foodproof® SL *Clostridium perfringens* Detection Kit

Revision A, February 2024

PCR kit for the qualitative detection of *Clostridium perfringens* DNA using real-time PCR instruments.

Product No. KIT230202

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

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1. Introduction

Clostridium perfringens (*C. perfringens*) is a spore-forming gram-positive bacterium that is found in many environmental sources as well as in the intestines of humans and animals. *C. perfringens* is commonly found on raw meat and poultry. It prefers to grow in conditions with very little or no oxygen; under ideal conditions, it can multiply very rapidly.

Clostridium perfringens is one of the most common causes of food poisoning in the United States. According to some estimates, this type of bacteria causes nearly a million illnesses yearly. Cooking kills the growing *C. perfringens* cells that cause food poisoning, but not necessarily the spores. If cooked food is not promptly served or refrigerated, the spores can grow and produce new cells. *C. perfringens* infections often occur when foods are prepared in large quantities and are then kept warm for a long time before serving. That's why outbreaks of these infections are usually linked to institutions (such as hospitals, school cafeterias, prisons, and nursing homes) or events with catered food.

2. Intended Use

The foodproof® SL *Clostridium perfringens* Detection Kit is designed to detect the specific sequence of the α-toxin gene for *Clostridium perfringens* in various food sources, clinical material and environmental samples. This kit provides a real-time PCR Master Mix with enzyme components and a specific primer/probe set for rapid testing by real-time PCR assay, as well as the Internal Control (IC) system for reliable results.

3. Principle of PCR detection

foodproof SL *Clostridium perfringens* detection assay is a qualitative, duplex real-time PCR test for detection of a pathogen specific gene (α-toxin) and the Internal Control (IC) using specific primers and probes labeled with fluorescent dyes. The target sequences are detected through the FAM and HEX (VIC) channel respectively.

The primer and probe mixture provided exploits 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 on a range of real-time PCR platforms. The monitoring of the fluorescence intensities during the real-time PCR reaction cycles 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 PCR-grade H_2O).

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 HEX (VIC) channel.

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	500 µL	Buffer containing dNTPs, $MgCl_2$ and Taq DNA polymerase
Primer / Probe Mixture	P	200 µL	Primer/ probe mixture: • α-toxin-specific primer and probe • IC-specific primer and probe • IC DNA
Control DNA	C	50 µL	Positive control DNA

5. Additionally required materials, reagents and devices

- 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 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 microcentrifuge tubes for PCR
- PCR-grade H_2O
- For DNA Extraction: foodproof® StarPrep® Two Kit or equivalent

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 techniques of DNA amplification.
- 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 during 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 run/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 areas where previous steps were performed.

7. Sampling and handling

7.1 Sample Collection

Various food source samples, environmental samples, clinical materials and cultured bacteria 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 20 µL; the volume of the DNA sample is 6 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	10 µL
Total	14 µL

2. Add 6 µL of extracted DNA sample into the tube.

8.2.3 Prepare Control Amplification Reactions

CONTROL + • Positive control amplification: Add 6 µL of Control DNA instead of sample DNA.

CONTROL - • Negative control amplification: Add 6 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 air bubbles and drops from the inside of the cap.

8.3 Amplification

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

Table 3: Temperature Time Profile

Temperature	Time	Cycle
95 °C	10 min	1
95 °C	15 sec	40
60 °C *	1 min	

* Detect the fluorescence at this step.

9. Data analysis

The fluorescence curves are analyzed in FAM and HEX (VIC) 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
α-toxin	FAM
IC	HEX (VIC)

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	α-toxin	IC	Interpretation
Case 1	+	-	+	+	α-toxin gene is detected.
Case 2	+	-	+	-*	
Case 3	+	-	-	+	α-toxin gene is not detected.
Case 4	+	-	-	-	Invalid result; retest
Case 5	+	+	+/-	+/-	
Case 6	-	+/-	+/-	+/-	

* Detection of the Internal Amplification Control in the respective channel is not required for positive results. 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 HEX (VIC) channel and *α-toxin* gene in FAM channel.	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**

  The limit of detection (LOD) is 10 to 100 genetic equivalents (GE).

- **Specificity**

  100% exclusivity for approximately 100 non-target strains

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 *Clostridium perfringens* Detection Kit has been tested against predetermined specifications to ensure consistent product quality.

14. Ordering information

Product	Order No.	# Tests
foodproof SL *Clostridium perfringens* Detection Kit	KIT230202	50 reactions
foodproof StarPrep Two	KIT230177	96 reactions

15. Supplementary Information

15.1 Ordering Information

Hygiena Diagnostics is offering 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 700 08

16. Change Index

Version 1
First version of the package insert.

Revision A, February 2024
Rebranding and new layout.
Z 700 08 20 -> INS-KIT230202-RevA

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