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Microbiological risks in the cosmetics industry

Author: Matteo Viganó, Food & Industry Microbiology, Bruker Microbiology & Infection Diagnostics

As the cosmetics industry embraces natural, preservative-free formulations, the risk of microbial contamination is rising - posing serious challenges to product safety and consumer health. Unlike pharmaceuticals, cosmetics lack globally harmonized microbiological testing standards, making proactive quality control more critical than ever. Water-based products are especially vulnerable, and contamination can lead to costly recalls and reputational damage. Advanced technologies like Bruker's MALDI Biotyper® and IR Biotyper® are now empowering manufacturers to rapidly identify and trace microbial threats - ensuring safety, compliance, and consumer trust in an increasingly competitive market.

In recent years, the cosmetics industry has seen consistent growth, fueled by rising interest in personal care, the continuous introduction of new products, and a global shift toward natural ingredients and "clean" formulations. Alongside this expansion, there has been a growing awareness of product safety - particularly concerning the risks posed by microbiological contamination.

The cosmetics sector shares many parallels with the pharmaceutical industry. Both are required to uphold rigorous standards of quality and safety, especially since their products are applied directly to the skin, face, and in some cases, mucous membranes. As a result, it is crucial to enforce strict controls not only on chemical composition but also on potential microbiological contamination - across the entire production chain, including raw materials, manufacturing environments, and packaging components.

This need has become even more pressing in recent years, as the concept of "naturalness" in cosmetics has gained prominence. Consumers are increasingly seeking formulations free from chemical preservatives and synthetic additives, favoring cleaner and more biological alternatives. As a result, the reduction or elimination of preservatives - unless adequately compensated - makes many cosmetics more susceptible to the proliferation of bacteria, yeasts, and molds.

This vulnerability is particularly critical in water-based products such as creams, lotions, shampoos, and liquid makeup, which provide a favorable environment for microbial growth if not properly stabilized. The consequences may range from simple product spoilage to serious health risks for consumers, including skin infections or allergic reactions.

Despite the importance of preventing contamination, cosmetics are regulated mainly at the regional level, rather than by a single global framework, although many markets reference common standards (e.g., ISO 17516 and ISO 22716). In Europe, ISO 17516:2014 serves as a technical guideline defining acceptable microbial limits according to product type, while also requiring the absence of specific pathogens such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, and *Candida albicans*.[1,2]

Beyond these pathogens, several studies have shown that other opportunistic microorganisms may pose a real risk of contamination in cosmetics as well. This includes species such as *Burkholderia cepacia* complex, *Enterobacter cloacae*, *Klebsiella pneumoniae*, *Bacillus cereus*, as well as yeasts like *Rhodotorula* and *Candida* spp., and environmental molds such as *Aspergillus* and *Penicillium*.[3]

Given the wide variety of potential microbial contaminants, it is crucial for quality control laboratories in the cosmetics industry to be equipped with fast, accurate, and reliable tools for microbial identification, allowing for timely intervention in case of contamination. In this context, the MALDI Biotyper® system has proven to be a cutting-edge technology for rapid and accurate microbial identification. This market leading MALDI-TOF MS system allows for the efficient identification of bacteria, yeasts, and molds, making a significant contribution to maintaining safety standards, while being cost-effective and easy to use. Its comprehensive reference libraries make it the ideal tool in a field dealing with a wide variety of microbes.[4]

While ensuring product safety is crucial, root cause analysis becomes especially important in large-scale production environments. When contamination is detected, it's essential to identify its origin to prevent future batches from being compromised as well. Here the IR Biotyper® comes into play. This system, based on FT-IR spectroscopy, offers same-day results without the hassle of complicated sample preparation needed for PFGE, MLST or WGS.[5] In today's increasingly competitive and challenging market, adopting state-of-the-art technologies not only helps prevent risks and product recalls, but also strengthens a brands reputation by demonstrating a commitment to quality and safety.

References

1 ISO 17516:2014 – Cosmetics – Microbiology – Microbiological limits (ISO 17516:2014 - Cosmetics — Microbiology — Microbiological limits)

2 Condalab (2020) – Microbiological Analysis in the Cosmetic Industry (Microbiological-Analysis-Cosmetics_EN_2020.pdf)

3 Neza & Centini, 2016, Microbiologically Contaminated and Over-Preserved Cosmetic Products According Rapex 2008–2014. Cosmetics 2016,3; https://doi.org/10.3390/cosmetics3010003

4 Expert insight on the MALDI Biotyper for microbial testing in a GMP environment: Bruker.com

5 MALDI Biotyper and IR Biotyper for pharma brochure: Bruker.com

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Online information
bruker.com/microbiology

Bruker Daltonics GmbH and Co. KG

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

info.md@bruker.com

Bruker Scientific LLC

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