Photodynamic inactivation of bioluminescent *Escherichia coli* by cationic pyrrolidine-fused chlorins and isobacteriochlorins

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**Introduction**

Photodynamic inactivation (PDI) represents a potential alternative methodology to inactivate microbial cells. This approach is based on the photodynamic therapy concept that comprises the action of three components: a photosensitizer (PS), a light source and oxygen (1). Porphyrins, chlorins and isobacteriochlorins can be used as PSs. In this communication we will report the results obtained in the PDI of bioluminescent *E. coli*, Gram (-) bacteria, in the presence of cationic pyrrolidine fused chlorins and isobacteriochlorins obtained from 5,10,15,20-tetrakis(pentafluorophenyl)porphyrin by 1,3-dipolar cycloadditions and after their immobilization on solid supports.

**Results & Discussion**

![Figure 1. Structures of cationic chlorin 1 and isobacteriochlorin 2 derivatives used in this study.](image)

The fluorescence and singlet oxygen quantum yields of 1 and 2 obtained in dimethylformamide (DMF) are listed in Table 1.

<table>
<thead>
<tr>
<th>Compound</th>
<th>(\lambda_{\text{max}}/\text{nm})</th>
<th>Fluorescence quantum yield ((\Phi_f)) (\pm0.05)</th>
<th>(\text{O}<em>2) quantum yield ((\Phi</em>{\text{O}_2})) (\pm0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>402 (5.23), 500 (4.19), 525 (3.64), 594 (3.69), 647 (4.64)</td>
<td>0.13</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>408 (5.08), 503 (3.88), 546 (3.97), 599 (4.19), 650 (3.65)</td>
<td>0.08</td>
<td>0.62</td>
</tr>
</tbody>
</table>

The photodynamic inactivation potential of compounds 1 and 2 and also of 1 on a solid support was investigated using the recombinant bioluminescent *E. coli*.

In this study the cationic isobacteriochlorin 2 was an effective PS against the bioluminescent *E. coli*, reaching the limit of detection (~6.1 log reduction) after a light dose of 36 J cm\(^{-2}\) for the highest concentration tested (20 \(\mu\)M). Photodynamic inactivation of *E. coli* was reached when derivative 1 was immobilized on a solid support.

**Conclusions**

The results obtained in this work confirm the high potential of these compounds to be used for photodynamic inactivation of Gram (-) bacteria.

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