

# Photodynamic inactivation of microorganisms

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A new approach to disinfection solar of water and sewage, by oxidative destruction of microorganisms by photosensitization has been developing as an alternative processes to eliminate pathogenic agents in water. The Solar disinfection processes are of particular interest to water treatment in sunny region like Brazil.

Sensitized photooxidation, also referred to as photosensitization or photodynamic action, is an indirect photochemical reaction very similar to photocatalytic oxidation. This process may offer an advantage over the photocatalytic process because the sensitizers can absorb light in the visible spectrum, allowing the use of a greater percentage of available sunlight. Photosensitization employs the visible light (or even sunlight) as energy source to activate a photocatalyst or photosensitizer that generates, in the presense of molecular oxygen dissolved in water reactive oxygen species such a OH<sup>\*</sup> radical and singlet oxygen (<sup>1</sup>O<sub>2</sub>) which are toxic to microorganisms [1-3].

A dye-sensitizer (methylene blue, MB) which absorbs in the visible range ( $\lambda_{max}$  = 665 nm) is an effective photosensitizing agent for the inactivation of several types of microorganisms. In our studies, commercial samples of methylene blue, gentian violet and toluidine blue which absorbs in the visible range was added to water to promote a photochemically sensitized disinfection process. In the experiments with bacterial suspensions of 10<sup>5</sup> CFU mL<sup>-1</sup> the samples were exposed to white, yellow and red artificial fluorescent light (3, 5 and 10 Klux) for 300 minutes [4].

The results show that Irradiation with visible light and suitable power density in the presence of MB or toluidine blue produces the complete inactivation of bacteria in 4 hours even to low light intensity and 100 ppb (Figure 1). Gentian violet request more power density to obtain the same inactivation.

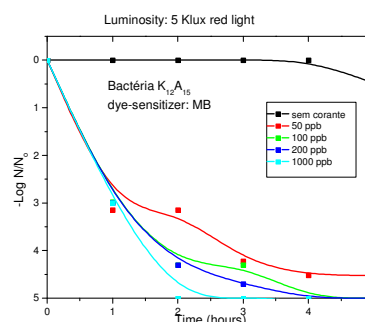


Figure 1 - Sensitized photooxidation with MB

These results make photodynamic techniques quite promising for the disinfection of microbiologically contaminated water. The complete inactivation of microorganisms with low light intensity means that this technology can be used even during cloudy days and during winter. The procedure seems to be of low cost and to have a low environmental impact.

## References

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