



Application of Box–Behnken design to optimize a sol-gel synthesis method for Ag and Zn doped CuO nanoparticles with antibacterial and photocatalytic activity

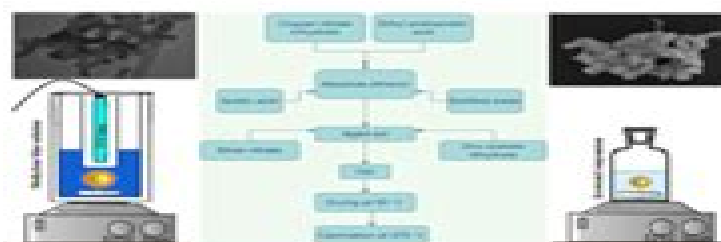
Shabnam Pourmoslemi¹ · Negar Bayati¹ · Reza Mahjub¹

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Abstract

Inorganic nanomaterials with antibacterial and photocatalytic properties have gained considerable attention according to potential for biomedical and environmental applications. The aim of the present study was to prepare silver and zinc doped copper oxide nanoparticles with maximum antibacterial and photocatalytic activity. Response surface methodology using Box–Behnken design was employed for optimizing a sol-gel method according to Ag and Zn content and calcination temperature of the nanomaterials. Time-kill profiles against *S. aureus* and *E. coli* and photocatalytic degradation of methylene blue under UV-C irradiation were determined for the fifteen synthesized materials; and copper oxide nanoparticles containing 2% w/w silver and zinc atoms and calcined at 375 °C were found as the optimum material. XRD, SEM-EDX and TEM analyses showed formation of monoclinic phase of copper oxide nanoparticles with approximate diameter of 50 nm. They showed fast and efficient antibacterial and photocatalytic activity, resulted from a synergistic effect between their inorganic constituents.

Graphical abstract



Keywords Antimicrobial · Copper oxide · Nanomaterial · Photocatalyst · Response surface methodology · Sol-gel

Highlights

- Sol-gel synthesis method was applied for synthesis of Ag and Zn-doped CuO nanoparticles.
- Sol-gel method was optimized according to ratio of precursors and calcination temperature.
- Ag–Zn-doped CuO NPs were characterized using XRD, SED-EDX, TEM and DRS.
- Obtained Ag–Zn-doped CuO NPs showed potent antibacterial and photocatalytic activity.

✉ Shabnam Pourmoslemi
sh.moslemi@umsha.ac.ir

¹ Department of Pharmaceutics, School of Pharmacy, Hamadan University of Medical Sciences, Hamadan, Iran

Application Of Box Behnken Design To Optimize The

**Basavarajaiah D. M.,Bhamidipati
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Table of Contents Application Of Box Behnken Design To Optimize The

1. Understanding the eBook Application Of Box Behnken Design To Optimize The
 - The Rise of Digital Reading Application Of Box Behnken Design To Optimize The
 - Advantages of eBooks Over Traditional Books
2. Identifying Application Of Box Behnken Design To Optimize The
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Application Of Box Behnken Design To Optimize The
 - User-Friendly Interface
4. Exploring eBook Recommendations from Application Of Box Behnken Design To Optimize The
 - Personalized Recommendations
 - Application Of Box Behnken Design To Optimize The User Reviews and Ratings
 - Application Of Box Behnken Design To Optimize The and Bestseller Lists
5. Accessing Application Of Box Behnken Design To Optimize The Free and Paid eBooks
 - Application Of Box Behnken Design To Optimize The Public Domain eBooks
 - Application Of Box Behnken Design To Optimize The eBook Subscription Services
 - Application Of Box Behnken Design To Optimize The Budget-Friendly Options

6. Navigating Application Of Box Behnken Design To Optimize The eBook Formats
 - ePub, PDF, MOBI, and More
 - Application Of Box Behnken Design To Optimize The Compatibility with Devices
 - Application Of Box Behnken Design To Optimize The Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Application Of Box Behnken Design To Optimize The
 - Highlighting and Note-Taking Application Of Box Behnken Design To Optimize The
 - Interactive Elements Application Of Box Behnken Design To Optimize The
8. Staying Engaged with Application Of Box Behnken Design To Optimize The
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Application Of Box Behnken Design To Optimize The
9. Balancing eBooks and Physical Books Application Of Box Behnken Design To Optimize The
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Application Of Box Behnken Design To Optimize The
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Application Of Box Behnken Design To Optimize The
 - Setting Reading Goals Application Of Box Behnken Design To Optimize The
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Application Of Box Behnken Design To Optimize The
 - Fact-Checking eBook Content of Application Of Box Behnken Design To Optimize The
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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