World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:18, No:02, 2024

Sustainable Nanoengineering of Copper Oxide: Harnessing Its Antimicrobial and Anticancer Capabilities

Authors : Yemane Tadesse Gebreslassie, Fisseha Guesh Gebremeskel

Abstract : Nanotechnology has made remarkable advancements in recent years, revolutionizing various scientific fields, industries, and research institutions through the utilization of metal and metal oxide nanoparticles. Among these nanoparticles, copper oxide nanoparticles (CuO NPs) have garnered significant attention due to their versatile properties and wide-range applications, particularly, as effective antimicrobial and anticancer agents. CuO NPs can be synthesized using different methods, including physical, chemical, and biological approaches. However, conventional chemical and physical approaches are expensive, resource-intensive, and involve the use of hazardous chemicals, which can pose risks to human health and the environment. In contrast, biological synthesis provides a sustainable and cost-effective alternative by eliminating chemical pollutants and allowing for the production of CuO NPs of tailored sizes and shapes. This comprehensive review focused on the green synthesis of CuO NPs using various biological resources, such as plants, microorganisms, and other biological derivatives. Current knowledge and recent trends in green synthesis methods for CuO NPs are discussed, with a specific emphasis on their biomedical applications, particularly in combating cancer and microbial infections. This review highlights the significant potential of CuO NPs in addressing these diseases. By capitalizing on the advantages of biological synthesis, such as environmental safety and the ability to customize nanoparticle characteristics, CuO NPs have emerged as promising therapeutic agents for a wide range of conditions. This review presents compelling findings, demonstrating the remarkable achievements of biologically synthesized CuO NPs as therapeutic agents. Their unique properties and mechanisms enable effective combating against cancer cells and various harmful microbial infections. CuO NPs exhibit potent anticancer activity through diverse mechanisms, including induction of apoptosis, inhibition of angiogenesis, and modulation of signaling pathways. Additionally, their antimicrobial activity manifests through various mechanisms, such as disrupting microbial membranes, generating reactive oxygen species, and interfering with microbial enzymes. This review offers valuable insights into the substantial potential of biologically synthesized CuO NPs as an alternative approach for future therapeutic interventions against cancer and microbial infections.

Keywords : copper oxide nanoparticles, green synthesis, nanotechnology, microbial infection
Conference Title : ICACAC 2024 : International Conference on Advances in Chemistry and Applied Chemistry
Conference Location : Sydney, Australia
Conference Dates : February 26-27, 2024