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Comparison of the efficacy of the photoinactivation of *Escherichia coli* using different lamps.

Vanesa Pérez Laguna[1]; Luna Pérez-Artiaga[2]; Verónica Lampaya[2]; Yolanda Gilaberte[3,4]; María José Revillo[2]; Antonio Rezusta[2,4].

(1) University of Zaragoza; Department of Biochemistry and Molecular Biology, Zaragoza, Spain. (2) Miguel Servet University Hospital; Department of Microbiology, Zaragoza, Spain. (3) San Jorge Hospital; Department of Dermatology, Huesca, Spain. (4) IIS Aragon; Department of Microbiology, Zaragoza, Spain

Background:

Nowadays, antibiotic resistance is increased and the development of new alternative to treat infections is required. Antimicrobial photodynamic therapy (aPDT) is a new treatment strategies based on the application of a photosensitizer (PS) activated by visible light to generate reactive oxygen species that are cytotoxic to the target cells. APDT could be an alternative treatment for infections. *E. coli* is commonly involved in skin and mucosal infections, where aPDT can be easily performed. Methylene Blue (MB) is a very active PS (maximal absorption wavelength (λ) at 665 nm) for aPDT.

The aim of this study is to compare the efficacy of aPDT-MB to photoinactivate *E. coli* using three lamps, one corresponding to its peak of λ absorption and the other two covering the entire ABSORPTION spectrum.

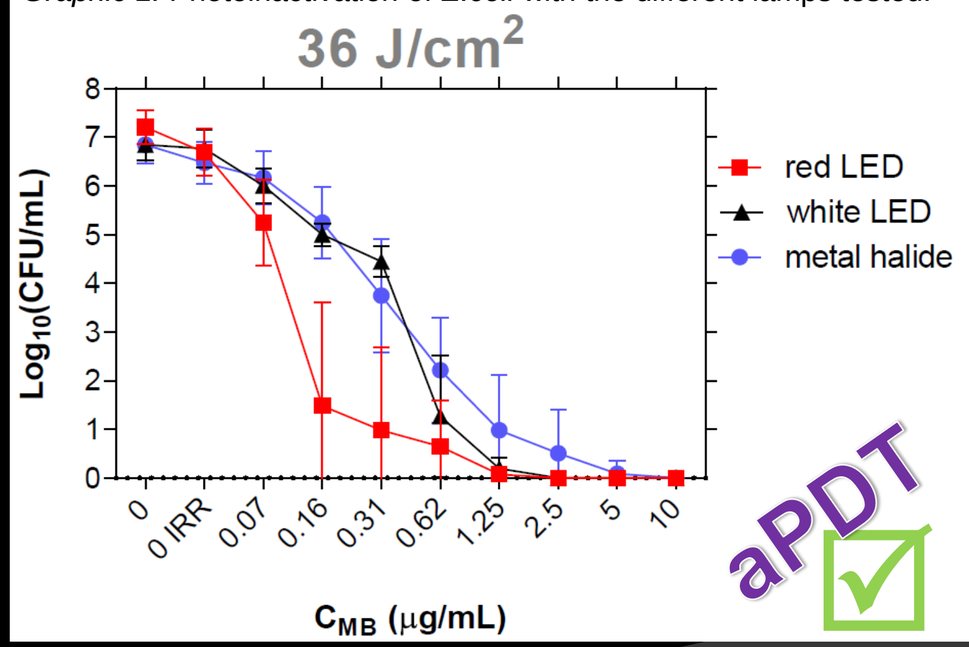
Material/methods:

E. coli ATCC 25922 suspensions containing >10^7 cells/mL were prepared. Different concentrations two-fold serial dilution of MB (from 0.16 µg/mL to 160 µg/mL) were added. Irradiation was performed using a fluence of 36 J/cm^2 with different lamps: red-light-emitting diode (LED) lamp (625 nm, an irradiance of 0.007 W/cm^2), white-LED lamp (460-515-625 nm, 0.024 W/cm^2) and white metal-halide lamp (broad-band 420 to 700 nm, 90 mW/cm^2). Afterwards, microbial suspensions were subcultured onto blood agar to determine the viable bacteria by colony-forming units counting (CFU/mL). Appropriate control experiments were carried out. A criterion of 6 $\log_{10}$ unit decrease from the starting inoculum was adopted to define bactericidal activity.

Results:

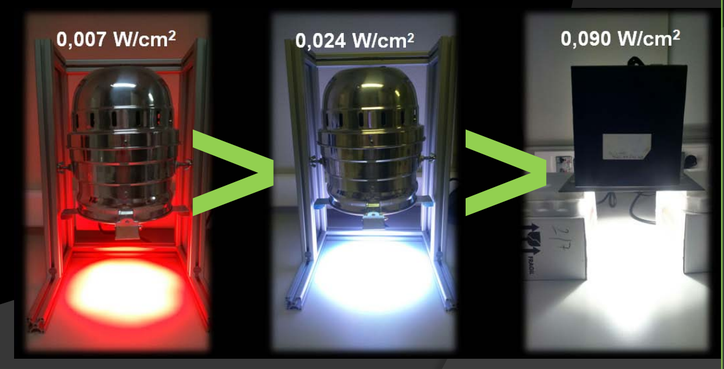
APDT with MB reached a reduction of 6 $\log_{10}$ in the number of CFU/mL using concentrations of MB between 0.6-1.25 µg/mL with red-LED light, whereas 1.25-2.5 µg/mL were needed with white-LED light, and 2.5-5 µg/mL with metal-halide administering 36 J/cm^2 with all of them (Graphic 1).

Graphic 1: Photoinactivation of *E.coli* with the different lamps tested.



Conclusions:

In vitro PDT-MB has a significant bactericidal effect on E. coli with any of the tested lamps although red light is more efficient than white light (red-LED aPDT-MB > white-LED aPDT-MB > white metal-halide aPDT-MB).



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