GP

news digest #007

Microbial Testing of Beer and Drinks

Beer is one of the oldest known fermented beverages and plays a rich role in our history. It is believed that fermentation was discovered about 10,000 years ago in the Middle East and Asia by soaking grains and rice in water – and so beer was born. Ancient vessels containing traces of a fermented beverage made from rice, honey and fruit were discovered in Asia and around 9,000 BC, barley and wheat were cultivated routinely in the Middle East to allow the malting of grain. The pyramids in Egypt were built by workers paid in beer and bread, and the world's oldest brewery is the Weihenstephan Benedictine monastery in Munich[1] founded in 725 AD, which still plays a pivotal role in Germany's world famous Oktoberfest.[2]

Brewing beer involves microbial activity at every stage, from raw material production and malting to in-pack stability. While fermentation of cereal extracts by the brewer's yeast *Saccharomyces* is the most important microbial process involved in brewing, a variety of other microbes affects the complete process and influences the quality of the final beer product.[3]

The rediscovery of yeast strains

The growth of the craft brewing industry, projected to achieve 14.1% growth to 2025,[4] has spearheaded a move towards the rediscovery of yeast as an essential contribution to the aroma profile of a beer. Although the great majority of *Saccharomyces* strains will produce ethanol as a fermentation end product, in practice the strains employed in the production of beers worldwide are classified into the categories of ale and lager yeasts. Ale yeasts, which are *Saccharomyces cerevisiae* strains, are the more diverse yeasts and are often referred to as "top-fermenting" yeasts.[3] *Saccharomyces pastorianus* is the most prominent yeast in the production of lager beer.

During fermentation, in addition to ethanol and carbon dioxide, yeasts produce a significant number of organic compounds that are essential for the taste of beer. The interest in new types of beer can also extend to non-*Saccharomyces* yeasts, including *Hanseniaspora uvarum*, *Lachancea cidri*, *Schizosaccharomyces pombe*, *Saccharomycodes ludwigii*, *Brettanomyces* spp., *Torulaspora* spp. and *Wickerhamomyces* spp. Old style fermented drinks are an interesting source of yeast strains with interesting properties for the craft brewing industry.

Ensuring premium quality through rapid typing

Rapid detection methods for yeast and bacteria are important for research and development into the quality, performance and safety of beer and drinks.

Beer spoilage microorganisms present a major risk for the brewing industry and can lead to the cost-intensive recall of contaminated products, and the consequent reputation damage. MALDI-TOF MS* can rapidly detect beer spoilage microorganisms in minutes, with an easy workflow.[5]

The Bruker MALDI Biotyper® (MBT) offers a smart solution for yeast and bacteria identification, starting from colony material in microbiology laboratories. The extensive MBT reference libraries (version 2021) cover >4,300 bacteria and fungi species, incl. 219 yeast references, for best match colony comparison, for microbial quality control testing.

*MALDI-TOF MS stands for Matrix-Assisted Laser Desorption/Ionization Time-Of-Flight mass spectrometry.

Parallel identifications on one target plate

To think outside the classic brewers' box, researchers are experimenting with non-traditional methods, such as unfiltered and unpasteurized sour beer with high probiotic live counts. One example of this is co-fermentation of *Lactobacillus paracasei* with a brewer's yeast. The MBT can support quality testing at this level of experimentation, by allowing a parallel identification of yeast and bacteria on one MALDI sample plate, which can hold close to 100 samples for one single analysis run.

Beer is considered an unfavorable substrate of growth for many microorganisms, however, there are a number of microbes that can thrive in beer, especially if it is unpasteurized or is not sterile-filtered, typical of the craft brewing process. The MBT workflow optimizes routine microbiological analysis and, in the event of contamination, identifies the microbe of interest in minutes.

A single detection run can identify many different microorganisms, all of which could compromise the beer's quality, including *Lactobacillus* spp., *Pediococcus* spp., *Weissella* spp., *Acetobacter* spp., *Enterobaceriaceae* or *Staphylococcus* spp.

Beer quality can also be affected by waterborne microbes such as *Legionella* spp., *Enterococci* or *Enterobaceriaceae*, all of which can be identified with the MBT.

Microbiological analysis to protect product quality

As the brewing industry continues to thrive, on-site microbiological analysis using the benchtop MALDI Biotyper® system is emerging as a rapid, high-throughput and cost-effective technology, which can be used in the detection of microorganisms that could adversely impact the quality of the beer.

For more information, visit
https://www.bruker.com/en/applications/microbiology-and-diagnostics/food-beverage-microbiology/maldi-biotyper-for-food-microbiology.html

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