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The antifungal activity of surface modified Mn doped ZnO nanoparticles

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A great amount of research has been done on the physicochemical properties of Mn doped ZnO (Mn-ZnO) nanoparticles such as ferromagnetism and photoluminescence. However less research has been conducted on its biochemical properties. This research focused on investigating one of its biochemical properties, namely antifungal activity, which is significant in the field of nanobiotechnology. Frescos are considered to be a world heritage and the frescos at Sigiriya, Dambulla and in other sacred places symbolize the pride of Sri Lankan culture. The fungi taken from the frescos of the Dambulla viharaya were chosen for the investigation. Although some methods have been identified as being able to destroy fungi, these methods cause also harm the paint of the frescos. This method could be considered as a safe method. Since it has been found that ZnO nanoparticles have antifungal activity, it was thought that an enhancement could be achieved via doping ZnO nanoparticles with Mn^{2+}. The nanoparticles were synthesized in the presence of surface passivating agent in order to control the particle size and Polyethylene glycol (PEG) was selected as the coating material as PEG is a biocompatible material which prevents the nonspecific absorption of nanoparticles to the cell membrane. The desired Mn-ZnO nanoparticles coated with PEG were synthesized by a modified version of an existing procedure which can be categorized as a method of co-precipitation. The presence of Mn^{2+} and Zn^{2+} was qualified and quantified by atomic absorption spectroscopy. The nanoparticles were characterized by FT-IR spectroscopy. The X ray diffraction data and scanning electron microscopic images were taken. Qualitative determination of antifungal activity of Mn-ZnO nanoparticles was carried out using the plate method. Further improvement of qualitative analysis and the quantitative determination were conducted by the flask method. The qualitative and quantitative determinations were done in the presence of potato dextrose agar as the negative control and silver nanoparticles as the positive control. Among the eleven genera of fungi, the Mn-ZnO nanoparticles coated with PEG exhibited fungicidal activity with four genera, and fungistatic activity for one genus. There was significant inhibition action with the other genera, and it is expected that increased concentration may result in complete inhibition of growth. The nanoparticle concentration which is required for hundred percent inhibition was determined on *Penicillium* sp.

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