Detection and evaluation of microbial contaminations affecting technical surfaces

**Microorganisms – blessing and distress**

Microorganisms like fungi and bacteria are omnipresent in nature and play an important role in all elemental-circuits. Therefore they are of vital importance to the continuity of ecosystems. They are even useful assistants to men: We employ them for brewing beer, baking bread, cleaning waste water or producing vitamins and antibiotics. Though most of the time their adverse effects are detected so much faster: Contaminations in medical departments and industrial production lines bring immense costs and cause heavy losses by rotting raw material or producing toxic by-products.

**Universal existance – growing importance of hygienic aspects**

Microorganisms exist in indoor air, on surfaces, in production-integrated media or are transferred to rooms and processes by careless personnel. Because of their immense growing ability as well as their adaptability to various locations and living conditions they appear to be highly efficient. In the whole production line – from fabrication to bottling, packing, to cleaning of components and plant elements – the microbial analysis of the hygienic status gains importance. Nowadays the need for efficient qualitative and quantitative evaluation methods for surface-bound microorganisms has increased tremendously.

**Range of services**

- Evaluation of microbial impurity on surfaces and in production-integrated media (e.g. water, raw materials, industrial products)
- Design, construction and judging of components regarding cleanliness, denseness and possible sterilisation capability
- Creating procedures to minimize the microbial and chemical load in various sectors (e.g. sterilization processes, elongation of retention times for cleansing baths, cost-efficient recycling of production-integrated media and waste water treatment)
- Development of innovative materials to reduce the upcoming of biofilms affecting packaging supply, pipelines, medical equipment and/or for the design of future workspaces
- Estimation of antimicrobial properties of specially coated surfaces
At the Fraunhofer IGB facility the relevance of biofilms was detected and their application promoted very early, e.g. to produce valuable products or to clean industrial and municipal waste water. But as well their avoidance and abatement ist encouraged by innovative techniques. These requirements raised the demand for effective qualitative and quantitative evaluation methods to detect surfacebound microorganisms.

The interdisciplinary cooperation between Fraunhofer IGB and some other Fraunhofer institutes provides a close connection of material development chemical-physicals and biological revision, in which interested industrial partners are integrated in the context of mission oriented research.

The aim is to create adapted solutions for each of these complex requirements:
- prevention of microbial contamination
- development and optimization of cleansing processes
- evaluation of the hygienic status in different application areas and processes.

**Modus operandi**

For the estimation of the hygienic status or the efficiency of anti-microbial coated surfaces different methods of sampling were established – especially designed for different demands (indoor air, surfaces, production-integrated media). Subsequently samples were processed and cultivated from which specifically adapted biological systems were chosen to evaluate surfaces and the germs’ ability to grow on plant-components. On the basis of microbiological process engineering and/or molecular biological working methods new proceedings were created and established.

**At the Fraunhofer IGB established microbial test applications**
- Development of methods for special demands and new requirements
- Screening for effective substances endorsed by the „agar diffusion test“ as a preliminary stage of material formation in terms of a selection process for effective substances
- Selection and cultivation of capable organisms based on the application range of the product (even pathogene microorganisms of risk-group 2) to judge surfaces
- Qualitative and quantitative methods of measurement to compare different materials and products
- Techniques to rate the adhesive properties of biofilm formation under static and dynamic terms
- Surface attributes of diffusing and chemical fixed functional groups
- Procedures to judge photocatalytic active surfaces under defined conditions
- Optical evaluation as well as photographic representation of growing biofilms on workpieces

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**Fig. 3:** Revision of the hygienic status before (left) and after (right) the cleansing process.

**Fig. 4:** The number of living germs can be diminished to a very considerable degree by the use of inactivating substances.