foodproof® **SL GMO Maize Multiplex Detection Kit**
(MON88017, NK603, MIR162)

Revision A, March 2024

PCR kit for the qualitative detection of MON88017, NK603 and MIR162 DNA using real-time PCR instruments.

Product No. KIT230219

Kit for 50 reactions for a maximum of 48 samples

Store at -15 to -25 °C

For food testing purposes.

FOR *IN VITRO* USE ONLY

Table of Contents

1. Introduction

Many countries worldwide have implemented legislation for use, cultivation and labeling of foodstuffs containing genetically modified organisms (GMOs). These regulations allow the usage of GMOs under certain conditions, often including a defined threshold for labeling or where the import and use of GMOs is prohibited. Thus, reliable methods for the detection and identification of GMOs in food and feed are required.

With the foodproof® SL GMO product line, Hygiena® Diagnostics offers a wide range of easy and reliable assays for the detection of GMOs. The foodproof SL GMO Multiplex Detection Kits allow fast, safe and easy detection in food and feed samples.

2. Intended Use

The foodproof SL GMO Maize Multiplex Detection Kit is designed to simultaneously detect the sequences of three (3) maize events (MON88017, NK603 and MIR162) in various processed foods, raw materials, feed, seeds, etc.

This kit provides a real-time PCR Master Mix with enzyme components and the specific primer/probe set for rapid testing by multiplex real-time PCR assay, as well as the Internal Control (IC) system for reliable results.

3. Principle of PCR detection

The foodproof SL GMO Maize Multiplex Detection Kit (MON88017, NK603 and MIR162) is a qualitative, quadruplex real-time PCR test for the detection of the specific gene for each event, MON88017, NK603 and MIR162 and the Internal Control (IC) using specific primers and probes labeled with different fluorescent dyes. The target sequences are detected through FAM, VIC (HEX), ROX and Cy5 channels, respectively.

The primer and probe mixture provided is based on the so-called TaqMan® principle. During PCR amplification, forward and reverse primers hybridize to the target DNA. A fluorogenic probe is included in the same reaction mixture, which consists of an oligonucleotide labeled with a 5'-reporter dye and a downstream 3'-quencher. During PCR amplification, the probe is cleaved and the reporter dye and quencher are separated. The resulting increase in fluorescence can be detected through a range of real-time PCR platforms.

The monitoring of the fluorescence intensities during the real-time PCR allows the detection of accumulating product without re-opening the reaction tubes after the PCR run.

The kit minimizes contamination risk and contains all reagents needed for detection (except for H_2O PCR-grade).

3.1 Internal Amplification Control

This kit contains the Internal Positive Control (IC) as PCR inhibition Control. The IC allows the user to determine and control possible PCR inhibition. The IC reagents are included in the primer/probe Mixture and the IC is co-amplified with target DNA from the sample. The results can be visualized in the Cy5 channel.

3.2 Carry-over prevention using UNG systems

The foodproof SL GMO Maize Multiplex Detection Kit (MON88017, NK603 and MIR162) utilizes the UNG system. Carry-over contamination between PCR reactions can be prevented by including uracil-N-glycosylase (UNG) in the reaction mix. UNG can only prevent carry-over from PCR reactions that include deoxyuridine triphosphate (dUTP) in the original PCR reaction.

4. Contents

This kit is intended for 50 reactions, including controls.

Table 1: Kit Contents

Reagent	Cap Label	Volume	Description
2x real-time PCR Master Mix	2xM	625 µL	Buffer containing dNTPs, $MgCl_2$, UNG and Taq DNA polymerase
Primer / Probe Mix 3 (Multiplex GM Maize Event)	P3	200 µL	Primer/ probe mixture: • MON88017-specific primer and probe • NK603-specific primer and probe • MIR162-specific primer and probe • IC-specific primer and probe • IC DNA
Control DNA 3 (Multiplex GM Maize Event)	C3	50 µL	Positive control DNA for P3

5. Additional Materials, Reagents and Devices Required

- Disposable powder-free gloves and laboratory coat
- Pipettors (0.5 to 10 µL, 2 to 20 µL, 20 to 200 µL, 200 to 1,000 µL)
- Sterile aerosol-barrier pipette tips
- Ice or benchtop cooler
- Vortex mixer
- Clean bench area or PCR box
- Tabletop centrifuge with rotor for 2 mL reaction tubes
- Real-time thermal cycler with FAM and HEX (VIC) detection channels
- Disposable polypropylene microtubes for PCR
- PCR-grade H_2O
- For DNA Extraction: foodproof Sample Preparation Kit

6. General precautions

- Store extracted positive material (samples, controls and other amplicons) away from all other reagents and add to the reaction mix in a separate area.
- Thaw all components thoroughly on ice before starting the experiment.
- When thawed, mix the components and centrifuge briefly.
- Do not pipette by mouth.
- Do not eat, drink, smoke, apply cosmetics or handle contact lenses in laboratory work areas.
- Do not use a kit beyond its expiration date.
- Safety Data Sheets (SDS) can be found at www.hygiena.com/documents.
- Use disposable gloves, laboratory coats and eye protection while handling samples and reagents. Thoroughly wash hands afterward.
- Dispose of all samples and unused reagents in compliance with local regulations.

- Specimens should be considered potentially infectious and handled in a biological cabinet in accordance with Biosafety Level 2 or other appropriate biosafety practices.
- Clean and disinfect all sample or reagent spills using a disinfectant such as 0.5% sodium hypochlorite, or other suitable disinfectant.
- Avoid contact of specimens and reagents with the skin, eyes and mucosa. If contact occurs with skin, eyes or mucosa, immediately flush with water and seek medical attention.
- Use of this product should be limited to personnel trained in laboratory DNA amplification techniques.
- To avoid carry-over contamination with PCR product or control DNA, please note the following points:
  1. Be careful not to contaminate the Primer/Probe Mixture and 2x real-time PCR Master Mix with other PCR products or Control DNA through pipetting. To prevent contamination, the use of aerosol-barrier tips is recommended.
  2. Open and close all sample tubes carefully. Avoid splashing or spraying PCR samples.
  3. It is important to have designated lab areas where PCR reactions are set up, preferentially separated in space from the areas where PCR reactions are analyzed.
  4. The laboratory process must be one-directional; it should begin in the Extraction Area and move to the Amplification and Detection Area. Do not transport samples, equipment and reagents to the areas where you performed previous steps.

7. Sampling and handling

7.1 Sample Collection

Various processed food, raw material, feed and seed samples are routinely examined.

7.2 Sample Storage

The assay sensitivity can be reduced if you routinely freeze the samples before testing or store them for an extended period of time. Avoid repeated freezing and thawing of samples, which may lead to DNA degradation and decreased sensitivity.

7.3 Nucleic Acid Extraction

Carry out DNA isolation according to the extraction kit's product instructions. For more information, please see www.hygiena.com.

8. Protocol

8.1 DNA Isolation

Hygiena Diagnostics provides sample preparation kits suitable for all kinds of foods and raw materials.
(See 5. "*Additional Required Materials, Reagents and Devices*")

8.2 Preparing the PCR

To prevent the risk of contamination with foreign DNA, we recommend that all experiment steps be performed in a PCR cleanroom or separated environment area. Aerosol-barrier pipette tips are recommended for each step.

8.2.1 Thawing the Kit Components

The use of ice or a benchtop cooler is recommended during experiments to maintain enzyme activity.

8.2.2 Prepare Reaction Master Mix

Each reaction has a total volume of 25 µL; the volume of the DNA sample is 5 µL.

1. Prepare the reaction mixture according to Table 2 below.

Table 2: PCR reaction mixture

Composition	Volume
Primer / Probe Mixture	4 µL
2x real-time PCR Master Mix	12.5 µL
PCR-grade H_2O	3.5 µL
Total	20 µL

2. Add 5 µL of extracted DNA sample into the tube.

8.2.3 Prepare Control Amplification Reactions

- Positive control amplification: Add 5 µL of Control DNA instead of sample DNA.

- Negative control amplification: Add 5 µL of PCR-grade H_2O instead of sample DNA.

8.2.4 Mixing

Mix the reagents in the PCR reaction tubes by tapping a minimum of 5 times. Briefly centrifuge the tubes to remove any air bubbles or drops inside the cap.

8.3 Amplification

- Program your real-time PCR instrument according to the manufacturer's manual.
- Create a temperature-time profile on your instrument as follows in Table 3.

Table 3: Temperature Time Profile

Temperature	Time	Cycle
50 °C	2 min	1
95 °C	10 min	1
95 °C	15 seconds	40
60 °C*	1 min	

* Detect the fluorescence at this step.

9. Data analysis

The fluorescence curves are analyzed in FAM, VIC (HEX), ROX and Cy5 fluorescence detection channels (see Table 4).

You can predict the presence or absence of the target gene in your samples by analyzing the real-time PCR results.

Table 4: Specific Detection on Fluorescence Channel

Target Gene	Fluorophore	Filter Range (nm)
MON88017	FAM	465 – 510
NK603	VIC (HEX)	533 – 580
MIR162	ROX	533 – 640
IC	Cy5	618 - 660

9.1 Interpretation of Results

- The signal is considered to be positive if the corresponding fluorescence accumulation curve crosses the threshold line.
- Results are accepted as relevant if both positive and negative amplification controls pass.
- **IC**: When amplifying a target sample with a high copy number, the IC may not produce an amplification plot. This does not invalidate the test and should be interpreted as a positive experimental result.

Table 5: Interpretation of Results

	Positive control	Negative control	MON88017	NK603	MIR162	IC	Interpretation
			FAM	VIC (HEX)	ROX	Cy5	
Case 1	+	-	+	+	+	+/- *	MON88017, NK603 and MIR162 are detected in a sample.
Case 2	+	-	+	+	-	+/- *	MON88017 and NK603 are detected in a sample.
Case 3	+	-	+	-	+	+/- *	MON88017 and MIR162 are detected in a sample.
Case 4	+	-	-	+	+	+/- *	NK603 and MIR162 are detected in a sample.
Case 5	+	-	+	-	-	+/- *	MON88017 is detected in a sample.
Case 6	+	-	-	+	-	+/- *	NK603 is detected in a sample.
Case 7	+	-	-	-	+	+/- *	MIR162 is detected in a sample.
Case 8	+	-	-	-	-	+	None of MON88017, NK603 and MIR162 is detected in a sample.
Case 9	+	-	-	-	-	-	Invalid result / retest
Case 10	+	+	+/-	+/-	+/-	+/-	
Case 11	-	+	+/-	+/-	+/-	+/-	
Case 12	-	-	+/-	+/-	+/-	+/-	

* Detection of the Internal Amplification Control in the respective channel is not required for a positive result. A high copy number of the target gene can lead to reduced or absent Internal Amplification Control signal.

10. Troubleshooting

Situation	Possible cause	Recommendation
Negative control samples are positive.	Carry-over contamination	• Exchange all critical solutions. • Repeat the analysis of all tests with fresh aliquots of all reagents. • Take measures to detect and eliminate the source of contamination.
No signal is detected for amplification positive controls.	Incorrect programming of the real-time PCR instrument.	• The PCR should be repeated after checking the programming of instruments, storage conditions and the expiration date.
	The kit reagents have expired.	
	Kit components have not been stored according to the manufacturer's instructions.	
	• Incorrect PCR reaction • Pipetting errors • Omitted reagents	• The PCR should be repeated after checking for correct pipetting scheme and reaction setup.
No signal is detected for IC in Cy5, MON88017 event in FAM, NK603 event in VIC (HEX) and MIR162 event in ROX channels.	PCR inhibitors are present at a high concentration.	• DNA extraction should be repeated.

11. Stability and Storage

Store the kit at -15 to -25 °C through the expiration date printed on the label.

12. Specifications

- **Sensitivity**

  MON88017: Limit of detection (LOD) at 0.1%.

  NK603: Limit of detection (LOD) at 0.1%.

  MIR162: Limit of detection (LOD) at 0.01%.

- **Specificity**

  MON88017 : MON89034 CRM detected

  NK603 : MON89034 CRM detected

  MIR162 : 100% exclusivity with other GM events

13. Quality control

In compliance with Federal State Institution of Science "Central Research Institute of Epidemiology" ISO 13485 – certified Quality Management System, each lot of foodproof SL GMO Maize Multiplex Detection Kit (MON88017, NK603, MIR162) has been tested against predetermined specifications to ensure consistent product quality.

14. Ordering information

Product	Order No.	# Tests
foodproof SL GMO Maize Multiplex Detection Kit (MON88017, NK603, MIR162)	KIT230219	50 reactions
foodproof Sample Preparation Kit III	KIT230174	50 reactions

15. Supplementary Information

15.1 Ordering Information

Hygiena Diagnostics offers a broad range of reagents and services. For a complete overview and for more information, please visit our website at www.hygiena.com.

15.3 Trademarks

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15.4 Contact and Support

If you have questions or experience problems with this or any other product of Hygiena Diagnostics GmbH, please contact our Technical Support staff (www.hygiena.com/support). Our scientists commit themselves to providing rapid and effective help. We also want you to contact us if you have suggestions for enhancing our product performance or using our products in new or specialized ways. Such customer information has repeatedly proven invaluable to us and the worldwide research community.

15.5 Reference Number

The reference number and original Hygiena Diagnostics GmbH article number: Z 725 03

16. Change Index

Version 1, November 2014
First version of the package insert.

Revision A, March 2024
Rebranding and new layout.
Z 725 03 20 -> INS-KIT230219-RevA

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