IR Biotyper®

Ready-to-use Classifier for *Listeria monocytogenes* serogrouping

Distinguishing major *Listeria monocytogenes* serogroups by AI-based classificaton

Listeria monocytogenes is one of the most important foodborne pathogens worldwide and a major concern for food manufacturers and regulatory authorities. Although listeriosis is relatively rare, it can cause severe disease, particularly in pregnant women, newborns, older adults, and immunocompromised individuals. Contamination events often require rapid source tracking and effective outbreak investigations to minimize public health risks.
Conventional *Listeria* serotyping is based on tedious and expensive agglutination assays, while alternative molecular methods such as PCR and sequencing can provide additional information but often require dedicated expertise, equipment, and longer turnaround times.
Fourier-transform infrared (FTIR) spectroscopy, combined with a machine-learning-based *Listeria monocytogenes* Classifier for the IR Biotyper, provides a rapid and standardized alternative for first-level serogroup classification. Starting directly from colony material, laboratories can obtain same-day results, supporting contamination source tracking and routine food safety workflows while reducing hands-on time and operational complexity.

Benefits of using Classifiers:

- Ready-to-use
- Immediate and clear result display by color coding and score values
- Easy and fast workflow improving lab efficiency
- Transparent, objective and standardized serogrouping results
- Reduces dependence on labor-intensive serological methods
- Safe (no open slides) and animal-friendly workflow (no rabbit antibodies)

Innovation with Integrity

GP

What's a Classifier?

An FTIR classifier is a software tool that learns from infrared spectra of known training classes and uses AI-based algorithms to confidently classify new, unknown spectra (Fig.1).

How was the *Listeria* Classifier developed?

The *Listeria monocytogenes* Classifier was developed using a collection of well-characterized isolates representing the major *L. monocytogenes* serogroups. Infrared spectra generated with the standardized IR Biotyper workflow were used to train a machine-learning-based classification model capable of recognizing characteristic serogroup-specific molecular fingerprints.

After model development, the classifier was validated using independent isolates and integrated into the IR Biotyper software, enabling automated and standardized classification of unknown *Listeria* isolates in routine workflows.

More than 7,000 spectra were used to test the classifier resulting in 99,5% accuracy for the discrimination of serogroups 1/2, 3 and 4x from each other. Depending on the serogroup the positive predictive value resulted in 99%, 99.9% and 100% (table 1).

		predicted				
		1/2	3	4x	unreliable	recall
true	1/2	4148	0	25	0	99.4%
	3	0	353	0	1	100.0%
	4x	6	0	2508	0	99.8%
	PPV	99.9%	100.0%	99.0%		
	ACC	99.5%				

Table 1. Confusion matrix of the test results; PPV: Positive predictive value; ACC: Accuracy

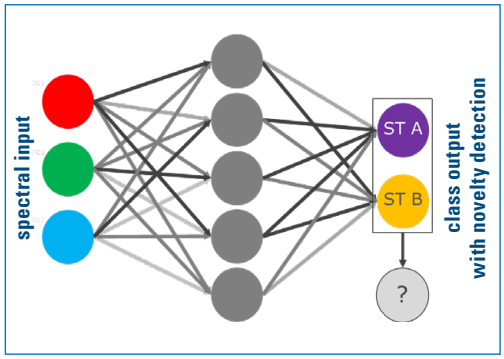

Fig. 1 Schematic depiction of a Classifier that can be applied to unknown samples for their classification (right side). Classifier creation involves a training set of isolates (left side) to establish a recognition network (middle).

Curious? Get more info on this topic:

- Expert Insight from the CVUA Stuttgart: 1910686-expert-insight.pdf
- Oberreuter *et al.*, 2023, Validated differentiation of *Listeria monocytogenes* serogroups by FTIR spectroscopy... https://doi.org/10.1016j.clispe.2023.10003
- Muchaamba *et al.*, 2026, Fourier transform infrared spectroscopy enables rapid strain typing and cluster analysis... https://doi.org/10.3389fmicb.2026.1735218

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