THE WATER MANAGEMENT SOCIETY

Rapid Microbiology Industry Liaison Group

MALDI-ToF (Bruker) Factsheet

These guides are intended to give unbiased views regarding a number of technologies and test kits and their potential capabilities.

The opinions expressed are the views of individual members of the Rapid Microbiology Industry Liaison Group and are supplied in good faith. Additional third party opinions are provided in the attached literature references and on-line links. The WMSoc cannot be held responsible for any misunderstanding or subsequent misapplication of this information.

The manufacturer should be contacted regarding details about availability, pricing, repairs, calibration, QA/QC recommended protocols, validation data, and performance data, etc.

The factsheets cannot give advice regarding specific water testing alert levels – these need to be advised by the regulators.

MALDI-ToF (Bruker) SUMMARY TABLE

- The Bruker MALDI Biotyper (MBT) method is designed to rapidly confirm (meaning to confirm the preliminary presumptive result of an alternative or a reference method) and identify (meaning to determine the identity of an analyte) i.e. it is used to confirm the identity of microorganisms grown by traditional culture.
- An advantage of MALDI-ToF is faster confirmation of organisms (reducing overall testing time).
- Increased specificity and sensitivity compared to traditional confirmation methods.
- Requires culture to provide organisms to test.

The information below is based on Bruker which is one of the manufacturers who have developed such systems for the identification of organisms.

Method	Matrix-assisted laser desorption / ionisation time of flight (MALDI-TOF) Biotyper
Bacteria detected	Very wide range of relevant bacteria (e.g. *Legionella, Pseudomonas, Mycobacteria* etc.)
Pre-concentration as per ISO 11731	N/A
Algorithm to convert results to CFU	N/A
Can differentiate between live and dead cells	Requires cultured cells, therefore live by default
Will detect viable but non-cultureable (VBNC) bacteria	Required cultured cells, therefore not VBNC
Interference from biocides	N/A
Use with complex water samples e.g. from cooling towers	N/A
Laboratory or field	Laboratory or Research and Development test method only
Are results comparable to current plate counts?	N/A
Would current plate technique still be required?	Yes - to grow bacteria for testing by MALDI-ToF
False positive False negative	Check with individual contract laboratory
Could rapid test give a positive result whilst culture test gives negative result?	N/A

Suitable verification data should be supplied by any laboratories undertaking the testing (or UKAS accreditation).
All tests should have positive and negative control data available - irrespective of whether laboratory or field-based.
N.B. Not all methods are suitable for field-based testing.

1.	General	
i.	Name of Test:	**MALDI Biotyper (MBT)**
ii.	Scientific principles / basis for test:	**Mass spectrometry**
iii.	Sensitivity: Specificity: Limit of detection:	**Not applicable.** **The MBT reference library is updated annually and includes information related to taxonomy and matching-hints.** **The MBT system requires 10^5 organisms to be spotted on to the target plate**
iv.	Scientific publication references:	**Moliner C, *et al.*, (2010). Rapid identification of *Legionella* species by mass spectrometry. J Med Microbiol. 59:273-284** **He Y, *et al.*, YW (2011). Matrix-assisted laser desorption ionization time-of-flight mass spectrometry and database for identification of *Legionella* species. Can J Microbiol. 57:533-538** **DIlger, T *et al.*,(2016) Rapid and reliable identification of waterborne *Legionella* species by MALDI-TOF mass spectrometry. Journal of Microbioogical Methods. 127: 154-9** **Bastin B *et al.*, (2018).Confirmation and Identification of *Salmonella* spp., *Cronobacter* spp., and Other Gram-Negative Organisms by the Bruker MALDI Biotyper Method: Collaborative Study, First Action 2017.09 .J AOAC Int.1;101(5):1593-1609** **Please contact Bruker for additional references**
v.	Patents:	**Yes**
vi.	Countries sold into:	**Worldwide**
vii.	Manufacturer: Supplier:	**Bruker Daltonics**
viii.	Commercially available:	**Yes**
ix.	Micro-organism species detected:	**Wide variety (see restrictions above in (iii))**
x.	Lab based: Field based:	**Yes** **No**
xi.	Can the test be used to determine operational control? Trend analysis?	**In conjunction with traditional culture**
xii.	Independent end-user data:	**Yes**
xiii.	Method validated by third party:	**Data available from individual users**

2.	Application details	
i.	Sample quality required:	**Can be used with complex matrices but with culture method caveats**
ii.	What sample preparation on-site is required:	**Samples do not require any additional treatment prior to transport to laboratory**
iii.	Does the sample need to be tested within a prescribed time scale (courier)?	**As per BS 7592 for *Legionella***
iv.	Sample bottle type: Sample volume required:	**As per BS 7592 for *Legionella***

3.	Analytical procedures	
i.	Does procedure require initial isolation of test organism by culture?	**Yes**
ii.	Which other substances and/or microorganisms are potential interferences or inhibitors?	**None, unless colony preparation is not pure**
iii.	What additional equipment will be required?	**Microcentrifuge - depends on organism of interest**
iv.	Is equipment specialised?	**Yes**
v.	Is the process automated? Could it be automated?	**Yes, sample preparation can also be semi-automated e.g. use of Bruker Galaxy instrument**
vi.	Does sample need pre-treatment prior to analysis?	**Water samples require filtration. Colony preparation for MBT may need extraction – depends on organism of interest**
vii.	Is training provided?	**Yes – 2 days bespoke on-site**
viii.	How long will test take before results are available?	**Subject to working restrictions but possible to process 96 samples in 40 minutes**
ix.	How many samples can be analysed?	**Subject to number of target plates available but theoretically thousands of samples/day**
x.	What units are results expressed in?	**Genus or species level identification by log score**
xi.	Does the result correlate with standard analytical procedures such as plating?	**Yes**
xii.	Is specialised training required to conduct test and interpret results?	**Yes**
xiii.	Are results reproducible:	**Yes**
xiv.	What errors (if any) could occur with analysis (weak link)?	**Poor sample preparation e.g. not enough colony mass, mixed culture preparation, organism not in database, poor analytical procedures**
xv.	Has test been validated for environmental samples?	**No**
xvi.	Does the final result include VBNC?	**No**
xvii.	Does it detect live or dead cells, or both?	**Confirmation step requires cultured cells**
xviii.	Has test been used in an EQA process or could it be?	**Yes**
xix.	Will it be possible for a user organisation to gain UKAS ISO 17025 accreditation?	**Yes**

Glossary:

Algorithms - can enable calculation between different measures (e.g. MPN to CFU)

Colony forming units - used to estimate the number of viable bacteria or fungal cells in a sample

Genus - a way of classifying bacteria. Genus comes above species & below family

Sensitivity - (also called the true positive rate or probability of detection) measures proportion of positives that are correctly identified as such

Species - a group of living things that all share common characteristics and that are all classified as alike in some manner

Specificity - (also called the true negative rate) measures proportion of negatives that are correctly identified as such

Strain - a particular variety of bacteria

Viable - the ability (of bacteria) to multiply

List of abbreviations:

ATP – Adenosine tri-phosphate

CFU – Colony Forming Units

EQA – External quality assurance

GU – Genomic unit

IMS – immunomagnetic separation

LOD - Limit of detection

MPN - Most Probable Number

MALDI ToF – Matrix Assisted Laser Desorption/Ionization Time of Flight

NF Validation - Third party certification

PCR – Polymerase Chain Reaction

qPCR – Quantitive Polymerase Chain Reaction

RTPCR - Real Time Polymerase Chain Reaction

VBNC – Viable but Non-Culturable