

[Back](#)

Exploring the efficacy of antimicrobial photodynamic therapy (aPDT) with magnetic fields (MFs) stimulation in treating methicillin-resistant *Staphylococcus aureus* (MRSA) infected wounds in rats using 532 and 660 nm laser

[Lasers in Medical Science](#) • Article • Open Access • 2026 • DOI: 10.1007/s10103-026-05065-2

[Suardi, Nursakinah](#)^a ; [Aldalawi, Ali A.](#)^{a, b} ; [Al-Farawn, Mahdi A. S.](#)^c ; [Mohd Bakhori, Siti Khadijah](#)^a ; [Mahmoud Ahmed, Naser](#)^{a, d} ; [+3 authors](#)

^aSchool of Physics, Universiti Sains Malaysia, Gelugor, Malaysia

[Show all information](#)

0

Citations

[Full text](#) [Export](#) [Save to list](#)

[View PDF](#)

[Document](#)

[Impact](#)

[Cited by \(0\)](#)

[References \(32\)](#)

[Similar documents](#)

Abstract

MRSA causes severe wound infections associated with tissue damage and increased apoptosis. This study evaluated the therapeutic efficacy of combining antimicrobial photodynamic therapy (aPDT) with external magnetic field (MF) stimulation in a MRSA infected rat wound model. One hundred male Wistar rats were allocated into five groups for two irradiation wavelengths, 532 nm and 660 nm: control (non-infected and MRSA infected untreated), laser alone, aPDT, laser combined with MF, and aPDT combined with MF. The aPDT protocol involved the topical application of a spinach-derived natural photosensitizer followed by laser irradiation, while a continuous external MF was applied locally over the wound site. Both wavelengths produced progressive reductions in bacterial load, with the magnitude of reduction depending on treatment and day. The aPDT-based treatments produced greater bacterial suppression than laser-only treatments, with aPDT + MF producing the lowest residual bacterial load at both wavelengths. At 532 nm, aPDT + MF produced a significantly lower bacterial load than aPDT alone on Day 4 (estimated mean difference = $-0.36 \log_{10}$ CFU/mL; adjusted $p < 0.001$).

Histological analysis demonstrated reduced inflammatory cell infiltration and enhanced tissue regeneration in the combined group. These findings indicate that external MF stimulation enhances the antibacterial and tissue repair effects of aPDT in MRSA infected wounds. © The Author(s) 2026.

Author keywords

Antimicrobial photodynamic therapy (aPDT); External magnetic fields stimulation; Infected wounds; Methicillin-resistant Staphylococcus aureus (MRSA); Rat model; Wound healing

Corresponding authors

Corresponding author	N. Suardi
----------------------	-----------

Affiliation	School of Physics, Universiti Sains Malaysia, Gelugor, Malaysia
-------------	---

Email address	nsakinahsuardi@usm.my
---------------	-----------------------

Corresponding author	A.A. Aldalawi
----------------------	---------------

Affiliation	School of Physics, Universiti Sains Malaysia, Gelugor, Malaysia
-------------	---

Email address	alialdalawi87@gmail.com
---------------	-------------------------

[View PDF](#)

© Copyright 2026 Elsevier B.V., All rights reserved.

- Abstract
- Author keywords
- Corresponding authors

About Scopus

- [What is Scopus](#)
- [Content coverage](#)
- [Scopus blog](#)
- [Scopus API](#)
- [Privacy matters](#)

Language

[日本語版を表示する](#)

[查看简体中文版本](#)

[查看繁體中文版本](#)

[Просмотр версии на русском языке](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions ↗](#) [Privacy policy ↗](#) [Cookies settings](#)

All content on this site: Copyright © 2026 [Elsevier B.V. ↗](#), its licensors, and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the relevant licensing terms apply.



[View PDF](#)