Proton Magic Angle Spinning NMR Reveals New Features in Photodynamically Treated Bacteria

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Z. Naturforsch. **58 c**, 401–407 (2003); received October 25, 2002/January 9, 2003

The bacterium *Propionibacterium acnes* is light-sensitive due to porphyrin-induced photosensitization. The light sensitivity increases with incubation of 5-aminolevulinic acid, ALA. For the first time, ^{1}H magic angle spinning NMR spectroscopy is used to describe the photo-induced changes in the bacterium after ALA incubation. Successful photosensitization was performed with light-emitting diodes in the blue and red regions (430 and 654 nm, respectively). The irradiation setup, suitable for irradiation of bacaterium suspensions in petri dishes is described. For NMR studies blue light diodes with about 90 μmol/m^{2}s were chosen. After blue light irradiation, the endogenous glycine betaine, proline, glutamate and choline levels in *P. acnes* decreased with increasing irradiation time. For sublethal light doses (50% survival fraction), the endogenous glycine betaine level decreased 80% on average. The corresponding percentages for proline, choline and glutamate were about 40, 25 and 10, respectively. It is hypothesized that the irradiation, inducing porphyrin photosensitization amplified by ALA incubation, leads to elimination of the osmolyte glycine betaine and possibly also proline by so-called regulatory volume decrease (RVD) mechanisms. These mechanisms are known to be active in several prokaryotic and eukaryotic cells when exposed to hypotonic stress. They are also known to be present in several eukaryotic cells during photodynamic therapy (PDT) exposure leading to hypotonoc stress. The findings contribute to the knowledge of the inactivation mechanisms of *P. acnes* in photosensitization, and could therefore be of interest in the efforts to use PDT as treatment of the acne disease.

Key words: Light Emitting Diodes, 5-Aminolevulinic Acid, *Propionibacterium acnes*