

## ***MALDI-TOF MS and FT-IR for Bacteria “from fish and chips”***

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The task of state food laboratories is the routine analysis of food samples, which are to some extent associated with foodborne diseases. The state veterinary laboratories are engaged in diagnostics of animal illness, including zoonotic diseases, mainly from stock. The Chemical and Veterinary Investigations Office Stuttgart (CVUAS) integrates both laboratory parts. In both sectors microbial analyses are time-critical, requiring a high degree of accuracy.

The introduction of FT-IR in our laboratory twelve years ago, and the purchase of MALDI-TOF MS in 2012 changed our workflow for differentiation of microorganisms significantly. Now, MALDI-TOF MS carries the brunt of decisions on species level, while FT-IR analyses are mainly focused on subspecies-decisions and isolate comparisons.

Giving various examples from our laboratory practice, the effectiveness of the powerful combination of MALDI TOF MS and FT-IR is shown:

Initially, the abnormalities in infrared-spectra of suspicious *Bacillus* CVUAS 2979, isolated from mashed potatoes during the investigation of a food borne outbreak, led to an intensive follow-up study. The uncharacteristically small growing colonies at 30°C were included in the description of *Bacillus (B.) cytotoxicus* [1], a thermotolerant member of the *B. cereus* Group, featuring the *cytK1* gene for cytotoxin K1 production. Now *B. cytotoxicus* is an established parameter in our microbiology department. The straightforward spectroscopic workflow allowed us to perform a first prevalence study in various potato products, showing high prevalence of *B. cytotoxicus* in dehydrated potato products and products made thereof [2].

The flexibility of the method combination allows for a rapid response to novel challenges or exotic requests. Without previous experience with the causative agent, *Moritella viscosa*, it was possible to support the investigation of cases of winter ulcer of marine fish in Iceland, which causes increasingly significant damage in aquacultures of salmon and other edible fish.

*Yersinia ruckeri* is the prominent bacterial pathogen of salmonids (rainbow-trout, brown trout) worldwide, causing red mouth disease [3]. After species differentiation by MALDI-TOF MS, infrared-spectroscopy helped to select *Yersinia* isolates for the production of pond-specific vaccines.

The combination of MALDI-TOF MS and FT-IR improved our microbiological diagnosis in speed and reliability to a degree that was not accessible with usual standard tools. This opens up many options for application in routine microbiology, notably under the aspect of very limited research resources.

### References

- [1] M.H. Guinebretière, S. Auger, N. Galleron, M. Contzen et al., *Int. J. Syst. Evol. Microbiol.* 63, 31-40 (2013).
- [2] M. Contzen, M. Hailer, J. Rau, *Int. J. Food Microbiol.* 174, 19-22 (2014).
- [3] F. Wortberg, E. Nardy, M. Contzen, J. Rau, *J. Fish Dis.* 35, 1-10 (2012).