South African Journal of Botany
Volume 155, April 2023, Pages 127-139

Plant-mediated synthesis of sphalerite (ZnS) quantum dots, Th1-Th2 genes expression and their biomedical applications

Walid Theib Mohammad [a], Hajar Alijani [b], Pawan Faris [c d], Ehsan Salarkia [e], Mahin Naderifar [f], Majid Reza Akbarizadeh [f], Nooshin Hashemi [g], Siavash Iravani [h], Abduladheem Turki Jalil [i], Marwan Mahmood Saleh [j k], Amirhossein Fathi [l] ✉, Mehrdad Khatami [m]

Show more

+ Add to Mendeley Share Cite

https://doi.org/10.1016/j.sajb.2023.01.041 Get rights and content

Abstract

Zinc sulfide (ZnS) quantum dots (QDs) have been widely explored for various industrial and medical applications owning to their unique properties. In this study, ZnS QDs were eco-friendly synthesis using green tea extract (GteaE). The properties of the QDs were evaluated by X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), high-resolution transmission electron microscopy (HRTEM), transmission electron microscopy (TEM), thermogravimetric analysis (TGA), differential thermal analysis (DTA), energy dispersive X-ray spectroscopy (EDAX), X-ray photoelectron spectroscopy (XPS), and Fourier-transform infrared spectroscopy (FTIR). Then, the cytotoxicity and apoptosis of ZnS QDs was studied based on 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) assay against *Leishmania major* promastigotes and macrophages. At the used concentrations of ZnS QDs, cytotoxicity examination revealed no lethal effect as the selectivity index (SI) was within the safety range ($SI=CC_{50}/IC_{50} \geq 1$). The SI for GteaE was 10.52 and ZnS QDs was 6.61. ZnS QDs exhibited higher efficacy, better biocompatibility, and eco-friendly advantages compared to meglumine antimoniate (MA) leishmaniasis drug. The gene expression profiles of Th1 and Th2 genes studied. A significant upsurge of Th1 subsets and transcription genes and a meaningful decline in Th2 cytokines subclasses at the equivalent concentrations was observed ($P < 0.001$). The ZnS QDs treatment provide a valuable source of potential bioactive agents for antileishmanial drug development in patients with Cutaneous leishmaniasis (CL) in future clinical settings.