ANTIBACTERIAL ACTIVITY OF SOLID SURFACES IS CRITICALLY DEPENDENT ON RELATIVE HUMIDITY, INOCULUM VOLUME AND ORGANIC SOILING

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Surface transfer of microbes is one of the main routes of transmission of infectious diseases in the community and in the hospital environment. Antimicrobial surfaces can potentially prevent pathogen transfer in critical applications, e.g., health care or food industry. According to legislative acts in Europe and in the United States, a proof of measured antimicrobial activity should be provided prior to making any marketing claims on antimicrobial nature of products. Several test methods exist that have been developed and standardized specifically for the testing of antimicrobial efficacy of surfaces. Due to the current poor understanding of the role of crucial environmental variables on antimicrobial activity of surfaces, we carried out a systematic series of experiments to elucidate the effect of bacterial drying and the presence of organic soiling during exposure. Altogether six hard surface types that were either advertised as antimicrobial or were historically known for their antimicrobial properties and that were based on copper, silver and quaternary ammonium compounds were exposed to Gram-negative *Escherichia coli* ATCC 8739 and Gram-positive *Staphylococcus aureus* ATCC 6538 at variable relative air humidity (RH), in two different droplet sizes mimicking small aerosol droplets and contamination with larger volumes of liquid, and in the presence or absence of organic soiling. Antibacterial activity evaluation was based on decreased colony forming units. In general, copper-based surfaces proved to be the most efficient followed by silver-containing surfaces and surfaces coated with quaternary silicon compounds. However, in dry exposure conditions, i.e., at low RH and high organic soiling, also copper surfaces lost their antibacterial activity and no decrease of colony forming units was observed for neither of the bacteria. At high RH, copper surfaces were most efficient in the case of microdroplet inoculation resembling fine aerosols. The presence of surface soiling specifically inactivated the antibacterial effect of metal-based surfaces and such inactivating effect depended on the concentration of surface soiling. Certain differences were observed also between the used test bacteria. While antibacterial effect towards *E. coli* was more affected by drying and size of the droplets, antibacterial efficacy against *S. aureus* was more dependent on surface soiling.

Our results highlight the importance of the selection of test conditions for antibacterial efficacy evaluation bearing in mind their application-relevancy.

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