Fraunhofer
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Experimental evaluation of microbial characteristics of surfaces of Nanofug® Premium der Co. PCI Augsburg GmbH

Evaluated specimen:
Nanofug® Premium of Co. PCI Augsburg GmbH

Test conditions:
Series of measurement with illuminated specimens, irradiation intensity was 0.85-0.95 mW/cm^2 UV-A-radiation (Philips TL-D 18W 108).
Exposed samples and samples kept in the dark were compared in all the test series.
The tests were conducted at a room temperature of 21°C, the relative humidity in the test chamber was adjusted to 50 %.

Test organisms:
Sarcina lutea (occur ubiquitously, generally being distributed by air currents) and *Aspergillus niger* (spore building common fungi)

Concentration of microorganisms:
Sarcina lutea: 1,000,000 bacterial cells (*Sarcina lutea*) on an area of about 20 cm^2
Aspergillus niger: 10,000 fungal cells (*Aspergillus niger*) on an area of about 20 cm^2
Replicas were conducted due to validation purposes

Results
Gram-positive bacterial strain *Sarcina lutea*:
Using an initial number of 1,000,000 bacterial cellsn (*Sarcina lutea*) on an area of about 20 cm^2 (Figure 1) of Nanofug® Premium, the majority of the cells is still viable after 12 hours in the dark (Figure 2).

There are no reproducible cells detectable on the exposed specimen of Nanofug® Premium (Figure 3). Their

development is strongly inhibited. Recultivation can be detected after extended incubation periods.

Figure 1 Figure 2 Figure 3

It was not possible to demonstrate a substantial inactivating effect of the samples. The results show that a reduction in the rate of multiplication occurs. In the case of continuous exposition, repeated exposure takes place; it is therefore probable that bacterial growth is reduced.

Fungal cells *Aspergillus niger*:
Using an initial number of 10,000 Pilzzellen (*Aspergillus niger*) on an area of about 20 cm^2 of Nanofug® Premium, the majority of the cells is still viable after 7 days in the (Figure 4, top row).
There are almost no reproducible cells detectable on the exposed specimen of Nanofug® Premium (Figure 4, bottom row).

Reduction factor of cells was 3 to 4 after several days of exposure.

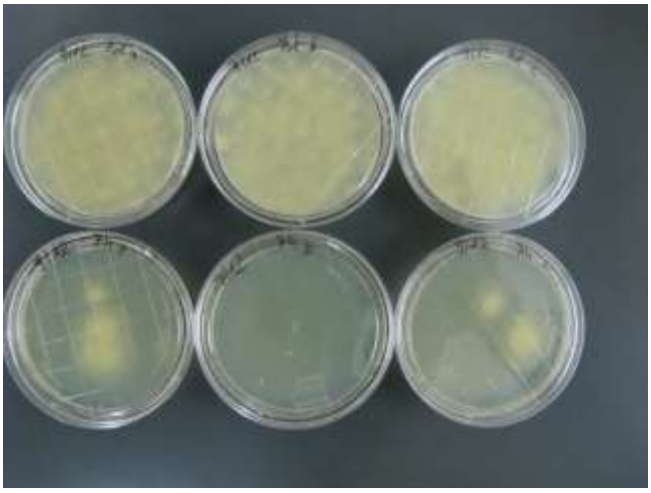

Figure 4

Conclusion:

In the case of continuous exposition, repeated exposure takes place; it is therefore probable that bacterial growth of the chosen test strains won't reproduce and will, with high probability, be inactivated.

Results from measurement series in February 2013, conducted at Fraunhofer Institute of Interfacial Engineering and Biotechnology, Stuttgart