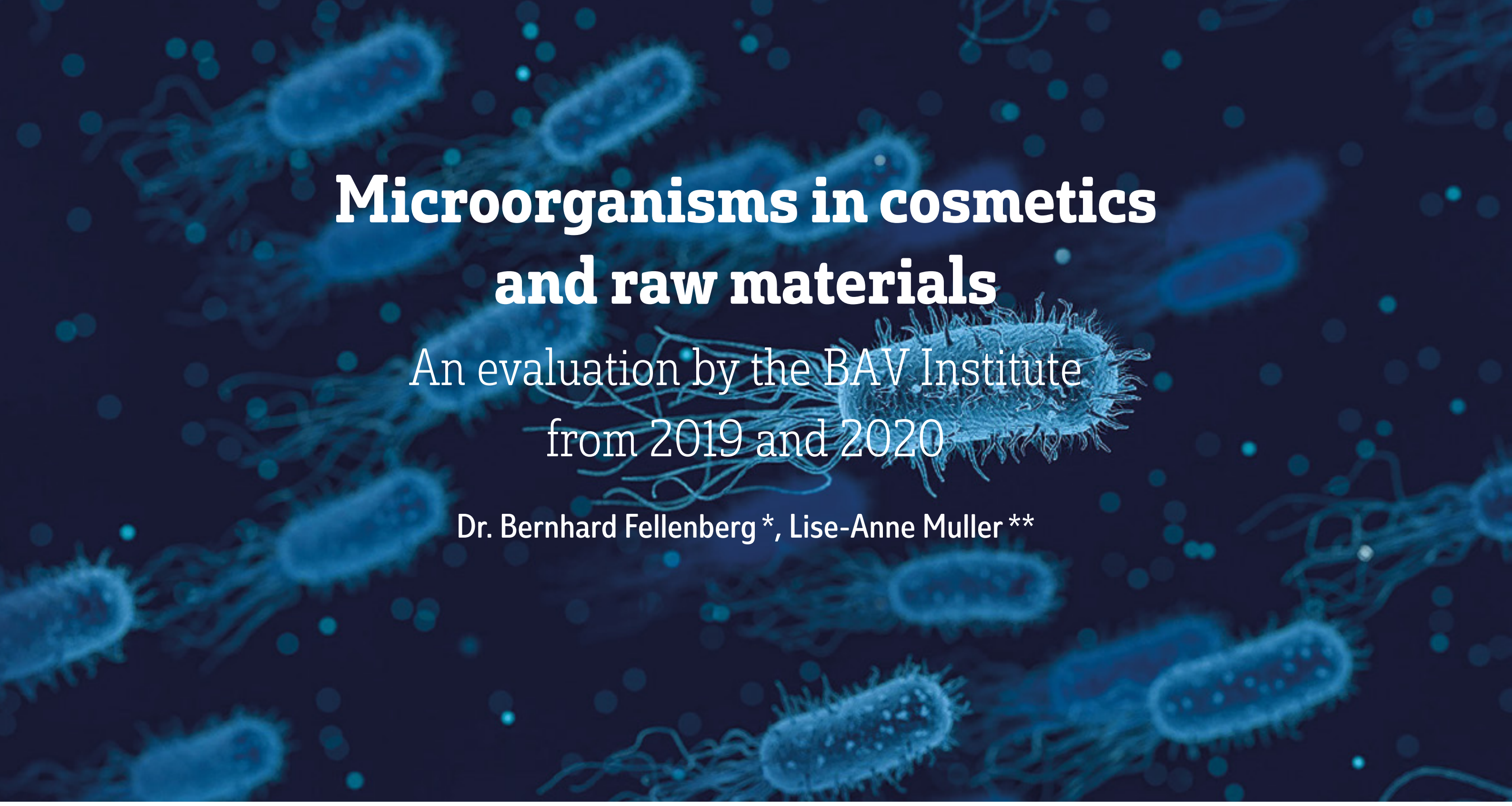

Microorganisms in cosmetics and raw materials

An evaluation by the BAV Institute from 2019 and 2020

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Introduction

The BAV Institute regularly carries out microbiological tests of cosmetic products and raw materials on customer orders. A large number of products are tested for their microbial status and – in the case of microorganism growth – these microorganisms are identified.

In the following evaluations, the data from these tests were evaluated over an observation period of 24 months with the aim of obtaining an overview of the most frequently detected microorganisms.

You will find these evaluations with corresponding explanations below.

1. Period under consideration and procedure

The evaluation was carried out over an observation period of 24 months (years 2019 and 2020). All cosmetic products and cosmetic raw materials sent to the BAV Institute with the aim of testing the microbial status (mostly according to ISO 17516)[1] were taken into account.

All identification results of these samples were evaluated.

The following points should be considered:

- Data from a total of **more than 165.000 samples** were evaluated
- **More than 5.000 individual identification results** were available
- The analysis of water samples and the testing of monitoring samples are not included
- **The number of positive samples is only meaningful to a limited extent,** as the proportion of conspicuous samples or samples with complaints in this sample is supposedly higher than in a comparable sample of end products from the trade (example: in the case of positive findings, increased testing of further samples of the same batch or associated raw materials is performed).

2. Proportion of bacteria, yeasts and moulds

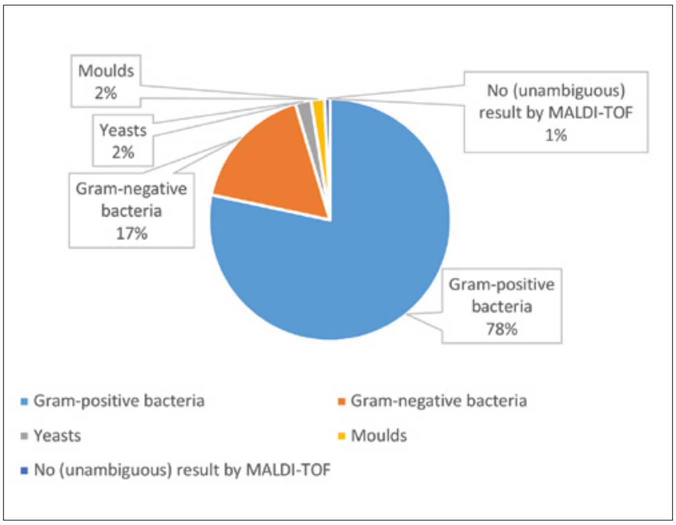

Figure 1: Proportion of different microorganisms in case of identification

As can be seen from the figure, bacteria in particular play a major role (more than 9 out of 10 samples). Yeasts and moulds are represented much less frequently, with a total of 4%.

Among the bacteria, mainly gram-positive bacteria play a role. This proportion of gram-positive bacteria is possibly increased by the following two points:

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- Water samples are not taken into account (mostly gram-negative bacteria)
- Raw materials are taken into account, here a frequent occurrence of gram-positive bacteria is observed

3. Specified and non-specified microorganisms

According to ISO 18415[2] (detection of specified and non-specified microorganisms in 1g product) and ISO 17516 (microbiological limits), a distinction is made in the evaluations:

- Specified microorganisms:
  Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Candida albicans
- Non-specified microorganisms:
  All other microorganisms, here additionally two bacteria are listed separately due to their relevance for cosmetics *(Pluralibacter gergoviae* and *Burkholderia cepacia)*

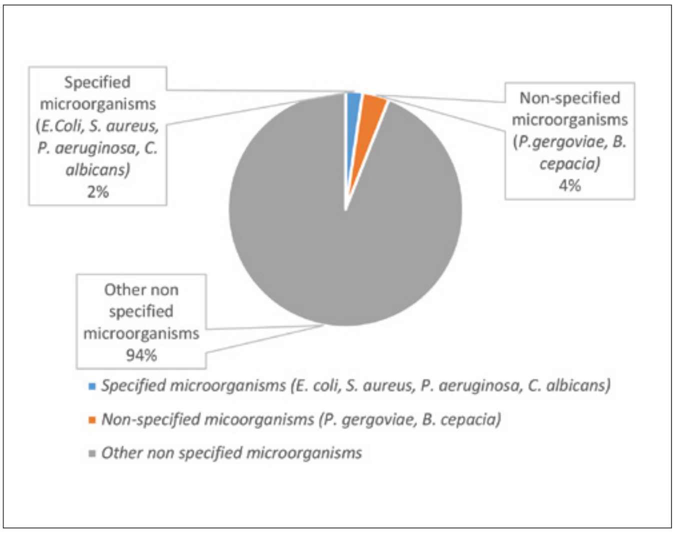

Figure 2: Proportion of specified and non-specified microorganisms

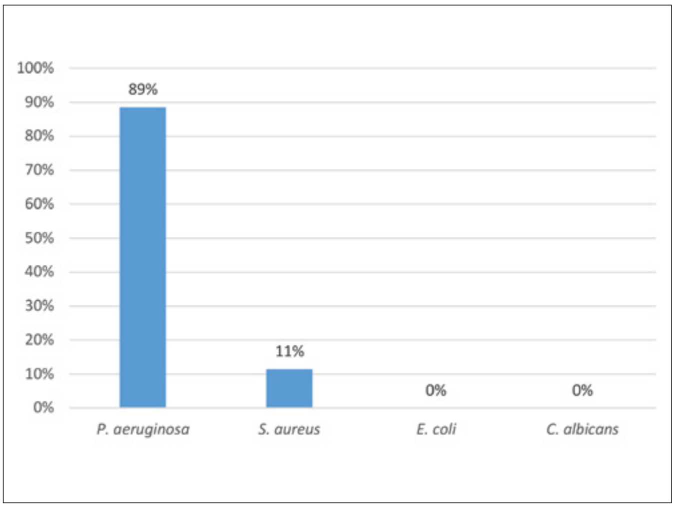

Figure 3: Proportion of specified microorganisms

4. Detailed evaluation of gram-positive bacteria

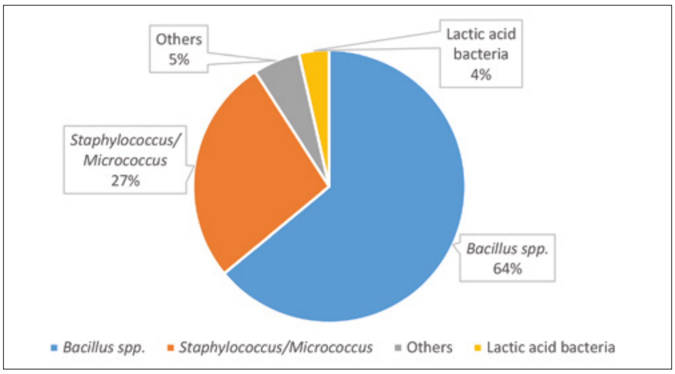

Figure 4: Distribution of microorganisms in the detection of gram-positive bacteria

In the following table, the data from Figure 4 are listed again in more detail with the naming of the most frequent representatives (sorted by frequency):

Type of microorganisms	Genus	Frequent representatives
Bacillaceae	*Bacillus*	*B. cereus, B. subtilis, B. pumilus, B.circulans, B. licheniformis*
	Paenibacillus	*P. glucanolyticus, P. amylolyticus*
	Brevibacillus	*B. parabrevis, B. agri*
	Lysinibacillus	*L. fusiformis*
Staphylcoccus/ Micrococcus	*Staphylococcus*	*S. warneri, S. hominis, S. epidermidis, S.capitis*
	Micrococcus	*M. luteus*
Lactic acid bacteria	*Lactobacillus*	*L. plantarum, L. paracasei*
	Enterococcus	*E. faecalis, E. casseliflavus, E. faecium*
	Streptococcus	*S. parasanguinis, P. vestibularis, P. salivarius*
	Globicatella	*G. sanguinis*
	Leuconostoc	*L. mesenteroides*
Others		*E.g. Microbacterium spp.* *Corynebacterium spp.* *Brevibacterium spp.*

Table 1: Frequently detected gram-positive bacteria

5. Detailed evaluation of gram-negative bacteria

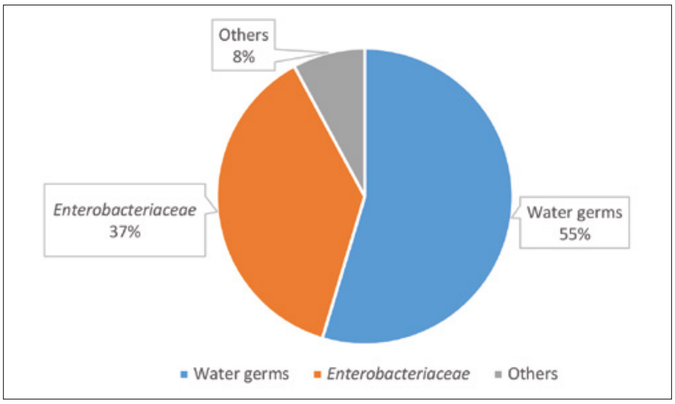

Figure 5: Distribution of microorganisms in the detection of gram-negative bacteria

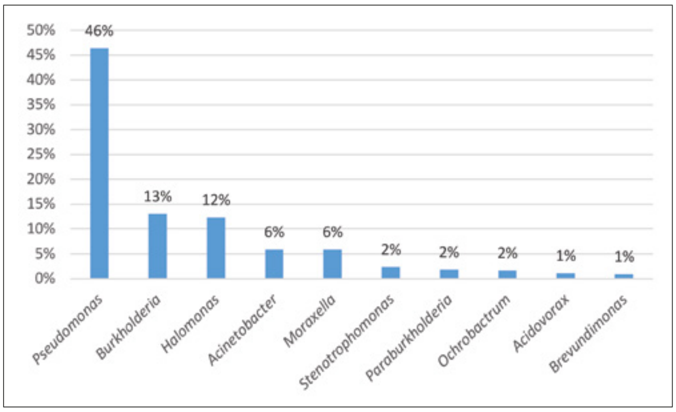

Figure 6: Water germs in cosmetics (distribution of the individual genus in relation to the total number of water germs)

In the above figures 5 and 6 gram-negative, oxidase-positive bacteria are defined as water germs.

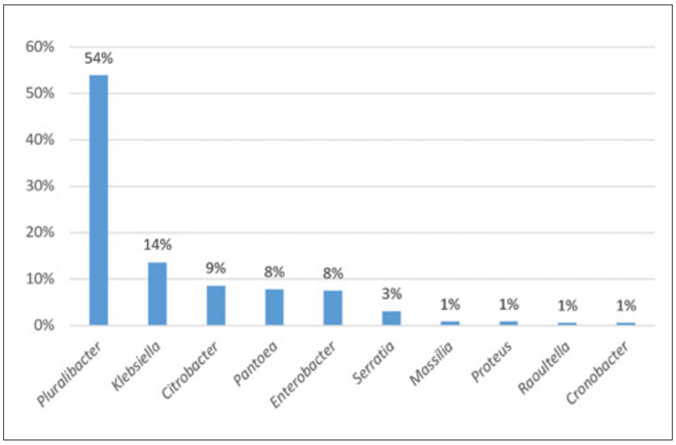

Figure 7: Enterobacteriaceae in cosmetics (distribution of the individual genus in relation to the total number of Enterobacteriaceae)

The following table also shows the most common representatives of gram-negative bacteria:

Type of microorganisms	**Genus**	**Frequent representatives**
Enterobacteriaceae	*Pluralibacter*	*P. gergoviae*
	Enterobacter	*E. asburiae, E. cloacae*
	Pantoea	*P. agglomerans, P. spp*
	Klebsiella	*K. oxytoca, K. pneumoniae, K. variicola*
	Erwinia	*E. spp.*
	Serratia	*S. liquefaciens, S. marcescens*
	Cronobacter	*C. spp*
	Citrobacter	*C. farmeri, C. freundii*
	Escherichia	*E. vulneris*
Water germs	*Pseudomonas*	*P. aeruginosa, P. monteilii, P. putida*
	Acinetobacter	*A. lwoffii, A. baumannii*
	Moraxella	*M. osloensis*
	Burkholderia	*B. cepacia, B. tropica, B.spp*
	Herbaspirillum	*H. spp., H. huttiense*
	Acidovorax	*A. temperans*
Others		*Acid lactic bacteria* *E.g. Acetobacter indonesiensis* *Gluconacetobacter liquefaciens*

Table 2: Frequently detected gram-negative bacteria

6. Detailed evaluation of yeasts

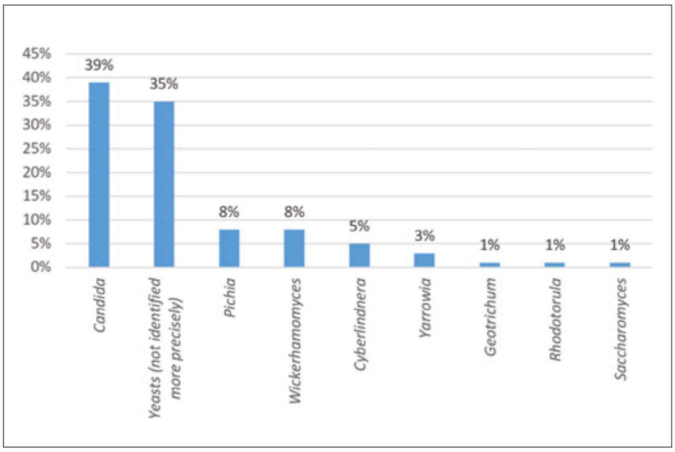

Figure 8: Distribution of yeasts (distribution of the individual genus in relation to the total number of yeasts)

Genus	**Frequent representatives**
Candida	*C. parapsilosis, C. guilliermondii,C. boidnii*
Pichia	*P. manshurica*
Wickerhamomyces	*W. anomalus*
Cyberlindnera	*C. fabianii*
Yarrowia	*Y. lipolytica*
Geotrichum	*G. spp*
Rhodotorula	*R. spp*
Saccharomyces	*S. cerevisiae*

Table 3: Frequently detected yeasts

7. Detailed evaluation of moulds

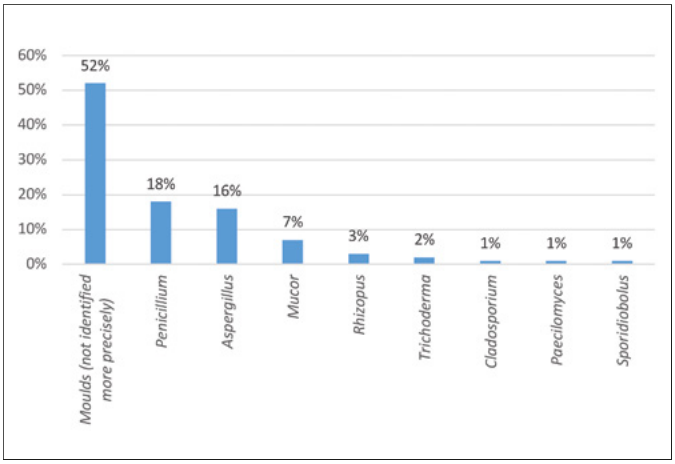

Figure 9: Distribution of moulds (distribution of the individual genus in relation to the total number of moulds)

In the case of moulds, most of them were not identified down to species level. A more precise information is usually not relevant with regard to a risk assessment.

8. Detailed evaluation of the distribution of bacteria, yeasts and moulds in samples with a total bacterial count of ≥ 1000 CFU/g product

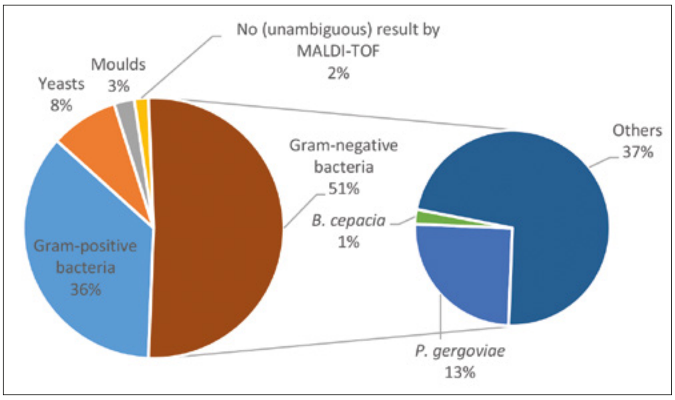

Figure 10: Distribution of the microorganisms detected in samples with a total microbial count of ≥ 1000 CFU/g product

9. Detailed evaluation of the distribution of bacteria, yeasts and moulds in samples with a total bacterial count of < 1000 CFU/g product

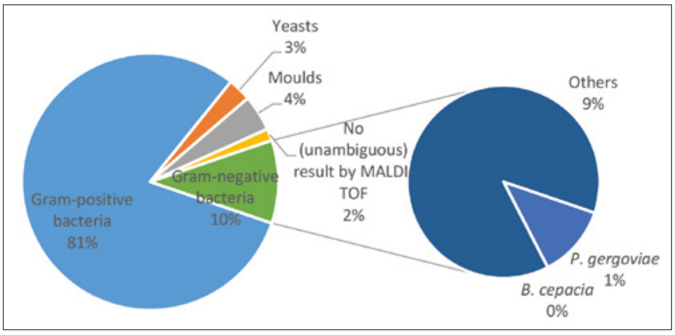

Figure 11: Distribution of the microorganisms detected in samples with a total microbial count of < 1000 CFU/g product

The following key statements can be deduced from all these data:

1. **Bacteria** play a **significantly greater role than yeasts and moulds** in the microbiological contamination of cosmetic products or raw materials.
2. When gram-positive bacteria are detected, they are often *Bacillus spp*. These bacteria are usually present in spore form and are less relevant in terms of a risk to the consumer.
3. Among the gram-negative bacteria, **Enterobacteria** (mostly from the environment and/or water) and **Pseudomonads** (water germs) play a major role. *Pseudomonas aeruginosa* and *Pluralibacter gergoviae* are particularly important here.
4. Among the yeasts, members of the *Candida* genus are detected in about 35% of cases.
5. Among the moulds, *Penicillium spp.* or *Aspergillus spp.* are most frequently detectable when identification is carried out.
6. The microorganisms *Pseudomonas aeruginosa, Staphylococcus aureus, Escherichia coli* and *Candida albicans* are listed in ISO 17516. According to ISO 17516, these microorganisms must not be present in 1g of product.
    a. *P. aeruginosa* was detected several times (see above)
    b. *S. aureus* was also determined, although in smaller numbers
    c. *E. coli* could not be detected
    d. *C. albicans* was also not detected
7. These data also reflect the data from the European rapid alert system[3]. With regard to a possible hazard, Pseudomonads and Enterobacteria are mentioned most frequently there. **Gram-positive bacteria, like yeasts and moulds,** also **play only a minor role** with regard to a possible health hazard.

Literature

1 *ISO 17516 – Cosmetics – Microbiology – Microbiological limits, 2015-02*

2 *ISO 18415 – Cosmetics – Microbiology – Detection of specified and non-specified microorganisms, 2017-09*

3 *Safety Gate: the EU rapid alert system for dangerous non-food products, www.ec.europa.eu/safety-gate-alerts*

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