

Eradication of Gram-Positive Bacteria by Photosensitizers Immobilized in Polymers

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Abstract : Photosensitizers are dye compounds belonging to various chemical groups that in all the cases have a developed structure of conjugated double bonds. Under illumination with visible light, the photosensitizers are excited and transfer the absorbed energy to the oxygen dissolved in an aqueous phase, leading to production of a reactive oxygen species which cause irreversible damage to bacterial cells. When immobilized onto a solid phase, photosensitizers preserve their antibacterial properties. In the present study, photosensitizers were immobilized in polyethylene or propylene and tested for antimicrobial activity against Gram-positive *S. aureus*, *S. epidermidis* and *Streptococcus* sp. For this purpose, water-soluble photosensitizers, Rose Bengal sodium salt, and methylene blue as well as water-insoluble hematoporphyrin and Rose Bengal lactone, were immobilized by dissolution in melted polymers to yield 3 mm diameter rods and 3-5 mm beads. All four photosensitizers were found to be effective in the eradication of Gram-positive bacteria under illumination by a white luminescent lamp or sunlight. The immobilized photosensitizers can be applied for continuous water disinfection; they can be easily removed at the end of the treatment and reused.

Keywords : antimicrobial polymers, gram-positive bacteria, immobilization of photosensitizers, photodynamic antibacterial activity

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