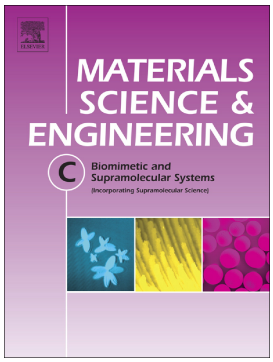

Copper-polyaniline nanocomposite: Role of physicochemical properties on the antimicrobial activity and genotoxicity evaluation

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Copper-polyaniline nanocomposite: Role of physicochemical properties on the antimicrobial activity and genotoxicity evaluation

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ABSTRACT

Copper nanoparticles (Cu NPs) have proven to own excellent antimicrobial efficacy, but the problems of easy oxidation and aggregation limit their practical application. Here, nanocomposite based on polyaniline (PANI) and Cu NPs solved this problem and brought additional physicochemical properties that are markedly advantageous for antimicrobial applications. Current work exploits this potential, to examine its time- and concentration-dependent antimicrobial activity, employing *E. coli*, *S. aureus*, and *C. albicans* as a model microbial species. Regarding the presence of polaronic charge carriers in the fibrous polyaniline network, effects of Cu NPs' size and their partially oxidized surfaces (the data were confirmed by HRTEM, FESEM, XRD, Raman and XPS analysis), as well as rapid copper ions release, Cu-PANI nanocomposite showed efficient bactericidal and fungicidal activities at the concentrations ≤ 1 ppm, within the incubation time of 2 hours. Beside the quantitative analysis, the high levels of cellular disruption for all tested microbes were evidenced by atomic force microscopy. Moreover, the minimum inhibitory and bactericidal concentrations of the Cu-PANI nanocomposite were lower than those reported for other nanocomposites. Using such low concentrations is recognized as a good way to avoid its toxicity toward the environment. For this purpose, Cu-PANI nanocomposite is tested for its genotoxicity and influence on the oxidative status of the human cells *in vitro*.

Keywords: copper nanoparticles, polyaniline, nanocomposite, antimicrobial activity, genotoxicity, oxidative status

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1. Introduction

As a result of rapid development of microbial resistance/adaptations to most current antimicrobial agents, there is an increasing need for designing new and efficient nanomaterials