SOLUS *LISTERIA MONOCYTOGENES* ELISA

Immunoassay-Based Test System for the Detection of *Listeria monocytogenes* in Selected Foods and Environmental Samples

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Certifying Body: AOAC

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This method's performance was reviewed by AOAC Research Institute and was found to perform to the manufacturer's specifications.

This method has been evaluated in the AOAC® *Performance Tested Methods*℠ Program for the detection of *Listeria monocytogenes* in bagged romaine lettuce (25g and 125g), hot dogs (25g and 125g), sliced deli ham (25g and 125g), processed cheese (25g and 125g), frozen raw shrimp (25g), ground beef (25g), stainless steel and polystyrene environmental surfaces. Solus *Listeria monocytogenes* ELISA method has been compared to the USDA-FSIS MLG 8.11 and FDA/BAM Chapter 10 reference methods, as applicable to matrices.
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1. INTRODUCTION

Solus *Listeria monocytogenes* ELISA provides a negative or a presumptive positive result from 2 enrichment steps within 51 to 59 hours, including the assay time.

2. INTENDED USE

Solus *Listeria monocytogenes* ELISA is for the detection of *Listeria monocytogenes* in selected foods and production environmental surfaces. The test method is easy to perform, however it requires laboratory facilities plus qualified and trained personnel. Basic training is recommended to first time users and is given by Solus Scientific Solutions Ltd.

Using the method includes compliance with Good Laboratory Practices (refer to EN ISO 7218).

3. REAGENTS PROVIDED

Most kit components are supplied stabilized and ready to use at working concentration with only the Washing Buffer concentrate requiring dilution. Each kit contains sufficient material for 1 (LISM-0096) or 5 (LISM-0480) x 93 determinations, plus controls. The kit expiry date is displayed on each product label.

Component	Appearance	Volume		Comments
		LISM-0096	LISM-0480	
Assay plate	96-well microplate with removable/ breakable strip format	1	5	Wells coated with antibodies against *Listeria monocytogenes*.
Negative control	Pale orange liquid. Green label.	3ml	10ml	Working concentration. Contains diluent with preservative.
Positive control	Black liquid. Red label.	3ml	10ml	Working concentration. Contains heat-killed *Listeria monocytogenes* in diluent with preservative.
Conjugate	Colorless/very pale straw-colored liquid. Orange label.	11ml	60ml	Working concentration. Contains horseradish peroxidase antibody conjugate in diluent with preservative.
Substrate	Colorless/very pale blue liquid. Blue label.	11ml	60ml	Working concentration. Contains 3, 3', 5, 5'-Tetramethylbenzidine (TMB), hydrogen peroxide and stabilizers.
Stop solution	Colorless liquid. Yellow label.	11ml	60ml	Working concentration. Contains 0.2M sulfuric acid.
Washing buffer concentrate	Colorless/yellow/orange liquid. White label.	10ml x 6	60ml x 5	Concentrated. Dilute before use. Wash buffer concentrate is provided in excess. Any unused wash buffer concentrate should be discarded. Do not mix reagent batch numbers.

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4. MATERIALS AND EQUIPMENT REQUIRED BUT NOT PROVIDED

Refrigerator at 2-8°C	Incubator at 37±1°C
Deionized or distilled (DI) water	Incubator at 30±1°C
Half Fraser broth	3ml transfer pipettes (sterile)
Solus Palcam broth	Vortex mixer
PAC selective supplement	Timer
Measuring cylinders for various volumes (e.g. 250 ml, 1L)	Heating apparatus (e.g. heat block) capable of heating to 85-100°C
Homogenizer (or similar apparatus) and bags	Pipettes and tips (1ml; 0.1ml)
Sponge samplers or swabs soaked in suitable neutralizing buffer (e.g. Letheen broth or HiCap buffer)	Dynex DS2 or Microplate washer and microplate reader with 450nm filter
Sterile 10ml tubes suitable for selective enrichment	Autoclave for decontamination of samples
Tubes for sample boiling (e.g. 5ml polypropylene rimless tubes 12x75mm)	Agar plates and standard confirmation test equipment. See section 10 for details.

5. REAGENT PREPARATION

5.1 Wash Buffer:

Prepare the following in a clean vessel.

LISM-0096	LISM-0480
Add 10ml (1 bottle) of the washing buffer concentrate to 240ml DI water and swirl to mix.	Add 60ml (1 bottle) of the washing buffer concentrate to 1440ml DI water and swirl to mix.

5.2 Culture Broth (growth medium):

- Prepare Half Fraser broth following manufacturer's instructions. Allow to cool to ambient temperature (18-25°C) before use in testing.
- Prepare Solus Palcam broth supplemented with PAC selective supplement following manufacturer's instruction and dispense into sterile 10ml tubes. Allow to cool to ambient temperature (18-25°C) before use in testing.

6. SAMPLE PREPARATION AND ENRICHMENT- standard method

6.1 Pre-enrichment for food samples

1 in 10 dilution:

- 25g sample (bagged romaine lettuce, hot dogs, sliced deli ham, processed cheese, frozen raw shrimp, ground beef). Homogenize 25g of the sample to be tested in 225ml of Half Fraser broth and incubate for 24-28 hours at 30±1°C.

1 in 4 dilution:

- 125g samples (bagged romaine lettuce, hot dogs, sliced deli ham, processed cheese). Homogenize 125g of the sample to be tested in 375ml of Half Fraser broth and incubate for 24-28 hours at 30±1°C.

6.2 Pre-enrichment for Environmental samples

- Sample the production environment surface with sampling device. Follow sampling device manufacturer's instructions for correct use, storage and transport.
- Add 100ml of Half Fraser broth to sponge sampler in a suitable sample bag.
  Add 10ml of Half Fraser broth to swabs.
- Hand massage for 2 minutes (sponge samplers) or mix by vortexing for 2 minutes (swabs) and incubate for 24-28 hours at 30±1°C.

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6.3 Selective enrichment

- Transfer 0.2ml of the enriched sample to 10ml of PAC supplemented Solus Palcam broth and incubate for 24-28 hours at 37±1°C. Ensure that the bench processing time of samples is kept to a minimum and that transfer to 37°C incubator occurs as soon as possible. This is important to avoid extensive growth of competing organisms.

7. POST ENRICHMENT HEAT INACTIVATION

7.1. When the sample incubation period is completed, transfer 1-2ml aliquot (avoiding particulates) to a sample boiling tube (e.g. 5ml polypropylene tube).

7.2. Heat the aliquot to 85-100°C for 15-20 minutes in the tube. After heating, allow the sample to cool to ambient temperature (18-25°C). This may be accelerated by placing the tubes in cold tap water for ~5 minutes.

The non-heat-inactivated samples should be kept for verification until ELISA results are obtained. These samples should be kept at 37±1°C if the ELISA test is to be carried out within 2 hours. If this is not possible, keep the broths for up to 72 hours at 2-8°C prior to the ELISA test.

8. ELISA ASSAY PROCEDURE

Manual procedure

8.1. Take test kit from storage at least one hour before use to allow the components to reach ambient temperature (18-25°C). Determine the number of wells required for the test. Take required number of strips from the pouch and fit them to the frame provided. Unused strips should be returned to the pouch and stored at 2-8°C.

8.2. Prepare Wash Buffer as detailed in section 5.1 for the kit size being used.

8.3. Leave the first well in the strip empty to serve as a 'blank' for measuring the absorbance of the substrate.

8.4. Pipette 0.1ml of Negative Control (Green label) into the second well.

8.5. Pipette 0.1ml of Positive Control (Red label) into the third well.

8.6. Pipette 0.1ml of each heat-inactivated sample separately into consecutive wells in the strip. If there are wells left over at the end of a test strip the Positive or Negative Controls may be repeated. †

8.7. Incubate the plate (containing the strips) at 37±1°C for 60 minutes (±5 minutes).

8.8. Pipette 0.1ml of Conjugate (Orange label) into all wells except the 'blank'.

8.9. Incubate the plate at 37±1°C for 60 minutes (±5 minutes).

8.10. After incubation, aspirate the contents of the wells, removing as much of the liquid as possible. Wash the wells 5-7 times with wash buffer ensuring complete filling and emptying of the wells through each wash cycle. Washing technique is critical to assay performance. It is recommended to use a microplate washer. *

8.11. Pipette 0.1ml of Substrate (Blue label) into all wells, including the 'blank' well.

8.12. Incubate the plate at ambient temperature (18-25°C) for 30 minutes (±5 minutes).

8.13. After incubation, stop the reaction by adding 0.1ml of Stop Solution (Yellow label) to all wells including the 'blank' well. The stop solution will cause any blue color in wells to change to yellow.

8.14. Read the optical densities of wells within 10 minutes in a plate reader using a 450nm filter. Before reading, inspect the wells for air bubbles and, if present, burst with a needle. The reader should be zeroed against the 'blank' well before the other wells are read. Do not use reference filter. The use of automatic ELISA equipment is preferred and should be set up and validated to this protocol.

† If using the Dynex instrumentation, care must be taken to avoid bubbles in the sample and reagent tubes, or films forming across the tube above the level of the liquid. It is essential to check that the system has successfully pipetted samples into the assay plate before proceeding.

*If using the Dynex instrumentation, it will perform a "supersweep" after every wash cycle. This increases the wash time compared to other Solus assay protocols but is required for accurate results.

9. INTERPRETATION OF RESULTS

Results are expressed as optical density (OD_{450}) measurements using a microplate reader.

Acceptance criteria:

Negative Control OD_{450}	< 0.100
Positive Control OD_{450}	> 0.500

The value of the blanking well (usually A1 when processing manually) should always be subtracted from all other results. Should the value of Negative or Positive controls not meet these criteria, the test is not considered valid and must be performed again.

Samples with OD_{450} readings of < 0.200 are considered negative in which case the analysis is complete, the results may be reported and the corresponding non-heat-inactivated samples may be discarded following local regulations/ guidelines.

Samples with OD_{450} ≥ 0.200 are considered presumptive positive for *Listeria monocytogenes*. Presumptive positive results must be verified using a recognized culture method.

10. CONFIRMATION OF POSITIVE RESULTS FROM *LISTERIA MONOCYTOGENES* ELISA

According to the AOAC-PTM validation study, all samples identified as positive for *Listeria monocytogenes* by the Solus *Listeria monocytogenes* ELISA assay must be confirmed by the following tests:

- Plate 100µl of non-heat-inactivated sample on *Listeria* selective agar plate MOX. Typical *Listeria* spp colonies form black colonies surrounded by a black halo. Conduct a catalase test and Gram stain on typical colonies isolated from the agar plates (catalase test is positive and bacterial cells shows a Gram positive rod morphology), and then stab into Sheep Blood Agar plates (SBA). Incubate the SBA for 24-48 hours at 35±2°C before reading the haemolysis results. As an alternative to SBA, colonies can also be biochemically characterized by performing biochemical galleries specific to *Listeria* species.
- Alternatively, result confirmation can be conducted following the confirmation protocols of respective reference methods, either USDA/FSIS-MLG Method 8.11 "Isolation and Identification of *Listeria monocytogenes* from Red Meat, Poultry, Ready-to-Eat Siluriformes (Fish) and Egg Products, and Environmental Samples" or FDA/BAM Chapter 10 "Detection and Enumeration of *Listeria monocytogenes* in Foods".

11. KIT STORAGE AND EXPIRY

The kit and any unused kit components should be stored at 2-8°C. DO NOT FREEZE.
The kit expiry date is displayed on the kit box plus all of the kit components within the box.
Any unused diluted wash buffer can be stored for up to 10 days if kept at 2-8°C. Any unused microplate strips should be returned to the foil pouch with the desiccant sachet and the seal closed completely, then stored at 2-8°C.

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12. SAFETY

While the procedures detailed are simple and easy to perform, they require laboratory facilities with qualified personnel trained for the handling of potentially pathogenic organisms. Training is recommended to first time users and is provided by Solus Scientific Solutions Ltd.

- The Stop Solution contains sulfuric acid which is corrosive. Wash immediately with large quantities of water if the solution comes into contact with skin or mucous membranes.

As a guide, the following precautions should be taken as a minimum:

- Protective clothing should be worn including lab coat, safety glasses, mask and gloves where appropriate.
- Do not pipette by mouth.
- Avoid contact with the skin.
- Do not eat, drink or apply cosmetics in the laboratory.
- Follow all applicable local, state/provincial, and/or national regulations on disposal of biological wastes.

13. PRECAUTIONS FOR OPTIMAL PERFORMANCE

- Reagents are provided at fixed working concentration. Optimum sensitivity and specificity will be reduced if reagents are modified or not stored under the recommended conditions.
- Do not mix different lots of reagents.
- Avoid microbial contamination of opened reagent bottles.
- Ensure that no cross contamination occurs between wells.
- It is essential for proper performance of the test that the enzyme-conjugated antibody is not allowed to contaminate other reagents and equipment.
- Ensure that kit components are not exposed to temperatures greater than 40°C.
- Solutions containing sodium azide should not be used for cleaning of equipment, especially washing devices (the peroxidase enzyme used in the kit is inactivated by sodium azide).
- Do not use for diagnostic purposes of medical specimens.

14. MSDS INFORMATION

Material safety data sheets (MSDS) are available for this test on request.

15. WARRANTY

Accurate results depend on the proper use of the kit by following the instructions for use carefully. If the kit fails to perform according to specification, please contact:

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Summary of changes

Change date	Issue Number	Change Summary
Aug2020	1	New Document

NOTE: Minor changes (e.g. formatting, grammar, correcting typographical errors) are not included in the summary of changes.

For more information visit www.solusscientific.com

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