advantages, over conventional antibiotics. The first and most important advantage of NPs is that we can modify or change the surface properties of NPs by different molecules, such as proteins, peptides, and nucleic acids [28]. Second, NPs can be used as drugs carriers that may overcome the stability and solubility problem of the drug. A NP can be used to achieve codelivery of two or more drugs for combination therapy [29]. The third important property of NP-based antimicrobial drug delivery is an alternate approach, to overcome the existing antibiotic resistance mechanisms developed by microbes [30]. Thus, NPs are of great interest, as they offer a number of benefits, over available conventional antimicrobial agents.

3. MYCOSYNTHESIS OF VARIOUS NPs AND THEIR BIOMEDICAL APPLICATIONS

3.1. Silver Myconanoparticles Synthesis

Since ancient times, silver has been used in the health care; recently, silver NPs (AgNPs) have been found to possess antimicrobial activity and hence have replaced the conventional elemental silver. Several ways have been suggested for mycosynthesis of AgNPs. Fungi have the ability to produce both intracellular and extracellular products, and they have high cell wall-binding capacity and metal intake capacity [31]. Fungal cell surface traps the silver ions and later reduces the ions by enzymes, present within the cell wall. Anthraquinones and naphthoquinones are secreted extracellularly, to further facilitate reduction. Nitrate reductase, a nicotinamide adenine dinucleotide phosphate, dependence is believed to be responsible for NP formation [32]. Also, the release of proteins and other metabolites, such as organic acids and polysaccharides, seem to be responsible for AgNPs of spherical shape [33]. AgNPs synthesized by different fungal species and their wide application are been listed in Table 1.

3.2. Application of Myco-synthesized Silver NPs

AgNPs have been widely used as potential antimicrobial agents, as coatings in dressings, in medicinal devices, and in the form of nanogels [52]. Silver NPs (1–10 nm) depicting bactericidal property may be attributed to either the formation of pores within the cell wall, leading to leakage of cellular content or the denaturation of the ribosome by the silver ion and inhibition of the expression of enzymes, essential for the production of ATP and DNA resulting in cell death [53]. One of the most commonly used and well known application of AgNPs is in the biomedical sciences, for example, topical ointments and creams containing silver to prevent infection of burns and open wounds [54]. AgNPs have a potent antibacterial activity against both drug-susceptible and drug-resistant gram-positive and gram-negative bacteria and antifungal activity against fluconazole-resistant *C. albicans*, *A. niger*, *A. fumigatus*, *A. flavus*, *A. versicolor*, *Penicillium* sp., and *T. rubrum*. The AgNPs can penetrate inside the cell and disrupt the membranes and cell walls, inactivate proteins, nucleic acids, blocking respiration and electron transfer, and subsequently lead to cell

3.3. Gold Myconanoparticles (AuNPs)

Until now, less than 30 fungal species have been studied for AuNPs biosynthesis. Studies suggest that to overcome the stress in the environment, fungi have enzymatic machinery available, which has the ability to reduce gold ions to form protein metal NPs. The formation of AuNPs can take place by intracellular or extracellular process (Table 2). In an extracellular process, the gold ions are absorbed by the cell wall enzyme, by electrostatic interaction with positively charged groups [78]. Whereas as in intracellular process, cystolic redox mediators are responsible for the reduction of Au^{3+} ions that diffuse through the cell membrane, through active bioaccumulation or passive biosorption [79]. *P. chrysosporium* biomass, after interaction with the Au^{3+} ions, was reported to be due to the involvement of tyrosine and tryptophan in the reduction process of Au^{3+} ions [80]. The other possible method for mycosynthesis of gold NPs is the synthesis of phytochelatins by transpeptidation reaction of glucose, cysteine, and glycine, for example, *C. albicans* synthesizes phytochelatin in the presence of glutathione and Au^{3+} ions, leading to the reduction to AuNPsthat are later capped by glutathione [81] (Table 2).

3.4. Application of Myco-synthesized Gold NPs

Gold NPs, produced by fungi, have attracted a great attention in the fields of medical and biological applications, in the past several years. Gold NPs can strongly absorb light, by the process of the surface plasmon resonance, that can be efficiently converted to heat, making the AuNPs useful for photothermal therapy of other various diseases. Gold NPs are being used as effective probes for cancer imaging. Gold NPs display good signal intensity and stability and are used as contrast agents for the diagnosis of heart diseases, cancer, and infectious agents [82–84] (Table 2).