Chapter

Plant-based Nanomaterials and their Antimicrobial Activity

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ABSTRACT

The emergence of microbial resistance to currently deployed antimicrobial agents has resulted considerable mortality and morbidity worldwide thus demanding the development of novel antimicrobial substances with diverse chemical structures and mechanisms of action. In this respect, plants that have been used by traditional healers to prevent or cure diseases caused by microorganisms could become useful as alternative sources for novel antimicrobials. The wide array of secondary metabolites such as phenolic compounds, alkaloids, terpenoids, etc. present in plants could elicit different pharmacological effects. Recent advances in nanotechnology have shown the potential to enhance the performance of these phytochemicals as antimicrobials. This chapter presents some of evidence for plant extracts/phytochemical-based nanomaterials being developed and evaluated for various applications in the field of microbiology. Fabrication of phytochemical-based antimicrobial nanofibers via electrospinning technique as wound dressing or other strategies to combat microbial infections will be discussed in detail. Furthermore, the encapsulation of phytochemicals with antimicrobial activity into various nanostructures like dendrimers, micelles, liposomes for the targeted delivery of the antimicrobial agents is also described using examples. The chapter proceeds to highlight the plant-mediated synthesis of metal nanoparticles and their antimicrobial potential, signifying the possibility of replacing conventional physico-chemical synthesis methods of metal nanoparticles that utilize expensive and often hazardous chemical agents. Although plant-based nanomaterials have displayed an imminent future in microbiology, the possible toxic effects and the safety concerns therein still need to be addressed. The chapter, therefore, provides a special emphasis on teratogenicity, cytotoxicity and carcinogenicity associated with the aforementioned nanomaterials.