

STUDY OF NEW CATIONIC METALLOPORPHYRINS AND TESTING ON ANTIBIOTIC RESISTANT MICROORGANISMS FOR THEIR INACTIVATION

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Abstract

Currently the antibiotic resistance of microorganisms is a major problem for medicine and the solving of this problem is the very important objective. Photodynamic inactivation of microorganisms by photosensitizers is one of the most promising directions for the destruction of microorganisms. Photosensitizers (mainly porphyrins) as dyes in aqueous media under the light action contribute to the generation of reactive oxygen species, which effectively inhibit the growth of microorganisms and destroy them. Previously we have already synthesized and studied a large set of new cationic porphyrins and metalloporphyrins, studied their photophysical characteristics and identified the most promising for use in biomedical applications. Generation of singlet oxygen is the determining criterion for the effective functioning of the porphyrins. It was found that the highest values of quantum yield of singlet oxygen (97%) have Zn-containing metalloporphyrins. Two strains of Gram (+) microorganisms: *St. aureus* 209 P and methicillin-resistant *St. aureus* as well as Gram (-) microorganism *E.coli* were tested in this work. We have studied the effectiveness of four types of porphyrins: meso-tetra [4-N-(2'-oxyethyl) pyridyl]porphyrin (TOEt4PyP)-(I); Zn-TOE4PyP-(II); Zn-meso-tetra [4-N-butyl pyridyl]porphyrin (Zn-TBut4PyP)-(III) and Zn-TBut3PyP-(IV). It was found that against both strains of *St. aureus* the highest activity has metalloporphyrin (IV) when the concentration of metalloporphyrins was 0.01 g/ml, which correlates with the received values of the quantum yields of singlet oxygen (97% for compounds III and IV). Destruction efficiency of microorganism *St. aureus* 209P by compound (IV) in comparison with compound (I) was higher more than 8 times that would be expected according to the values of quantum yield of singlet oxygen generation (for the compound (I) is 77%). Considering that the compounds (III) and (IV) are practically non-toxic, these compounds can be recommended for studies in vivo, with the aim of further clinical application. So our experiments show that small doses of cationic porphyrins (Zn-metalloporphyrins) have high efficiency against both Gram (+) and Gram (-) microorganisms after 30 min of irradiation.

Keywords: Photodynamic inactivation of microorganisms, cationic porphyrins, quantum yield of singlet oxygen, metalloporphyrins, *St. aureus*, *E.coli*

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