Expert Insights

- Save time with rapid and easy microbial strain typing on the IR Biotyper®

FT-IR

Innovation with Integrity

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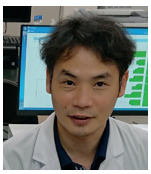
Scientists at TechnoSuruga Laboratory use the latest infrared spectroscopy technology for powerful strain typing



Working with Bruker

Dr. Tadao Kunihiro, section manager at TechnoSuruga Laboratory Co. Ltd. in Japan uses the Bruker IR Biotyper® for strain typing of bacteria and yeast, providing faster and more cost-effective contract analysis services across Japan.

"The Bruker IR Biotyper has enabled us to increase the efficiency of our research and development (R&D), as well as our contract analysis services for our industrial and academic clients."

TechnoSuruga Laboratory in Shizuoka, Japan, is developing its business as a contract analysis service using both microbiological testing and physical and chemical analysis, providing total support for these analyses for a wide range of customers, ranging from quality control (QC) laboratories in the food and beverage industry to academic research. As a company well-renowned for its microbial analysis capabilities, TechnoSuruga Laboratory offers a broad portfolio of tests, including DNA sequencing and molecular phylogenetic analysis, and microbial species identification. In response to requests from customers in R&D, TechnoSuruga Laboratory has now integrated strain typing into its service offering.

The classification of microorganisms at the strain level is advantageous in a range of situations, for example in hygiene control and source tracking in the food and beverage industry, where timely decisions on safety and quality of production batches is vital.

In recent years, TechnoSuruga Laboratory has received an increasing number of requests for strain identification (strain typing) and has been meeting this need with services such as pulsed field gel electrophoresis (PFGE). However, PFGE is a time-consuming method that takes several days or weeks to deliver a result and requires considerable human resources and technical expertise. Dr. Kunihiro describes the laboratory's challenges with this technique:

"The challenges of strain identification include the ability to obtain rapid identification results, the ability to work with a variety of strains, the ease with which we can respond to customer requirements for strain identification, and its usefulness as a pre-test (screening) before implementing other strain identification methods (PFGE and genome sequencing etc.).

Conventional methods of strain identification based on genetic analysis such as PFGE and MLST (multi-locus sequence typing) take a long time to complete, and customers have to wait for the result. In addition, it is difficult to deal with bacterial species that have not been measured."

Advanced infrared spectroscopy

The infrared (IR) spectra of intact microbial cells are highly specific fingerprint-like signatures that can be used to differentiate, classify, and identify diverse microbial species and strains.[1] IR spectroscopy delivers high differentiation power at the level of molecular genetic methods such as PFGE, MLST, and whole genome sequencing (WGS), but in a faster, simpler, and more economical workflow.

TechnoSuruga Laboratory acquired an IR Biotyper system from Bruker in February 2020, initially for its R&D program, and introduced the technique as a contract measurement service for strain identification in October 2020. The IR Biotyper is a Fourier Transform Infrared (FT-IR) spectroscopy system that analyzes the molecular vibrations of carbohydrate constituents present in many molecules, for example, such as glycoproteins. The FT-IR spectrum acts as a fingerprint, allowing the classification of microorganisms with comprehensive bioinformatic analysis. The system analyzes spectral data from multiple identical microbial species isolated from various environments and raw materials in cases of product contamination.

The IR Biotyper is a much faster and easier technique for strain identification compared with conventional identification methods such as PFGE and MLST. For example, 10 isolates cultured under the same conditions can be identified in less than three hours (Figure 1).

The speed of the IR Biotyper is particularly important in cases of contamination source identification, where rapid decision-making is vital to contain outbreaks and ensure product safety (Figure 2).

TechnoSuruga Laboratory also successfully uses Bruker's MALDI Biotyper® to provide

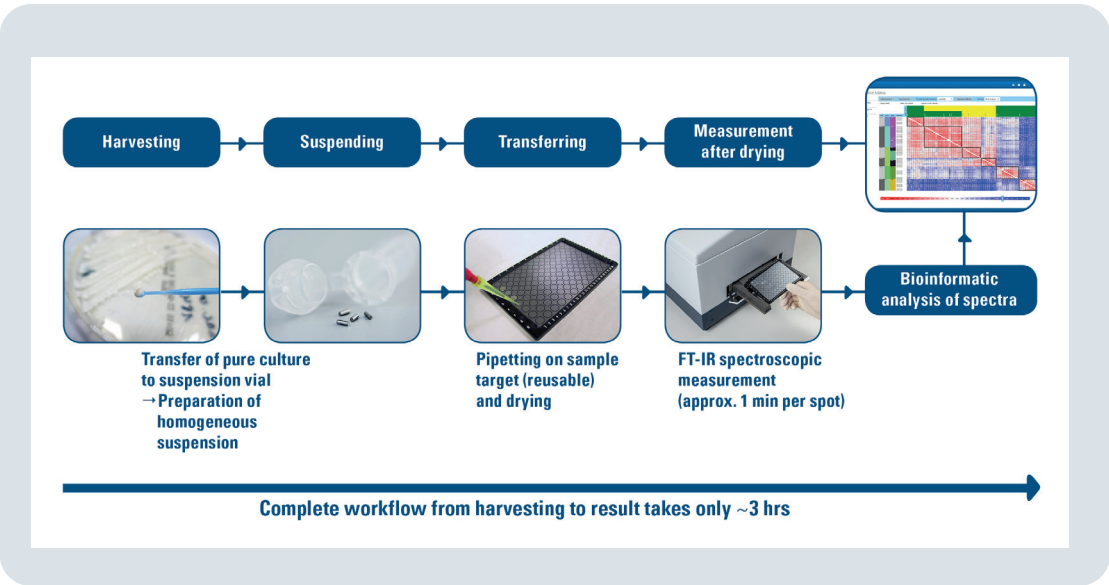


Figure 1: IR Biotyper workflow requires less time for strain typing and is easier to operate than conventional methods.

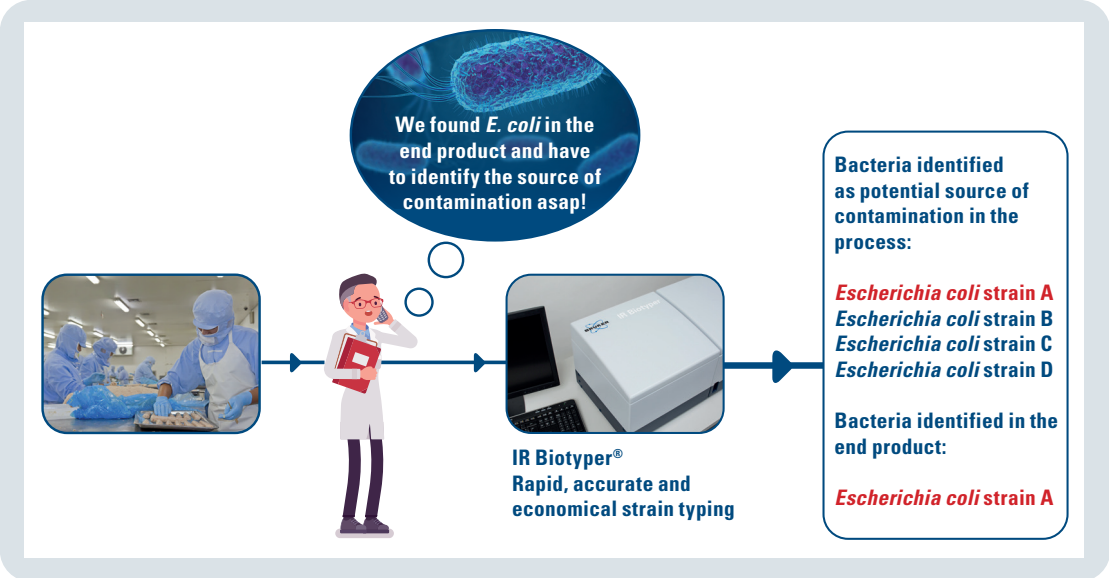


Figure 2: The IR Biotyper enables fast identification of the source of contamination.

contract analysis services for bacterial species identification. IR spectroscopy is complementary to this matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry (MS) system and can be combined with the MALDI Biotyper to combine the strength of rapid and easy microorganism confirmation and identification with IR strain typing into one workflow. Using both instruments together, TechnoSuruga Laboratory can provide comprehensive QC and monitoring from identification of bacteria to contamination source identification.

Figure 3 demonstrates the strain identification capabilities of the IR Biotyper. Seven strains of the budding yeast *Saccharomyces cerevisiae*

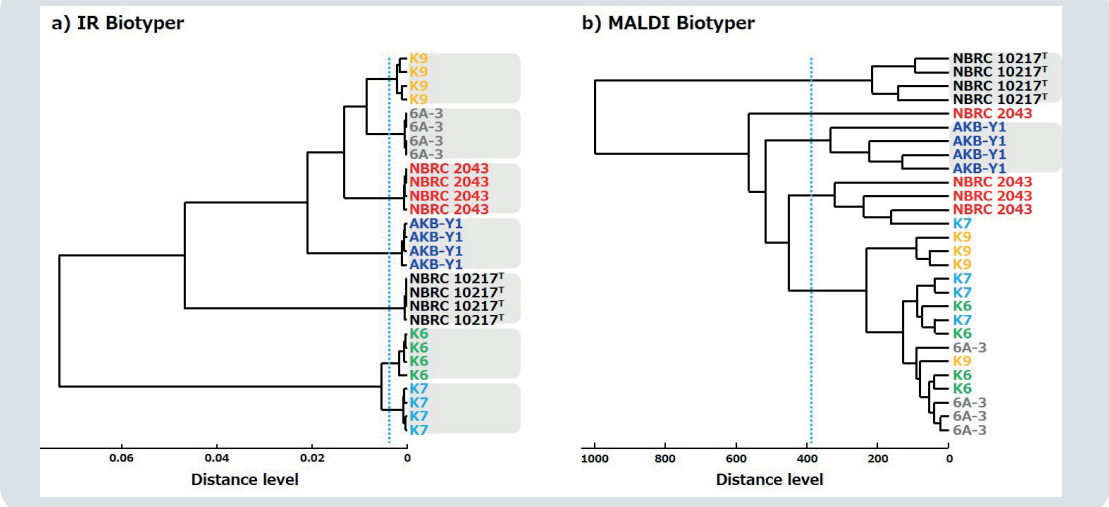


Figure 3: IR Biotyper results differentiating seven strains of budding yeast (Saccharomyces cerevisiae) (a) strain differentiation by IR Biotyper (b) strain typing by cluster analysis on MALDI Biotyper.

were analyzed, and the IR spectra were compared to cluster analysis results from mass spectra (MALDI Biotyper). Each strain forms a cluster (Figure 3a), which indicates that the strains can be grouped into one class. On the other hand, the results of the MALDI Biotyper showed that it is difficult to distinguish between the strains because several strains were mixed in the same cluster (Figure 3b).

As well as strain identification, the IR Biotyper has demonstrated its capacity to differentiate microbial subspecies. Scientists at TechnoSuruga Laboratory analyzed Bifidobacterium with the IR Biotyper and were able to differentiate three subspecies and seven different strains (Figure 4). Five were classified as *B. longum* subsp. *longum* (5 strains), and the other two subspecies were classified as *B. longum* subsp. *suis* and *B. longum* subsp. *infantis*.

Dr. Kunihiro comments on the impact the IR Biotyper has had on the company and the way it services its customers:

"Our company, which can provide total support from microorganism separation to ampoule storage, has a variety of applications, and we have been able to increase the efficiency of our R&D as well as our contract analysis services."

Future potential

There is a growing demand for strain typing that goes beyond microbial species identification in various manufacturing applications. The IR Biotyper has no restrictions on the types of bacteria that can be tested, and the ability to identify a wide variety of bacterial strains is one of its major advantages.

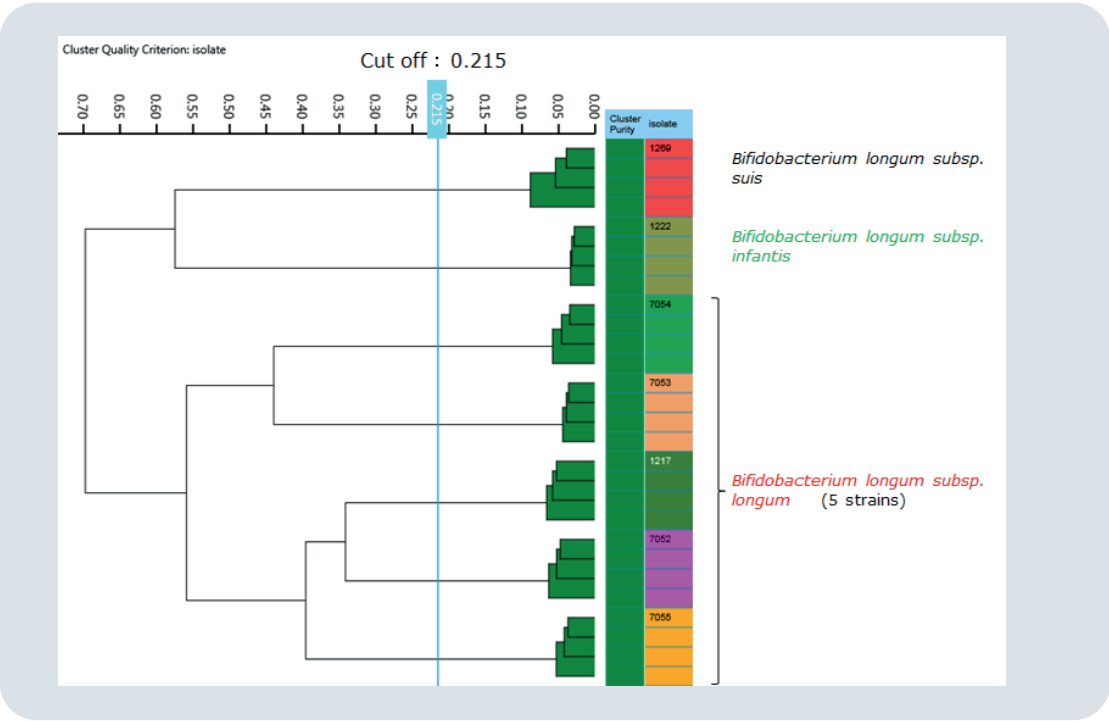


Figure 4: IR Biotyper strain typing of Bifidobacterium (3 subspecies, 7 strains).

In addition to the search for the source of contamination, Bruker is also conducting R&D on strain-level identification of bacteria that have been difficult to identify, and improving workflows for challenging applications such as yeast.

Dr. Kunihiro describes TechnoSuruga Laboratory's future outlook:

"The IR Biotyper is expected to become widely used in the future as an effective technology for QC in food and beverage manufacturing, where the strain identification of bacteria is required, due to its superior speed and ease-of-use compared with conventional strain identification methods.

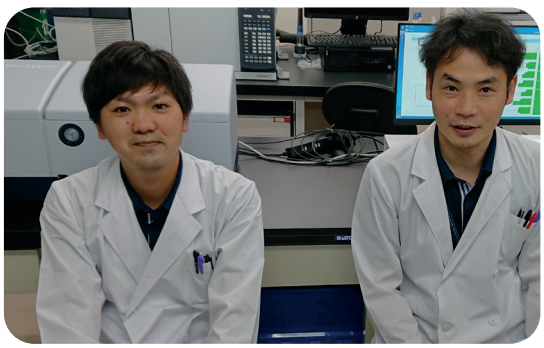
The IR Biotyper is a very good technology, and we believe that the increase in the number of users will contribute to the demand for strain identification and the development of businesses that make use of the differences in the capabilities of each strain. As a technology, it is likely to become more popular in the future."

For more information about TechnoSuruga Laboratory's services, please visit
https://www.tecsrg.co.jp/

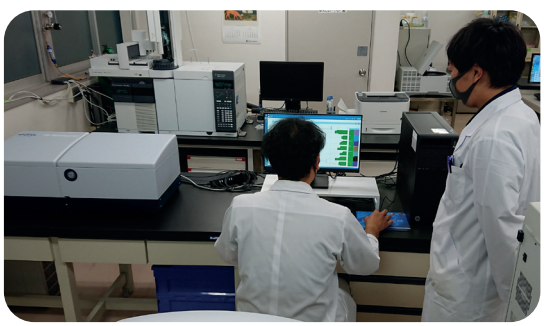
For more information about the IR Biotyper, please visit
https://www.bruker.com/en/products-and-solutions/microbiology-and-diagnostics/microbial-strain-typing.html

References

[1] Lasch P and Naumann D (2015) Infrared Spectroscopy in Microbiology. In Encyclopedia of Analytical Chemistry, R.A. Meyers (Ed.).



Dr. Morohoshi (left) and Dr. Kunihiro (right)



Dr. Kunihiro (left) and Dr. Morohoshi (right) evaluating results on the IR Biotyper


IR Biotyper

Expert Insights

About TechnoSuruga Laboratory Co. Ltd.

At the time of the company's foundation in 1997, TechnoSuruga Laboratory (then known as NCIMB Japan Co., Ltd) became the only private company in Japan to provide microorganism identification services. Today, TechnoSuruga Laboratory is offering a broad range of services, including microbial identification, analysis of microbiota, DNA sequencing, and testing services. The company also conducts research and development of analytical methods and the achievements are publicly available. Many researchers use TechnoSuruga's services to obtain data for their scientific activities.

About Bruker Corporation

Bruker is enabling scientists to make breakthrough discoveries and develop new applications that improve the quality of human life. Bruker's high-performance scientific instruments and high-value analytical and diagnostic solutions enable scientists to explore life and materials at molecular, cellular and microscopic levels. In close cooperation with our customers, Bruker is enabling innovation, improved productivity and customer success in life science molecular research, in applied and pharma applications, in microscopy and nanoanalysis, and in industrial applications, as well as in cell biology, preclinical imaging, clinical phenomics and proteomics research and clinical microbiology.

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Bruker Daltonics GmbH & Co. KG

Bremen · Germany
Phone +49 (0) 421-2205-0

Bruker Scientific LLC

Billerica, MA · USA
Phone +1 (978) 663-3660

info.md@bruker.com - www.bruker.com/microbiology