bacteria, fungi, algae, and viruses. These organisms possess bioreduction capabilities for metal ions, therefore making them ideal for NP synthesis [8, 9]. Among them, fungi are considered the most favorable for biofabrication purposes, being the most pertinent choice due to their high metal ion tolerance and metal ion accumulation, by various biological and physiochemical activities. When compared with other microbes, fungi have simple nutritional requirement, hence are easy to isolate and subculture by serial dilutions, plating, and hyphal extraction methods [10]. Fungi, being totipotent, possess the ability to expand their growth by hyphae or spores, for subculturing and to obtain pure isolate [11]. Unlike bacteria, the morphological and cultural characteristics of fungi in solid and liquid medium make it easy to check for the cross contaminants and therefore, making it easy to handle during the process [12]. Fungi can also be cultured easily, by solid substrate fermentation for obtaining the large amount of biomass [13]. Fungi being eukaryotic, nonphototrophic, and filamentous organisms consist of a rigid and dynamic cell wall with mechanical strength, withstanding changes in osmotic pressure, and environmental stress. This makes fungi to be able to endure the harsh parameters in the bioreactor vessel, such as high flow pressure, agitation, and other conditions [14]. The fungal cell wall causes the adherence between fungal walls and also acts as a signaling center to activate signal transduction pathways within the cell [15]. Fungi as biocatalysts are the wonderful choice for upscale production of NPs because of their capacity to secrete extracellular molecules and large amount of enzyme per unit of biomass, resulting in a higher intracellular metal uptake capacity. Additionally, the NPs accumulated outside the fungal biomass are lacking the cellular components in contrast to the bacterial fermentation process that requires several additional steps to achieve a clear filtrate of colloidal broth [16]. Fungi facilitate to devise the effective strategies for the synthesis of metal NPs of various sizes and chemical compositions, by secreting specific enzymes such as reductases for successful application in various biotechnological and biomedical applications [16].

2.2. The Probable Mechanism of Myconanoparticles Synthesis

The exact mechanism of biosynthesis of NPs by fungi is still being studied, as different organisms react differently, when treated with metal ions. Fungi produce both intra- and extracellular inorganic compounds, but the mechanism for synthesis for both processes differs among the organisms [12]. In the biosynthesis, special ion transportation of the microbe is involved, and the cell wall also plays an important role. There is an electrostatic interaction between the negative charge of the cell wall and the positive charge of the metal ions. The metal ions are reduced to NPs by the enzymes present in the cell wall and are subsequently diffused out through the cell wall. The mechanism of synthesis of NPs by *Verticillium* sp. involves trapping, bioreduction, and capping. When the metal ions come in contact with the fungal cell surface, electrostatic interaction takes place, which traps the ions; thereby, metal ions are reduced to metal NPs by the enzymes [17]. Extracellular synthesis of NPs mainly involves the bioreduction of metal ions by enzyme reductase, secreted by fungi [18]. Fungi are known to secrete huge amounts of extracellular proteins, with wide functions such as fungal secretome, which refers to all the proteins secreted into the extracellular space, that is found in high concentration has been used extensively for the industrial production of proteins [19]. However, the information of the fungal secretome is still at its early stage. These large and unexplored fungal secretome can play a vital role in gold (Au) reduction and gold NPs (AuNPs) capping [20]. The anthraquinones and naphthaquinones, which act as reducing agents on a specific metal, are also being produced by fungi, for example iron NPs (FeNPs) synthesis by the reduction of ferric ion is carried out by nitrate reductase [21]. The schematic representation for the synthesis of myconanoparticles is shown in Fig. 1.

2.3. Achieving Different Sizes of Myconanoparticles

It is a known fact that the size of a particle affects the properties of a material. Fungi are being widely used for the synthesis of NPs, to obtain desired size, shape, different chemical compositions, monodispersed with well-defined dimensions. Fungi have been reported as efficient synthesizers of clusters of atoms of a definite size [7]. The direct control of parameters such as substrate concentrations, pH, temperature, source compound, agitation, reaction time, and irradiation has been found to influence the synthesis of NPs [22]. The impact of pH and metal ion concentration, on the size and monodisperity of NPs produced by *Penicillium fellutanum*, was reported to play a crucial role, for example, the synthesis of silver NPs (AgNPs) by *P. fellutanum* was hindered by high silver ion concentration; thereby, the desired size and monodisperity were not achieved. This could be presumed that increasing the metal concentration allows the particle synthesis at a faster rate. But in higher metal concentration, the synthesized particles may get aggregated, forming bigger