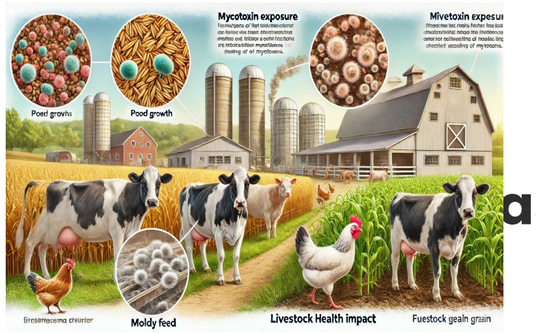
Technology Match Maker | Veterinary Diagnostics | Dec 2024

Title of the tech: Aptamer Based Detection of Mycotoxins in Animal Feed



Lead Scientist: Dr. Koteswara Rao

Organization: CSIR-National Chemical Laboratory

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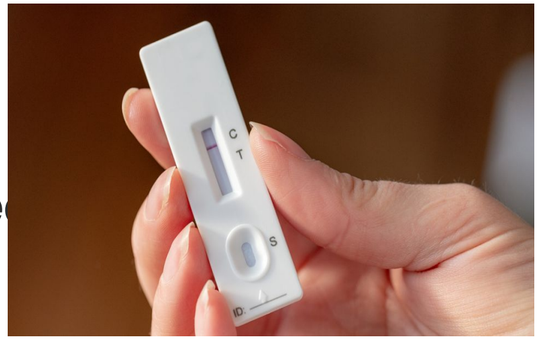

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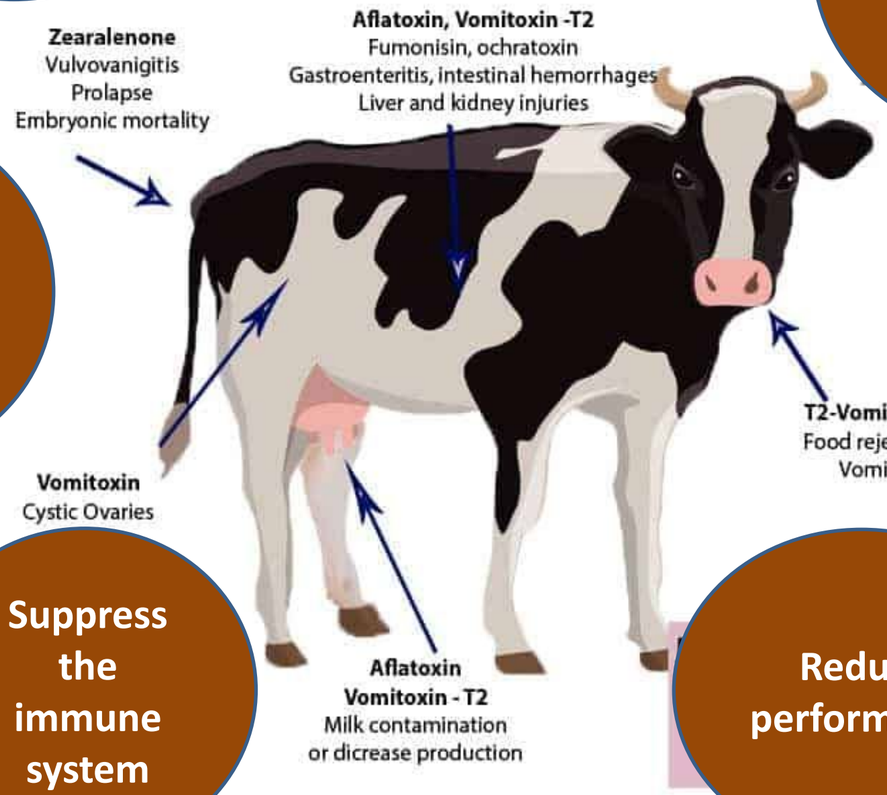
Problem definition

Reduce Animal fertility

Increases the AMR

Increased Secondary Infections

Reduced Feed Quality



Impact on Animal-Related Products

Suppress the immune system

Reduce performance

The need of hour is effective and point of care detection of mycotoxin contamination in Animal Feed

Mycotoxins are a significant threat to animal feed leading to estimated economic losses of $2 to $3 billion annually

Problem definition

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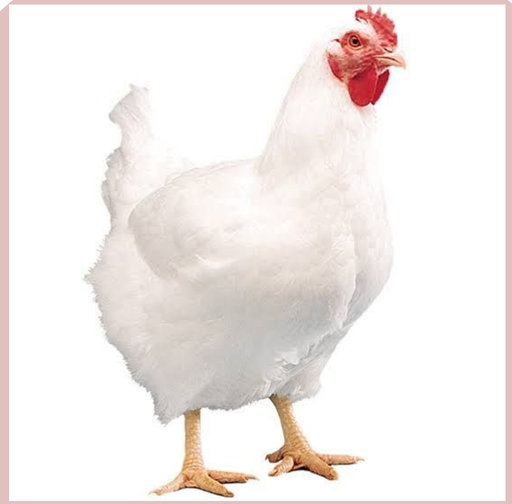
Poultry production is the fastest-growing agricultural sector, especially in the tropics and subtropics



Ochratoxin A

- Nephrotoxic
- Reduced Growth Performance
- Poor FCR
- Immunosuppression
- Mortality
- Liver damage

The total economic impact of OTA contamination in poultry farming is often estimated to range from **$2 to $4 billion annually**

A reduction in feed efficiency could add **$15,000–$25,000** additional feed costs.

The current poultry market demand is $ 322.55 billion, with a CAGR of 3.8%, which is expected to reach $ 422.97 billion in 2025 with CAGR of 7%

Currently available solutions

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The traditional mycotoxins detection typically involves a combination of sample preparation, extraction, clean-up, derivatization and detection.

S. no	Name of the test	Turn around time	Cost (INR)	Specificity (%)	Sensitivity (ng/mL)
1	Chromatography-Methods	5-10 days	2000	97	1.0-5.0
2	Mass Spectrometry	5-10 days	3000	99	0.10-1.0
3	Immunoassay-Based Methods (ELISA)	2-3 hours	1000	80	0.10-1.0
4	Fluorescence Detection	1-2 hours	1000	90	0.05-1.0
5	Biosensors	15-30 min	1000	85	1.0-10.0
6	CSIR-NCL-Myco-Tech	15-20 min	500	95	1.0-5.0

Mycotoxins Tolerable limit in animal feed (µg/kg)		
	European commission	USFDA
Aflatoxin B1	5.0	20.0
Aflatoxin M1	5.0	20.0
Ochratoxin A	20.00	50.00

European Commission

fssai

CODEX ALIMENTARIUS
International Food Standards
World Health Organization
Food and Agriculture Organization of the United Nations

Value proposition

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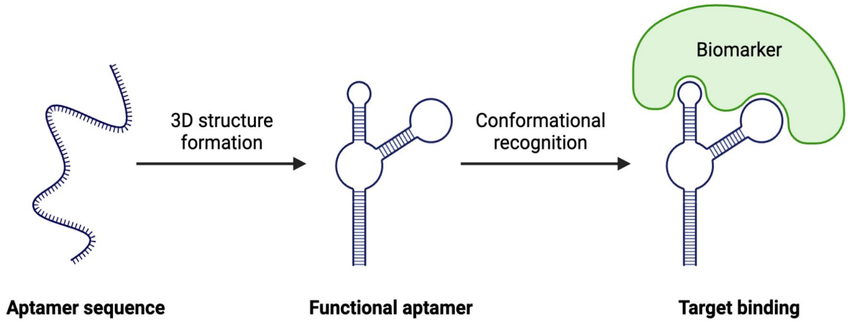
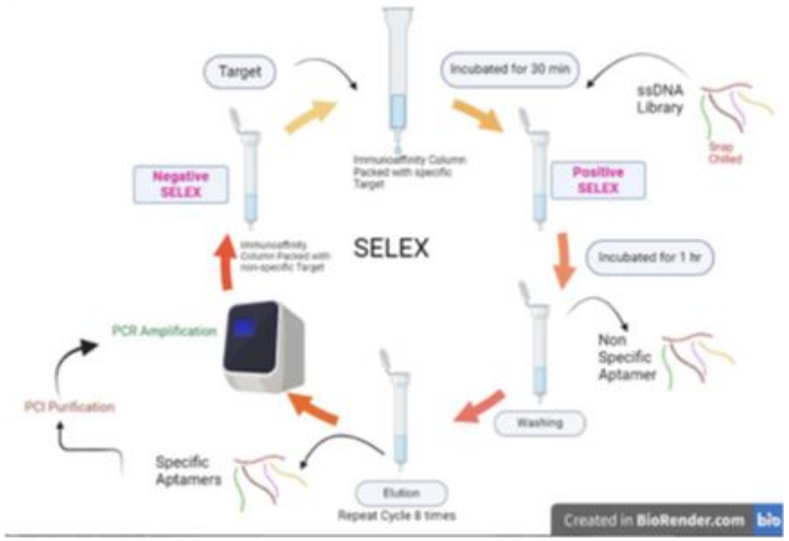
Binding of Aptamer to its Target Through Conformational Recognition





Highly specific to toxin chemotype

Stable at room temperature

Point of care (PoC) use

Aptamer Based Mycotoxin Detection Platform in Animal Feed

Highly sensitive; detection limit as low as 1-5 ng/mL

Quick results: 15-20 mins

Affordable; Rs<500/ test

Potential Customer

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- Food and Beverage Industry
- Animal Feed Industry
- Agriculture
- Cosmetics & Personal Care
- Export and Import

About the Technology: Use case 1 of Aflatoxin M1

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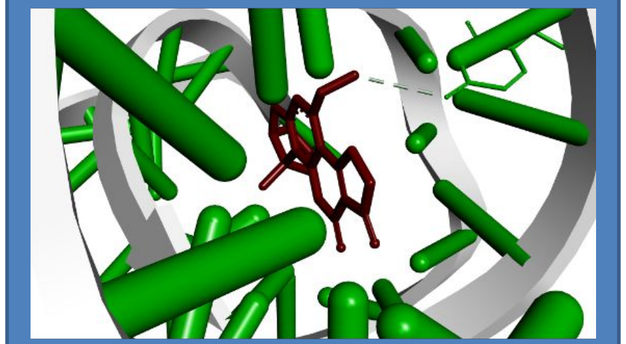
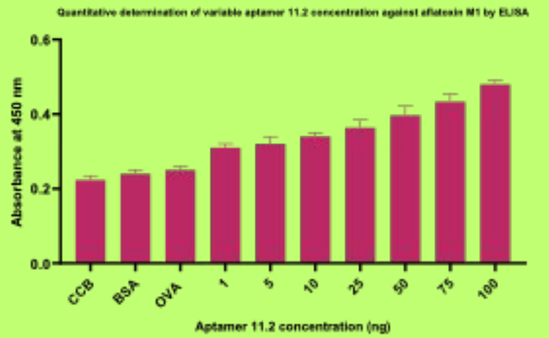
An ssDNA aptamer-based biosensing platform for the rapid detection of Aflatoxin M1 offers a novel and powerful solution for addressing testing of milk and dairy products



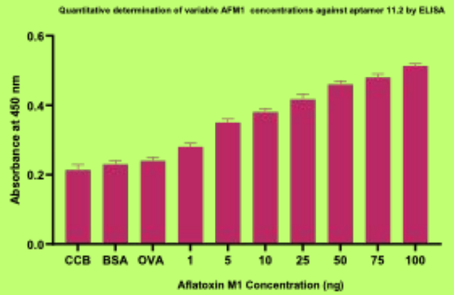
Process features:

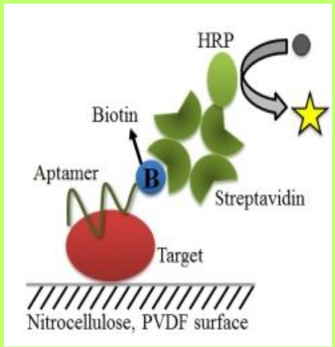
- An aptamer is a short ssDNA or RNA molecules bind to a specific target with high affinity and specificity
- Aptamers developed by Systematic evolution of ligands by exponential enrichment (SELEX)
- Quantitative results with in 30 min



Product features:

- High Sensitivity and Specificity
- Stability at ambient temperature
- Rapid detection with 30 min
- ELISA: LOD/LOQ:5-10 ng
- Cost-effective (< INR: 500)
- Compactable in ELISA, LFD, and electrochemistry
- Portable and field-deployable testing
- Versatility: Testing of milk and milk products





About the Technology: Use case 2 of Ochratoxin A

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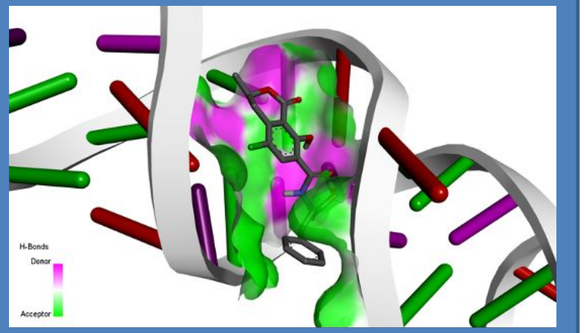
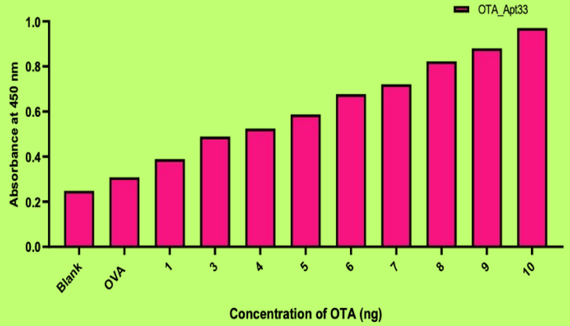
An ssDNA aptamer-based biosensing platform for the rapid detection of Ochratoxin A offers a novel and powerful solution for addressing testing of food and feed safety issues



Process features:

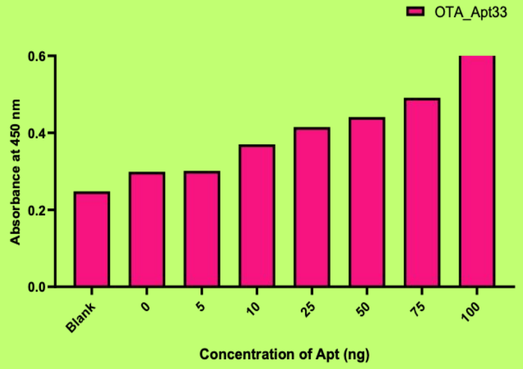
- An aptamer is a short ssDNA or RNA molecules bind to a specific target with high affinity and specificity

- Aptamers developed by Systematic evolution of ligands by exponential enrichment (SELEX)
- Quantitative results with in 30 min



Product features:

- High Sensitivity and Specificity
- Stability at ambient temperature
- ELISA: LOD/LOQ:5-10 ng/mL
- Lateral flow device: 1-10 ng/mL
- Compactable into ELISA, LFD and electrochemistry
- Versatility: Testing of poultry and animal feed



Market analysis

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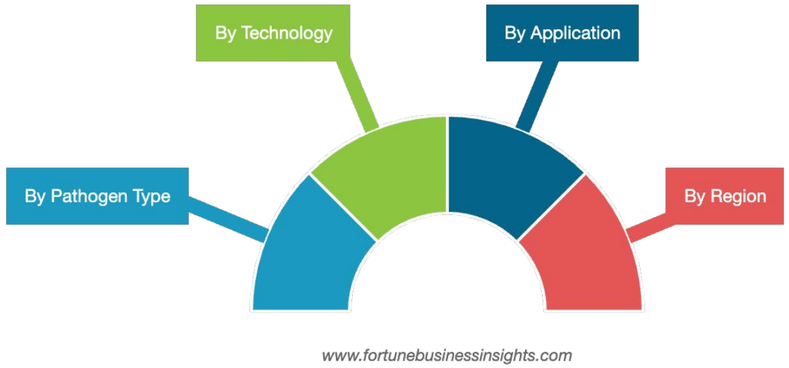
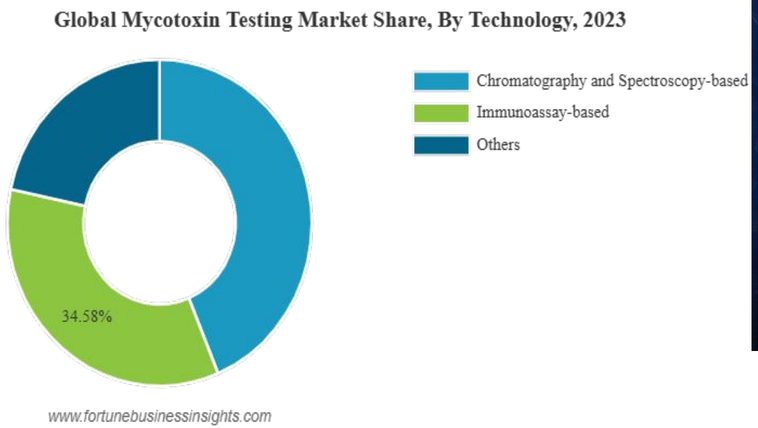
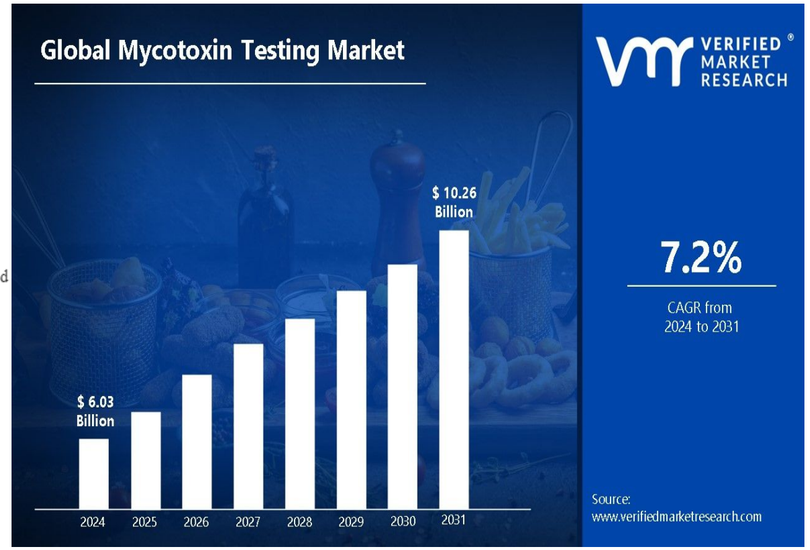
The **mycotoxin testing market** was valued at approximately **USD 1.5 billion to USD 2 billion** in 2023, and it is expected to grow at a CAGR of around **7% to 9%** from 2023 to 2030.



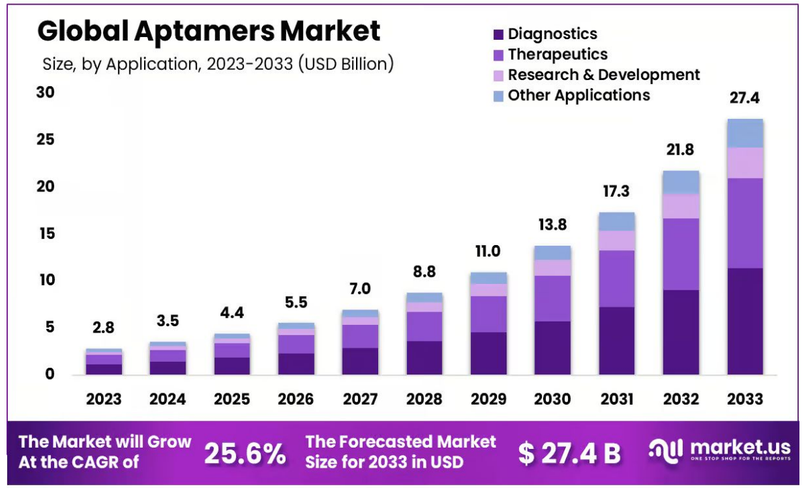
Mycotoxin Testing Market Segments





Key Market players for Mycotoxin detection : DSM, ImagoAI, ExciPlex, Eurofins Scientific, SGS S.A., Bureau Veritas, Intertek Group, ALS Ltd., PerkinElmer, Inc., Krishgen BioSystems.

- Asia Pacific is expected to hold a prominent share of the global market.
- The rapid developing regulations, coupled with increasing international trade, is a key factor driving the market.
- Rising awareness of food safety in emerging markets is the latest market trend.



Current Status:

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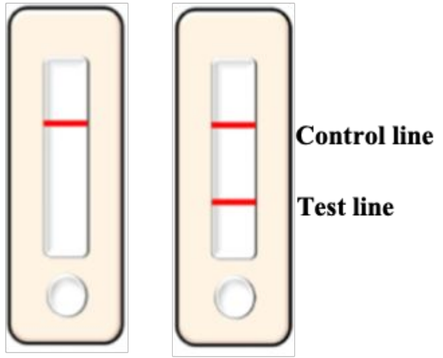
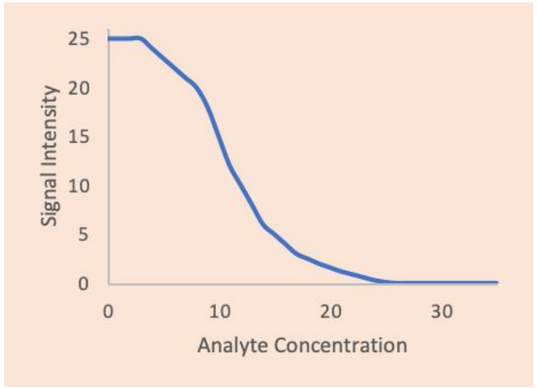
Technology Status:

- **Developed novel ssDNA Aptamers (TRL:2)**
- **Highly selective and sensitive (TRL: 3)**
- **Qualitative Detection of LOD (5-10 ng/mL)**
- **Developed aptamer based ELISA (5-10 ng/mL)**
- **Lateral flow Assay (1-10 ng/mL) (TRL:4)**

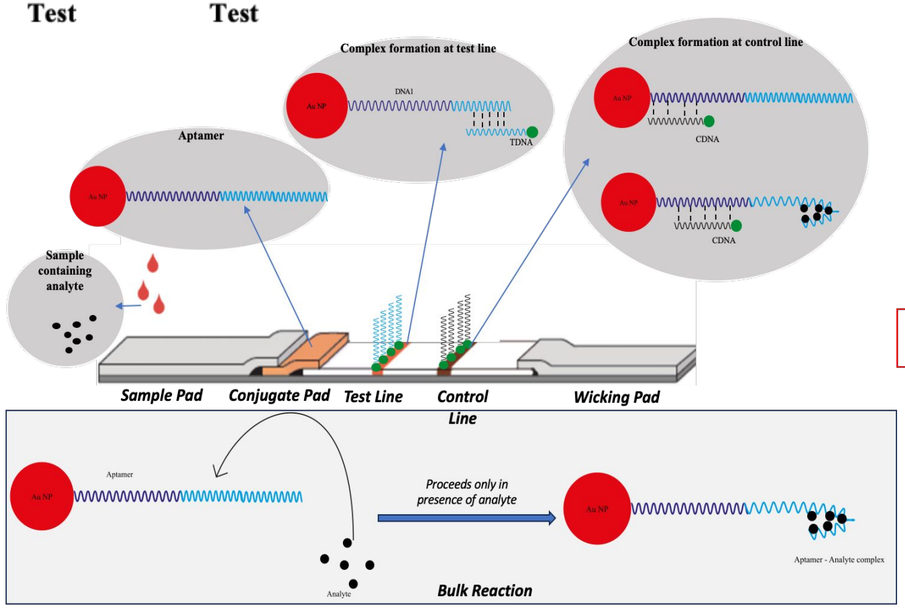
IP Status: Patent filed and granted in India.

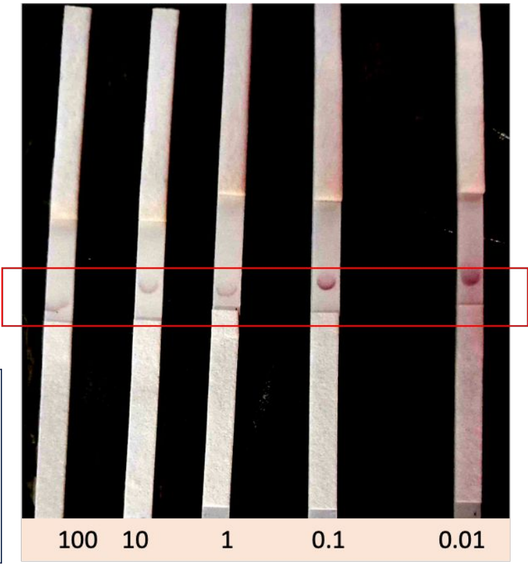
- **Priority date: 2023-2024**
- **Coverage: Detection of Mycotoxins Using Aptamers and their Application**
- **Patent filed:**
  - **Ochratoxin A: Indian Patent File: 0187NF2023**
  - **Aflatoxin M1: Indian Patent File: 01657NF2024**





Prof. Bhushan Toley
IISc, Bangalore





The limit of detection has improved and stands at around 0.1 – 1 ng/mL.

Team & Organisation

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About the organization

National Chemical Laboratory (CSIR-NCL), Pune, established in 1950, is a constituent laboratory of Council of Scientific and Industrial Research (CSIR). CSIR-NCL is a science and knowledge based research, development and consulting organization. It is internationally known for its excellence in scientific research in chemistry and chemical engineering as well as for its outstanding track record of industrial research involving partnerships with industry from concept to commercialization

Lead Scientist

Dr. Koteswara Rao

Senior Scientist

Biochemical Sciences Division

CSIR-NCL

- **Expertise:** Microbiology and molecular biology
- **Awards:** Fellow of Telangana Academy of Sciences

Key assets and strengths of the team:

- Team Strength: 6
- Patents filed: 5
- Research publications: 50+
- Edited and wrote to 2 books on Mycotoxins
- Well equipped lab

Team and Collaborators

Dr. Dhanasekaran

Dr. Narendra Kadoo

Dr. Bhushan Chaudhari

Prof. Bhushan Toley

Next Steps

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- Team has developed the background science, invented novel ssDNA library against each mycotoxin and demonstrated proof-of-concept at lab-scale.
- Next phase includes further deployable point of care (PoC) Diagnostic Device development:
  - Commercial ELISA Kit
  - Lateral Flow Device/ test strip/Dipstick
  - Electrochemical Sensors
  - Scale-up and filed validation
  - Manufacturing and licensing of the test kits
  - Develop same platform technology for other mycotoxins
- Optimize for quality and cost of final product as per industry/regulatory bodies requirements

Seeking:

- Industrial partners interested in technology licensing.
- Industrial partners interested in sponsoring further technology advancement and scale up.
- Industrial partners interested in raising 3rd party funds for a collaborative project.
- Industry interested in tapping scientist capabilities as an expert/ consultant.

Catalysing Innovation

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For More Information Contact:

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