MOLECULAR MAPPING:
the "weapon" recommended against microbial contaminations by Coca-Cola Hellenic

INTRODUCTION

Molecular mapping, also referred to as ***metagenomics***, is the solution championed by expert Dr. Kalliopi Chalkou in the ongoing battle within the beverage industry against microbial biofilms.

As the Head of Quality, Safety, and Environmental Governance at Coca-Cola Hellenic, Dr. Chalkou shared her insights at bioMérieux's 2024 European Beverage Quality Conference. With her deep expertise in microbial biotechnology, she highlighted how this cutting-edge technology has been implemented at CCH since 2013. It has played a key role in enhancing the company's strategic quality plan, resulting in an impressive **80% reduction in quality incidents.**

IT'S « A WAR »

Dr. Kalliopi Chalkou deliberately uses the term "war" to describe the ongoing battle in the beverage industry **against microbial biofilms-clusters of bacterial cells that adhere to surfaces and develop a protective layer, making them highly resistant to cleaning treatments.**

The stakes are immense, with Coca-Cola Hellenic operating 62 factories worldwide and serving a market of over 700 million consumers daily.

Moreover, consumer preferences have shifted toward increasingly spoilage prone food and beverage options, such as energy drinks, juices, and vitamin waters. These preservative-free products are more vulnerable to various microbiological risks, which can significantly impact product quality.

THE ONLY VIABLE STRATEGY: INVESTING IN PREVENTION

In this battle, Dr Kalliopi Chalkou emphasises that companies have two choices: react to the problem or proactively take steps to prevent it. However, given the high stakes and the cost of a quality incident, the only viable strategy is investing in prevention.

This is precisely the approach Coca-Cola Hellenic has taken by reinforcing its quality strategy under the guidance of a dedicated scientist. **Since 2013, the company has adopted groundbreaking technology that moves away from conventional microbiology—molecular mapping.**

More than a decade later, Dr Chalkou strongly advocates for this approach, predicting that **“in the coming years, it will become a frontline weapon against biofilms”—**not only because of the risks involved but also due to the **“serious limitations associated with conventional microbiology.”**

“Molecular mapping is going to become the fontline weapon against biofilm"

The principle of molecular mapping is clearly explained by Dr Chalkou. The first step is to collect samples at every stage of the production process including raw materials, production environment, process and rinse water and the finished product, in order to create a comprehensive microbial map.

The next step is to perform a complete microbial DNA extraction from each sample, sequencing it and comparing it against available databases. Through this process, scientists can determine exactly which microbes are present, their frequency of occurrence and the relative abundance of each species.

“SPECIES THAT CANNOT BE RECOVERED USING CONVENTIONAL MICROBIOLOGY METHODS"

The accumulation of specific microbial species and their growth within the total microbial community may indicate the presence of biofilm. Comparative analysis of the microbial communities (pre and post-cleaning) may provide a measure of effectiveness of any cleaning program.

“In many cases, we are dealing with species that cannot be detected using conventional microbiological methods.”

Thanks to molecular mapping, Dr Kalliopi Chalkou says “we can create a colour map so we can see what species are present in low frequency with low abundance in one part of the plant”, allowing her to “understand where there is a biofilm risk for example”.

Furthermore, molecular tests also provide crucial insights on the microbial quality and safety of incoming products and raw materials, offering valuable information for supplier evaluation.

Finally, in terms of quality risks, the scientist praises the tool which can also be a valuable aid, for example, in case of legal or consumer claims about products produced several months prior: **“We can go back to our freezer to retrieve the sample and we can activate the molecular/metagenomic mapping tool in order to get a full analysis of what species are present”.**

It is the most “objective” input to any arbitration process, “a very clear, very pragmatic contribution”. For Dr. Chalkou, molecular mapping is an “extremely powerful and sensitive tool”. Relating to our understanding of the factory microbiome: **“the depth to which we can go is really impressive”. The questions that may be addressed are limited only by our imagination and understanding of the production process.**

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