV	*S. Typhi*	Licorice Extract	80	150	[17]
CV–DPV	*S. Typhi*	Water	17	35	[18]
DPV	*S. Typhi*	spring water and milk	34	150	[19]
EIS	*S. Typhi* and *ABF1*	Soil run-off	1CFU/mL, 0.001ng/mL	5	This work

SPR-Surface plasmon resonance; EIS-Electrochemical impedance spectroscopy.

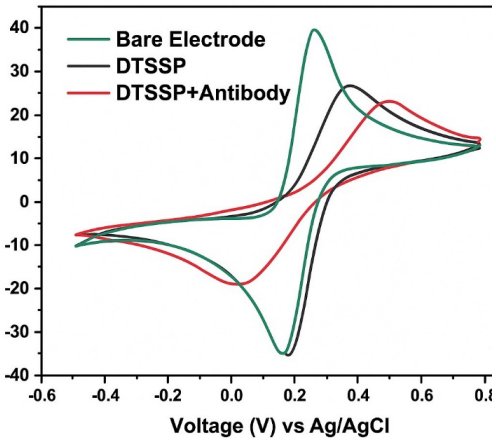


Figure S1. Surface characterization of the electrode at different modification stages: bare ZnO electrode, after DTSSP functionalization, and after antibody immobilization. The changes in surface morphology and electrochemical behavior confirm successful stepwise modification.

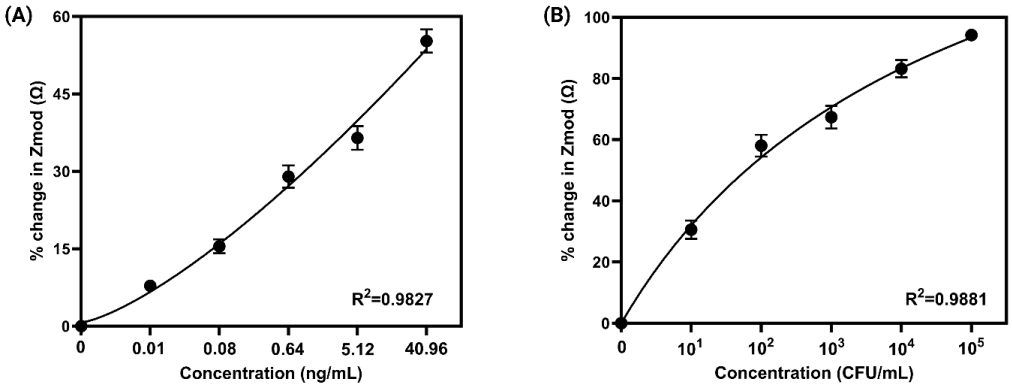


Figure S2. Calibrated dose–response plots for *Aflatoxin B1* (A) and *Salmonella Typhi* (B) in potable water, showing change in impedance response across the tested concentration range.

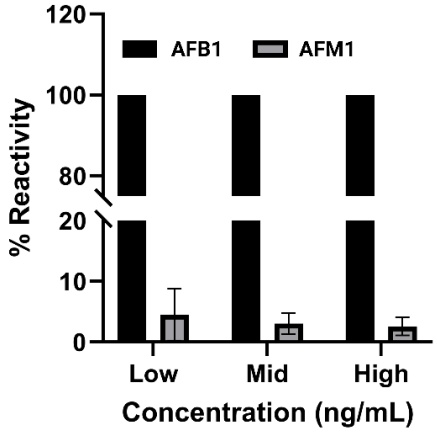


Figure S3. Cross-reactivity analysis for AFM_1 and AFB_1 on AFB_1 - modified sensors tested with mixed analyte cocktails, showing minimal non-specific response.

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