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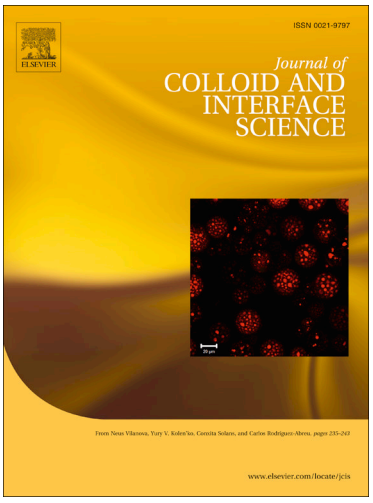

Feature Article

Nano-structured Antimicrobial Surfaces: From Nature to Synthetic Analogues

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Nano-structured Antimicrobial Surfaces: From Nature to Synthetic Analogues

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Abstract

The scientific and industrial interest in antimicrobial surfaces has significantly increased in recent times. This interest is largely in response to the persistent microbial contamination of industrial and, importantly, medical implant surfaces. Bacterial contamination of implant surfaces often leads to infection at the implant-tissue interface, and with the prevalence of increasing levels of antimicrobial resistance; the treatment of these infections is becoming far more challenging. Recently, many naturally occurring, high-aspect-ratio surface topographies have been discovered that exhibit high levels of biocidal efficacy. These include epicuticular lipid nano-architectures that are formed on the surfaces of insect wings, such as cicadae and dragonflies. The antimicrobial activity of such surfaces has been found to be a consequence of the physical interactions taking between the nanoscale topography of the substrate and the attaching pathogenic cells, meaning that the activity is independent of biochemical surface functionality. Importantly, these desirable surface properties can be translated to synthetic biomimetic surfaces, which, when mimicked, lead to a substantial increase in the antimicrobial properties of such surfaces. This paper reviews the recent advances in understanding the basis of these mechanical antimicrobial mechanisms, and discusses the progress being made towards the fabrication of optimised, biocompatible, synthetic analogues.