Antimicrobial nanomaterials based on metal oxide

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The development of new antimicrobial agents based on nanomaterials arouses a strong interest in the biomedical field, in particular in the current health context. Metal oxides seem to be very good candidates due to their high antimicrobial potential but also thanks to their excellent chemical stability and biocompatibility [Xiang et al. 2017]. Indeed, the work of Dadi et al. 2019 recently showed the antimicrobial potential of zinc oxide ZnO and copper oxide CuO nanoparticles in thin film and in solution. The antimicrobial activity of nanoparticles is largely influenced by their size. Indeed, physical and chemical properties of materials can be exacerbated or very different at the nanometric scale in connection with the increase in the surface/volume ratio when the size decreases.
The objective of this work concerns the development of materials based on nanoparticles (Nps) of metal oxides with the aim of measuring and optimizing their antimicrobial properties for the detoxification of surfaces and ventilation systems. The antimicrobial activity of the nanoparticles is evaluated on two Gram (-) bacteria (Escherichia Coli and Pseudomonas aeruginosa), a Gram (+) bacteria (Staphylococcus aureus) and a yeast (Candida albicans).

Thanks to the soft chemistry synthesis methodology implemented in the context of this study, we were able to develop nanocrystals of ZnO wurtzite, of variable sizes between 16 nm and 36 nm. The antimicrobial potential of nanoparticles is studied using the microdilution method and the determination of the Minimum Inhibitory Concentration (MIC). The results highlight an antimicrobial effect of ZnO nanocrystals. We observe that the minimum inhibitory concentration is around 40% in nanoparticles (i.e. 400 µg/mL). The percentage inhibition of the growth of Escherichia Coli is 30%.

References

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