PRESS RELEASE

Sanitized siphons – fewer hospital germs

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP has been involved with development of processes and equipment for cleaning, sterilization, and surface modification for decades. As a partner in the newly launched "Siphon" project, the Fraunhofer FEP will be presenting the Institute's current research focused on the field of hygiene and sanitation at the MedTecLIVE trade fair in Nuremberg (Hall 10, Booth 10.0 - 621) May 21-23, 2019.

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About 800,000 - 900,000 people every year in Germany alone[1] suffer from nosocomial infections, i.e. infections that occur in connection with hospitalizations. About one third of these cases are caused by retrograde bacterial exposure of immuno-compromised patients.

One of the many sources of this is the hospital water system. While primary water is sterilized, bacteria can enter the hospital almost unhindered via the drainage system. As a large-scale study[2] has shown, bacteriological colonization first takes place via the sewage pipes connected to the odour trap in the sink drain that contains water, called the siphon. If the water tap is opened, primary water flows down through the drain. At the same time, the air mass above the water in the siphon is forced upwards into the sink – pulling bacteria with it. These bacteria can be detected in a roughly three-foot radius of the sink. And since there is always a person near the sink when the water is running, it can be assumed that bacteria can practically always be transmitted this way. Fortunately, not every contact with bacteria immediately leads to an illness. On the contrary, most bacteria in and around our bodies are valuable helpers. Nevertheless, pathogenic pathogens can also spread in the manner described. Hospitals also often have patients with weakened immune systems, which makes them particularly susceptible to bacterial infections.

Up to now, the siphon has been sanitized at great effort by autoclaving (baking it) or treating it with antibacterial cleaning agents at intervals, which can prevent a large portion of the spread of bacteria. These methods work in principle, but they are not only time-consuming and logistically difficult, but also place a financial burden on the hospital and ultimately on the health care system. Instead, what about a siphon that – once installed – were able to continuously prevent bacterial colonization safely?

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Researchers from Fraunhofer FEP and MoveoMed GmbH have joined forces for this ambitious project led by the German Federation of Industrial Research Associations (AIF). "The novel approach comprises development of a siphon insert that permanently prevents bacteriological colonization and thus also prevents retrograde infection," explains Jan-Michael Albrecht, Managing Director of MoveoMed.

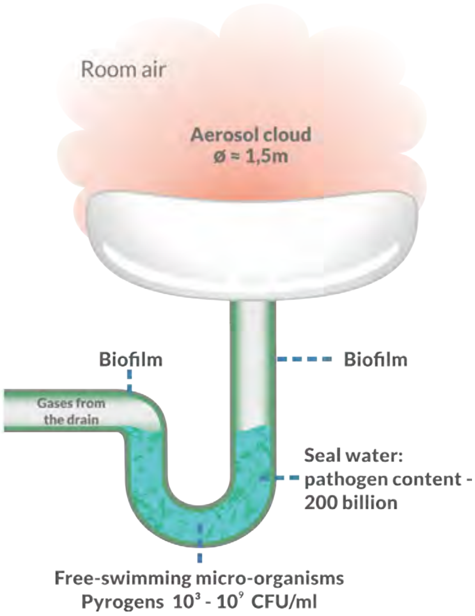
Technologically, the known photocatalytic effect of titanium dioxide (TiO_2) will be used. When illuminated with UV light, this substance produces what are known as radicals that can quickly destroy bacteria or other biological contaminants in a very short time. This is already utilized in self-cleaning cladding and wall paint, where tiny TiO_2 particles achieve their cleaning effect when exposed to sunlight. Each time a TiO_2 particle is hit by a ray from the sun (more precisely the UV portion of the sunlight), an oxygen radical is formed. The stronger the incident radiation and the more titanium particles there are, the more pronounced is the formation of radicals and thus the biocidal effect. Unfortunately, however, no sunshine and thus no natural UV radiation gets into a waste water pipe. Additionally, the self-cleaning siphon idea is more difficult to realize due to the small amount of space available. In contrast to the normally quite large surface area of a building wall, which would represent a large surface area for reactions, large areas cannot be easily found in normal domestic or industrial wastewater pipes, or other available space.

The goal is therefore to compress the photocatalytic self-cleaning effect of a façade in the blazing sun so that the same result (cleaning and disinfection) is achieved within a dark and narrow wastewater pipe. The small surface area will be overcome by utilizing porous sintered materials. These are metals that are first drawn out as threads that are then loosely folded together to form metallic netting with a lot of surface area. Finally, heat treatment solidifies the material. In this way, a material with a very large internal surface area is created that can then be coated with the photocatalytic and highly reflective titanium dioxide. The lack of sunlight will supplanted by the use of special UV LEDs additionally installed in the siphon.

The difficulties associated with this ambitious project do not lie principally in researching new technologies, but instead more in applying existing technologies to completely new fields of application. In order to achieve this, diverse expertise from a wide variety of fields has been successfully combined and focused. For example, the sintering process developed by the Fraunhofer Institute for Manufacturing Technology and Applied Materials Research (IFAM) for manufacturing metallic materials with large surface areas is employed.

Dr. Ulla König, Deputy Head of the Medical and Biotechnological Division, is pleased: "The Fraunhofer FEP is contributing its expertise in coating technology as well as in microbiology and analytics."

Last but not least, consortium partner MoveoMed has experience in the field of innovative wastewater technology. Their current model MoveoSiphon ST24 serves as a benchmark for the intended microbiological efficacy.



Schematic representation of the bacterial problem area in a sink/siphon

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Standard siphon with retrofitted ST24 for thermal disinfection

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About "Siphon":

The group project between a research institution (FEP) and a medium-sized company (MoveoMed) has been funded by the German Federal Ministry for Economic Affairs and Energy (BMWi) under its main investment programme for small and medium-sized enterprises (Zentrales Investitionsprogramm Mittelstand / ZIM, funding code ZF 4597702BA8) via the German Federation of Industrial Research Associations (AIF) as project manager. Starting in January 2019, a 2-year term is planned, at the end of which a prototype will be presented.

About MoveoMed GmbH:

MoveoMed GmbH is an owner-managed company that offers tailored solutions to hygiene problems for medical facilities (hospitals, medical practices, nursing homes, etc.). Founded in Radebeul near Dresden in 2012, the company has set itself the goal of contributing to the improvement of hygiene, especially in hospital sanitation.

Sources:

[1] Peter Walger, Walter Popp, Martin Exner; *Statement of the DGKH on prevalence, mortality and prevention potential for nosocomial infections in Germany 2013*; federal press conference, March 28, 2014

[2] E. de Jonge, M.G.J. de Boer, E.H.R. van Essen, H.C.M. Dogterom-Ballering, K.E. Veldkamp; *Effects of a disinfection device on colonization of sink drains and patients during a prolonged outbreak of multidrug-resistant Pseudomonas aeruginosa in an intensive care unit*; Journal of Hospital Infection; 01-2019

Fraunhofer FEP at MedTecLIVE, May 21-23, 2019, Nuremberg, Germany:

Hall 10, Booth No. 10.0 - 621