Three references showing *Listeria Monocytogenses* is effectively inactivated by blue light

1. Roh Heyong Jinand Kim, A. and K. G. S. and K. D.-H. (2016)
'Photoinactivation of major bacterial pathogens in aquaculture',
Fisheries and Aquatic Sciences, 19(1), p. 28.
doi: 10.1186/s41240-016-0029-5.

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Abstract

Significant increases in the bacterial resistance to various antibiotics have been found in fish farms. Non-antibiotic therapies for infectious diseases in aquaculture are needed. In recent years, light-emitting diode technology has been applied to the inactivation of pathogens, especially those affecting humans. The purpose of this study was to assess the effect of blue light (wavelengths 405 and 465 nm) on seven major bacterial pathogens that affect fish and shellfish important in aquaculture.

Results

We successfully demonstrate inactivation activity of a 405/465-nm LED on selected bacterial pathogens. Although some bacteria were not fully inactivated by the 465-nm light, the 405-nm light had a bactericidal effect against all seven pathogens, indicating that blue light can be effective without the addition of a photosensitizer. *Photobacterium damselae*, *Vibrio anguillarum*, and *Edwardsiella tarda* were the most susceptible to the 405-nm light (36.1, 41.2, and 68.4 J cm^{-2}, respectively, produced one log reduction in the bacterial populations), whereas *Streptococcus parauberis* was the least susceptible (153.8 J cm^{-2} per one log reduction). In general, optical density (OD) values indicated that higher bacterial densities were associated with lower inactivating efficacy, with the exception of *P. damselae* and *Vibrio harveyi*. In conclusion, growth of the bacterial fish and shellfish pathogens evaluated in this study was inactivated by exposure to either the 405- or 465-nm light. In addition, inactivation was dependent on exposure time.

Conclusions

This study presents that blue LED has potentially alternative therapy for treating fish and shellfish bacterial pathogens. It has great advantages in aspect of eco-friendly treating methods differed from antimicrobial methods.

2. Murdoch, L. E. *et al.* (2012)
'Bactericidal Effects of 405 nm Light Exposure Demonstrated by Inactivation of Escherichia, Salmonella, Shigella, Listeria, and Mycobacterium Species in Liquid Suspensions and on Exposed Surfaces', *The Scientific World Journal*, 8.
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Abstract

The bactericidal effect of 405 nm light was investigated on taxonomically diverse bacterial pathogens from the genera *Salmonella, Shigella, Escherichia, Listeria*, and *Mycobacterium*. High-intensity 405 nm light, generated from an array of 405-nm light-emitting diodes (LEDs), was used to inactivate bacteria in liquid suspension and on exposed surfaces. *L. monocytogenes* was most readily inactivated in suspension, whereas *S. enterica* was most resistant. In surface exposure tests, *L. monocytogenes* was more susceptible than Gram-negative enteric bacteria to 405 nm light when exposed on an agar surface but interestingly less susceptible than *S. enterica* after drying onto PVC and acrylic surfaces. The study findings, that 405 nm light inactivates diverse types of bacteria in liquids and on surfaces, in addition to the safety advantages of this visible (non-UV wavelength) light, indicate the potential of this technology for a range of decontamination applications.

3. O'Donoghue, B. *et al.* (2016)
'Blue-Light Inhibition of Listeria monocytogenes Growth Is Mediated by Reactive Oxygen Species and Is Influenced by σB and the Blue-Light Sensor Lmo0799.', *Applied and environmental microbiology*. American Society for Microbiology (ASM), 82(13), p. 4017–4027. doi: 10.1128/AEM.00685-16.
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Abstract

Listeria monocytogenes senses blue light via the flavin mononucleotide-containing sensory protein Lmo0799, leading to activation of the general stress response sigma factor SigB (σ(B)). In this study, we investigated the physiological response of this foodborne pathogen to blue light. We show that blue light (460 to 470 nm) doses of 1.5 to 2 mW cm(-2) cause inhibition of growth on agar-based and liquid culture media. The inhibitory effects are dependent on cell density, with reduced effects evident when high cell numbers are present. The addition of 20 mM dimethylthiourea, a scavenger of reactive oxygen species, or catalase to the medium reverses the inhibitory effects of blue light, suggesting that growth inhibition is mediated by the formation of reactive oxygen species. A mutant strain lacking σ(B) (ΔsigB) was found to be less inhibited by blue light than the wild type, likely indicating the energetic cost of deploying the general stress response. When a lethal dose of light (8 mW cm(-2)) was applied to cells, the ΔsigB mutant displayed a marked increase in sensitivity to light compared to the wild type. To investigate the role of the blue-light sensor Lmo0799, mutants were constructed that either had a deletion of the gene (Δlmo0799) or alteration in a conserved cysteine residue at position 56, which is predicted to play a pivotal role in the photocycle of the protein (lmo0799 C56A). Both mutants displayed phenotypes similar to the ΔsigB mutant in the presence of blue light, providing genetic evidence that residue 56 is critical for light sensing in L. Monocytogenes. Taken together, these results demonstrate that L. monocytogenes is inhibited by blue light in a manner that depends on reactive oxygen species, and they demonstrate clear light-dependent phenotypes associated with σ(B) and the blue-light sensor Lmo0799.