Co-sputtered nanostructured antibacterial coating on air filters

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Indoor air quality directly affects occupant health, comfort and productivity. Healthy air quality is guaranteed by next generation air filtration systems. However, dirt accumulation and low maintenance of the filtration apparatus lead to microorganism deposition and growth and to a possible biofilm formation on the surfaces. Thus instead of providing clean air, filters themselves become a source of contaminated air. This can increase the risk of infectious diseases. In this work, a nanostructured antibacterial coating was deposited on glass fibre and metallic air filters by means of radio frequency co-sputtering technique. Scanning electron microscopy demonstrated the effective coating deposition on the filter fibres, not occluding the porosity of the filter itself and so not altering its filtration performances. Filters were exposed, for different times, to a standard bacterial suspension of S. *epidermidis* or *E. coli* by means of a bioaerosol generator. The exposure of the filters to the bioaerosol, under tested and controlled conditions, represent worst case scenario where a few minute exposure results in dense bacterial growth on the agar surface as shown in Figure 1. Antibacterial performances of the coated filters were assessed evaluating the presence of microbial growth, under and around the filter, on Mueller-Hinton (MH) agar after an incubation of 48 hours at 37°C; uncoated filters were tested as control.

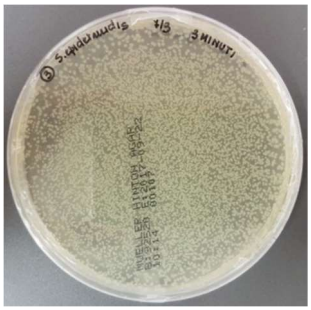

Figure 1. *S. epidermidis* colonies on MH agar plate after a 3 minute exposition to bioaerosol and an incubation at 37°C for 24 hours

Co-sputtered nanostructured coating deposited on filtering materials demonstrated a complete inhibition of *S. epidermidis* and *E. coli* growth (Figure 2).

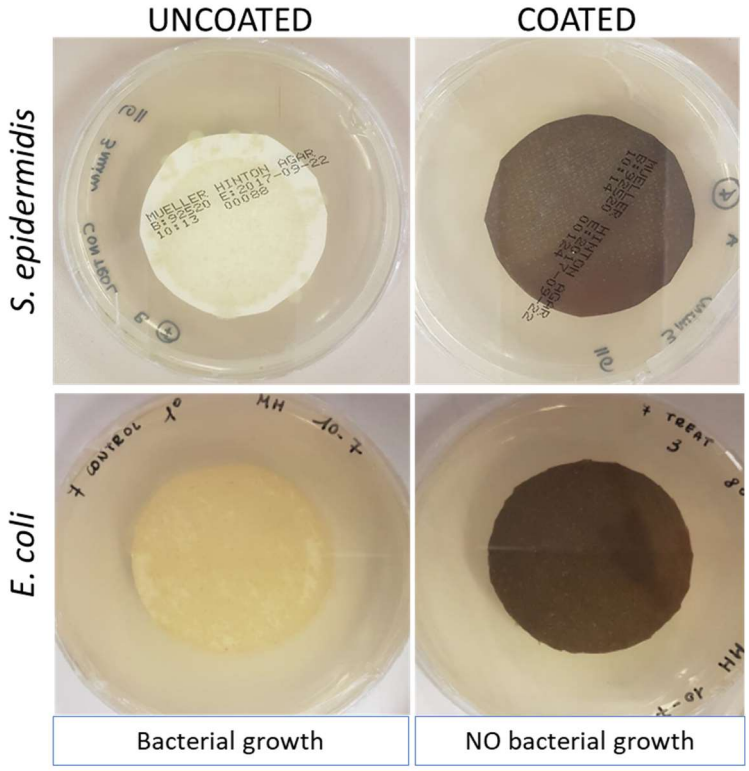

Figure 2. Evaluation of bacterial growth after filter exposition to bioaerosol (3 minutes) of *S. epidermidis* or *E.coli* and an incubation on MH agar at 37°C for 48 hours: bacterial growth on uncoated glass fibre filter (on the left); no bacterial growth on coated glass fibre filter (on the right)

Sputtering is considered a green process easy to be industrially scaled-up. These antibacterial air filters will positively impact on wellbeing, health and safety of the entire population.