ABSTRACT

Application of Metal Oxide nanoparticles synthesized via the green route has been a recent trend to achieve latent fingermark detection with superior ridge clarity. In the current study, Zinc Oxide nanoparticles were synthesized via an efficient, eco-friendly, and economical green route by using Leaf Extract of Lemon (*Citrus limon*) Plant. The phytochemicals found in the Lemon leaf extract served as a reducing agent to reduce Zinc Acetate Dihydrate into Zinc Oxide Nanoparticles. The nanoparticles were prepared through the heating method in which 1mM solution of Zinc Acetate Dihydrate was mixed with an equal amount of lemon leaf extract and heated for 100 minutes at 70°C on a Hot Plate. From the start of the heating process, a sample of nanoparticles was collected after every 20 minutes. Total 5 samples were collected labeled as 20 Min, 40 Min, 60 Min, 80 Min, and 100 Min. These samples were then analyzed by UV-Vis Spectroscopy to check the synthesis of Zinc Oxide Nanoparticles. Among these samples, the "60 Min" sample showed maximum absorption at 374 nm, which is compatible with the absorption peak of Zinc Oxide nanoparticles reported in the Literature. This sample was selected for further characterization and application. The Zinc Oxide nanoparticles were further characterized by the SEM-EDX technique, which showed the quasi-spherical shape of nanoparticles with a flower-like configuration. The EDX data showed that the elemental composition of Zinc Oxide Nanoparticles was 87.38%. Lemon leaf extract and Zinc Oxide Nanoparticles were analyzed by FTIR Spectroscopy to elucidate the functional groups in leaf extract and bonding among Zn and Oxygen atoms in the nanoparticles. The nanoparticles were further subjected to Latent Fingerprint Detection in both colloidal solution and powdered form. Four clean glass slides were taken and divided into two sets: Set "A" and Set "B." Fingerprints were deposited on all glass slides. One glass slide of Set "A" was treated with nanoparticles powder while the second one was dipped in a colloidal solution of nanoparticles for 24 hours. The same process was repeated for Set "B" glass slides. Set "A" Glass slides were visualized under UV Light, while Set "B" glass slides were visualized under white light. In both cases, glass slides treated with Zinc Oxide nanoparticle powder showed better contrast and fingerprint pattern. The present study revealed that the green synthesized ZnO nanoparticles have the potential to be used as a more economical and useful technique for Latent Fingerprint Detection and Enhancement.

Keywords: Latent Fingerprint Detection, Fingermark enhancements, Citrus limon, Zinc Oxide nanoparticles.