Ensuring Honey Safety: Rapid Testing for Antibiotic Residues

Nicola Kane*, Mark Squance, Suzanne Ramage, Morteza Afrasiabi; Biorex Food Diagnostics | Corresponding Author: nicola@biorexfooddiagnostics.com

Biorex Food Diagnostics, 9A, The Technology Park, Antrim, United Kingdom, BT41 1QS

Overview

Antibiotic contamination in honey can arise from hive treatments or environmental exposure, posing health risks, driving antimicrobial resistance and risking regulatory non-compliance. Residues threaten consumer safety and may lead to rejected shipments, financial losses, and reputational damage.

To safeguard public health and maintain market access, strict residue limits are enforced globally, with the EU regularly updating maximum residue levels (MRLs) for antibiotics in honey. While confirmatory methods such as LC–MS or HPLC offer high accuracy, they are costly, time consuming and require specialised facilities, making routine or on-site monitoring impractical for many producers.

Using lateral flow immunoassay technology and freeze-dried conjugates the product "FlowSense" delivers high sensitivity, specificity and accuracy in under 10 minutes. This product addresses these challenges by providing a rapid, portable and cost-effective screening solution for up to 49 antibiotics. This enables producers, exporters and regulators to perform continuous quality control, detect issues early and take corrective action, helping ensure compliance, safeguard supply chains, and protect consumer trust.

Testing Principle

Step 1: Sample Preparation

All sample preparations, except for Chloramphenicol and Nitrofurans (which require solvent extraction and evaporation), involve simple dilute-and-shoot methods.

Method

Weigh 1g Honey

↓

Add appropriate volume sample diluent

↓

Shake 3 minutes

↓

Add appropriate volume into micro well

↓

Follow incubation steps

↓

Results

Step 2: Rehydration of Freeze-Dried Conjugates

After sample preparation, which is designed to release the target antibiotic, the user applies the liquid sample into a well containing freeze-dried conjugate (biomolecule-labelled gold particles). The sample buffer rehydrates the freeze-dried conjugates, which then binds to the target antibiotic if it is present.

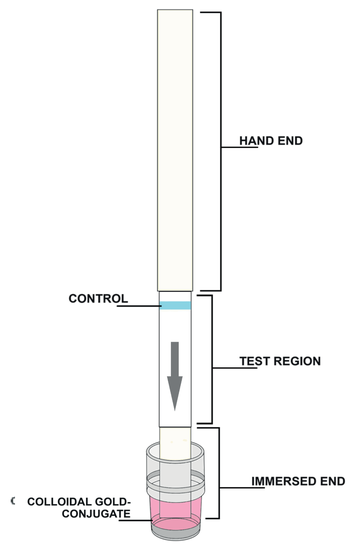


Figure 1: Orientation of Lateral Flow Test

Step 3: Detection

The prepared sample moves along the strip. If the antibiotic is present, the conjugate-analyte complex competes for binding to the antibodies immobilised at the test line. If the antibiotic is absent, no competition occurs, and a control line will appear to confirm that the test is functioning properly.

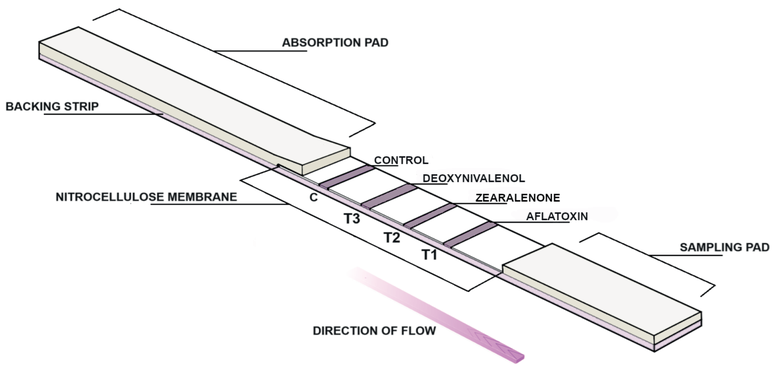


Figure 2: Example of 3 in 1 Test Strip (BXEFB58A)

Step 4: Interpretation

After a few minutes, the result can be interpreted.

A. Visually - If the analyte is present, it binds to the antibodies at the test line, blocking the labelled analyte from binding, resulting in no visible line or a faint line. If the analyte is absent, the labelled analyte binds freely to the antibodies at the test line, forming a visible line.

OR

B. FlowSense Reader- Using the same principles as visual detection, but with an enhanced sensitivity.

The FlowSense Reader has been designed to provide an accessible and effective method for food quality testing, offering numerous advantages to end-users. With a low initial investment, it is financially viable for a wide array of businesses and organisations. Its user-friendly design eliminates the need for prior experience or specialised technical skills, ensuring that anyone can operate it with ease.

Thanks to its portability, the FlowSense Reader can be used effortlessly in various environments, from field operations to different areas within food production facilities. This convenience allows for seamless integration into any workflow, ensuring that testing can be conducted without interruptions.

Key Benefits

- Easy user accessibility with minimal training needed.
- Portable for on-site testing.
- Provides semi-quantitative results to reduce visual interpretation errors.
- Multiple target analysis capability.
- Export via USB drive.
- High data storage capacity.
- Easy printing facilities via USB.

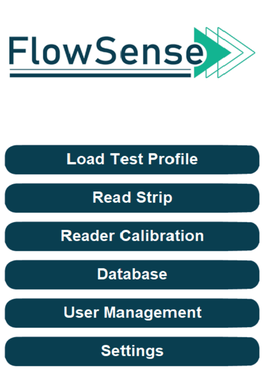


Figure 3: Accesible user interface.

Figure 4: FlowSense Reader (Portable on-site testing)

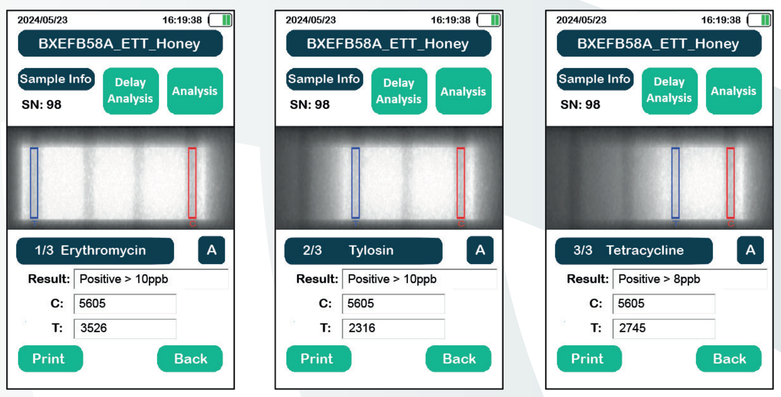


Figure 5: Example of test output using FlowSense Reader

Results

Description	Cat No.	Assay Time	Antibiotic	FlowSense Reader Detection (ppb)	Visual Detection (ppb)
Streptomycin Honey Flowsense Rapid Test	BXEFB55A-Q	10mins	*Streptomycin Dihydrostreptomycin	2 3	N/A
Multi-Sulfonamides Flowsense Rapid Test (High Sensitivity)	BXEFB56A	8mins	*Sulfadimidine (Sulfamethazine) Sulfametoxydiazine Sulfaclozine Sulfamonomethoxine Sulfisomidine Sulfadimethoxine Sulphaquinoxaline Sulfamerazine Sulfadiazine Sulfachloropyridazine Sulfamoxole Sulfamethizole Sulfamethoxypyridazine Sulphormethoxine Sulfapyridine Sulfamethoxazole Sulfisoxazole Sulfathiazole	1 1 1.5 1.5 1.5 1.5 2 1.5 2 2 3 4 9 20 20 25 45 60	1.5 1.5 2 2 2 3 3 3 4 4 6 8 10 40 40 60 90 100
Multi-Antibiotic Honey (Quinolones/ Thiamphenicol/ Spectinomycin) Flowsense Rapid Test	BXEFB57A	10mins	*Enrofloxacin Norfloxacin Ciprofloxacin Oxolinic acid Danofloxain Pefloxacin Flumequine Lomefloxacin Fleroxacin Difloxacin Ofloxacin Enoxacin Sarafloxacin Nalidixic acid Marbofloxacin Thiamphenicol Spectinomycin	0.75 0.75 1 1 1 1 2 2 2 2 2 2 2.5 4 10 2 10	1.5 1.5 1.5 1.5 1.5 1.5 3 3 3 3 4 4 4 6 15 5 15
Multi-Antibiotic Honey (Erythromycin/ Tylosin/Tetracyclines) Flowsense Rapid Test	BXEFB58A	10mins	*Erythromycin *Tylosin Tilmicosin *Tetracycline Oxytetracycline Doxycycline Chlortetracycline	10 10 12 8 12 20 15	15 10 15 15 15 40 30
Chloramphenicol Honey Flowsense Rapid Test	BXEFB59A**	8mins	*Chloramphenicol	0.2	0.5
Multi-Nitrofuran Honey (AHD/AOZ/ SEM/AMOZ)	BXEFB60A**	10mins	*Nitrofurantoin (AHD) *Furazolidone (AOZ) *Nitrofurazone (SEM) *Furaltadone (AMOZ)	0.25 0.25 0.25 0.5	0.5 0.5 0.5 0.5

Δ *Reporting target
Δ**Solvent use required.

Figure 6: Honey Testing Panel

Intra-Precision

Intra-assay precision was evaluated using the control line ILU (Intensity Light Unit) of each FlowSense test with a negative honey sample and a spiked honey sample containing a defined concentration of the target antibiotics.

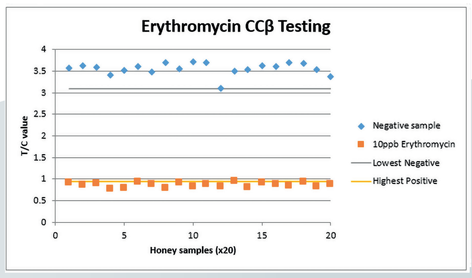
Each sample was analysed twenty times to assess test precision. The coefficient of variation (CV) for all test lines was below 10%.

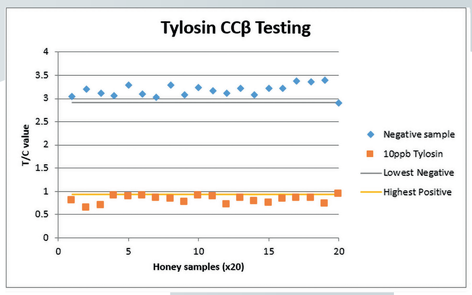
Figure 7: Intra-precision: Control Line

Detection Capability

CCβ is a validation process used to confirm a method's ability to reliably detect the target analytes. It involves testing 20 different honey samples, both blank and spiked with a known concentration of target analyte. The criteria is considered acceptable if there is no overlap between the blank and spiked results. All the FlowSense test kits complies with EU regulatory limits for all the required antibiotic.

Detection Capability ETT (BXEFB58A)





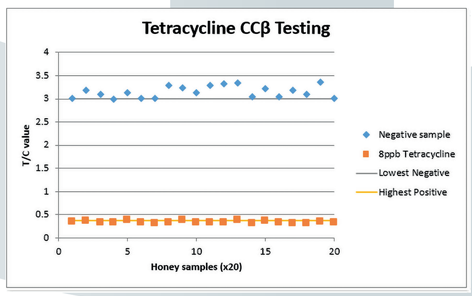
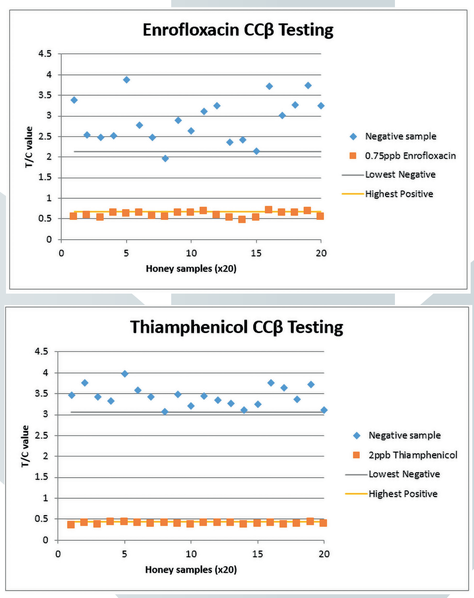
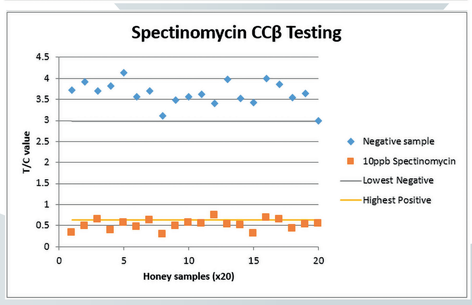


Figure 8-10: Detection Capability (3 in 1) of Erythromycin, Tylosin, Tetracycline

Detection Capability QTS (BXEFB57A)





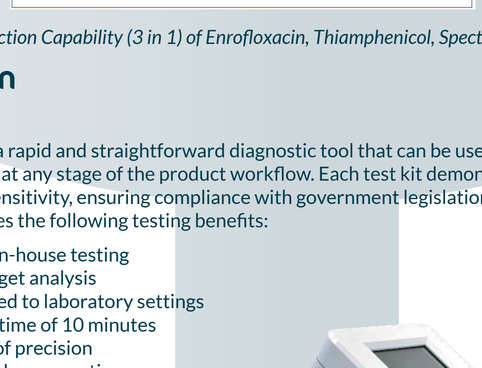


Figure 11-13: Detection Capability (3 in 1) of Enrofloxacin, Thiamphenicol, Spectinomycin

Conclusion

FlowSense offers a rapid and straightforward diagnostic tool that can be used with minimal expertise by users at any stage of the product workflow. Each test kit demonstrates high levels of precision and sensitivity, ensuring compliance with government legislation. As a platform, FlowSense provides the following testing benefits:

- Affordable in-house testing
- Multiple target analysis
- Not restricted to laboratory settings
- Short assay time of 10 minutes
- High levels of precision
- Simple sample preparation
- Excellent Correlation with FAPAS material

Contact Us

biorexfooddiagnostics.com
sales@biorexfooddiagnostics.com