Investigating the Dual-Action Potential of (Z)-6-methoxy-2-(naphthalen-1-ylmethylene) Benzofuran-3(2H)-one (AU-23): A Novel Synthetic Aurone Derivative with Antibacterial and Anti-Inflammatory Activity

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Abstract

Aim/Background: Aurone is a well-known, naturally occurring, minor flavonoid with significant biological properties. However, their low abundance in nature limits their application in the medical field. In this study, we investigated the antimicrobial and anti-inflammatory properties of a novel synthetic aurone, (Z)-6-methoxy-2-(naphthalen-1-ylmethylene) benzofuran-3(2H)-one (AU-23). Materials and Methods: AU-23 was synthesized via multistep synthesis reactions involving the oxidative cyclization of 2'-hydroxychalcones. AU-23 was tested for antibacterial, minimum inhibitory concentration and antibiofilm activity against several ATCC strains using agar well diffusion, broth-micro dilution and XTT assay methods respectively. Results: At various concentrations, it selectively inhibited the growth of four strains (P. aeruginosa ATCC 9027, methicillin-resistant S. aureus (MRSA) ATCC 33591, methicillin-sensitive Staphylococcus aureus (MSSA) ATCC 25923 and methicillin-resistant S. aureus (MRSA) ATCC 43300). Moreover, it was observed that AU-23 had a bactericidal effect on sensitive strains of MSSA ATCC 25923 and P. aeruginosa ATCC 9027, as well as a bacteriostatic effect on MRSA ATCC 33591 and MRSA ATCC 43300. AU-23 also displayed effective antibiofilm activity against monomicrobial biofilms but not against polymicrobial biofilms. The findings of PCR study revealed that AU-23 downregulates the expression of pro-inflammatory cytokines and mediators (i.e., IL-6, IL-1β, iNOS and TNF-α), as well as crucial pattern recognition receptors (TLR4 and CD14) in LPS-stimulated RAW 264.7 cells. Molecular docking studies demonstrated that the ability of AU-23 to bind to the mouse TLR4/MD-2 complex was comparable to that of dexamethasone. Conclusion: the results of several studies conducted, suggests that AU-23 has the potential to function as an effective dual-action agent with antimicrobial and anti-inflammatory properties. © Author (s) 2025.

Author keywords

Anti-inflammatory activity; Antibiofilm activity; Antimicrobial activity; Aurone; Docking study

Indexed keywords

EMTREE drug terms

1 (2 hydroxy 4 methoxyphenyl) 3 (naphthalen 1 yl) prop 2 en 1 one; 6 methoxy 2 (naphthalen 1 ylmethylene) benzofuran 3(2H) one; dexamethasone; flavanoid; gentamicin; interleukin 1beta; interleukin 6; lipopolysaccharide; nitric oxide; toll like receptor 4; tumor necrosis factor; unclassified drug; vancomycin

EMTREE medical terms

action potential; agar diffusion; antibacterial activity; antibiofilm activity; antiinflammatory activity; antimicrobial activity; apoptosis; Article; bacterial growth; bacterial strain; bactericidal activity; carbon nuclear magnetic resonance; cell culture; cell viability; chemical structure; chromatography; colony forming unit; cyclization; cytotoxicity; electrospray mass spectrometry; enzyme linked immunosorbent assay; Escherichia coli; field study; flow cytometry; hydrogen bond; IC50; MCF-7 cell line; methicillin resistant Staphylococcus aureus; minimum bactericidal concentration; minimum inhibitory concentration; molecular docking; nuclear magnetic resonance; proton nuclear magnetic resonance; Pseudomonas aeruginosa; RAW 264.7 cell line; real time polymerase chain reaction; reverse transcription polymerase chain reaction; RNA extraction; Staphylococcus aureus; XTT assay

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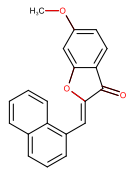
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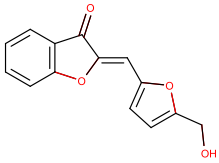
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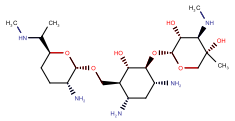
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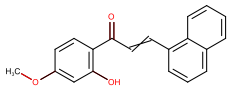
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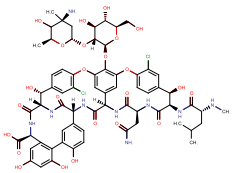
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