

Chapter 16

Nano Approach: Indian Spices as Antimicrobial Agents

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ABSTRACT

The mortality rate for infectious diseases in India, in 2017, was 416.75 per 100,000 persons, which is two times more than the United States of America due to multi-drug resistant pathogens and many more social and ethical challenges. Nano formulates are an alternative, eco-friendly solution. Nano medicine development from different food material is one of the fastest growing research fields. The nano formulated phytochemicals of spices can solve the delivery issues and even shows antimicrobial properties against multi-drug-resistant microorganisms as well as through Indian daily food. In this chapter, the recent research approaches in antimicrobial activity of nano formulation of different Indian spices and active phytochemicals of spices are comprehensively discussed. The most common methods for antimicrobial determination and the minimum inhibitory concentration of modified materials are also enlisted. The size of any nano material usually is 1 to 100 nanometers. Different nano formulates of different spices show antimicrobial activity against different pathogens.

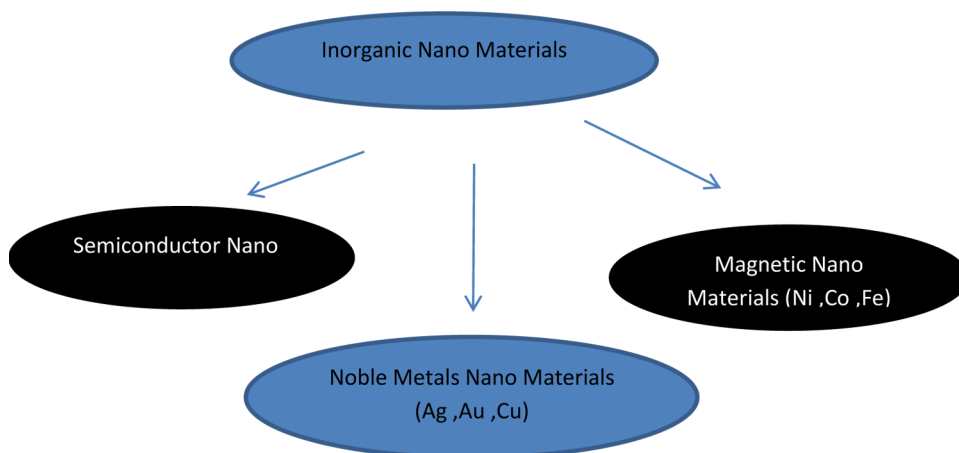
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INTRODUCTION

Many Asian countries use different types of spices in food as a test maker, preserver, coloring agent, and for specific flavor also, and India isn't exception among them. These spices have different medicinal properties like antimicrobial, anti-inflammatory, antioxidant, and anticancer properties. A researcher has made one combination of spices with nanotechnology where it is spreading in an interdisciplinary way in association with biology, chemistry, material science, physics, medicinal science, pharmacology and engineering fields. In this chapter, we will discuss nanoparticles, i.e., Nanoformulates of some Indian spices.

We will enlist only antimicrobial properties of Indian spices nanoformulations. In this chapter, we will focus on mainly metallic nanoparticles. Actually, these are inorganic nanomaterials, and it is of three types – semiconductor nanomaterial (TiO_2 , ZnO); noble metal nanomaterial (Ag , Au , Cu); magnetic nanomaterial (Ni , Co , Fe).

Figure 1.



For the formation of nanoparticles, there are different types of methods used in the laboratory like physical, chemical, and biological methods. Physical and chemical methods are more expensive and deal with hazardous chemicals while the biological or green synthesis of nanoparticles is economical and eco-friendly. It is very important that it is more favorable for large scale production.

Methodology of Nanoformulates Production

Nanoparticles, due to their unique size and shape, possess various physiochemical properties like optical, thermal, magnetic, electronic, catalytic and physical that have gained much attention towards their synthesis as well as their use in different fields such as electronics, biotechnology, chemical, antimicrobial activities, DNA labelling, drug delivery, cosmetics, coatings and packaging (Rezvani et al., 2012, Kohler et al., 2001). Generally, these nanoparticles are effective and possess limited side effects. In nanotechnology, a fast growing area of research, is the biosynthesis of nanoparticles. Due to their cap-

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