Porphyrin-like Carbon Polymer Dots From Glycine With Multitarget Photodynamic Activity

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Porphyrins are well-known photosensitizers with several applications in oncological and antimicrobial photodynamic treatments thanks to the oxidative potential of singlet oxygen ($^1O_2$). However, their clinical advancement is still hindered by the poor solubility in water and complex multi-step synthetic procedures.[1]
Our study[2], revisiting a typical abiotic route for oligopeptide synthesis[3], unveils for the first time glycine as an effective and single precursor for the genesis of porphyrin derivatives with a straightforward one-pot thermal procedure.
Structural, dimensional, morphological and optical characterizations highlight the generation and self-assembly of these species within a carbonized polymeric matrix in the form of water-soluble and dual blue/red emitting porphyrin-like Carbon Polymer Dots (CPDs).
The nanosystems exhibit efficient $^1O_2$ generation under visible light exposure during Indocyanine Green photodegradation tests and elevated biocompatibility in Vero E6 cell line. Notably, the porphyrin-like dots also display significant photoinduced virucidal activity against *Vaccinia virus*, reaching a 92% of virions inactivation. In addition, nanosystems obtained after refinement of the synthetic protocol were evaluated in antibacterial and oncological models, showing photodynamic inactivation of *Escherichia coli* under blue-light irradiation and of murine 4T1 breast carcinoma cells upon red-light exposure.
These findings propose the produced porphyrin-like dots as promising theranostic tools for further biomedical investigations, combining potential diagnostic and therapeutics functions for antimicrobial or oncological photodynamic therapy.

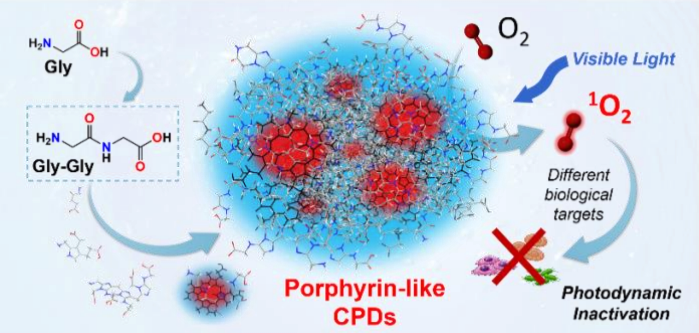

Figure 1 – Schematic representation of the genesis and application of the porphyrin-like CPDs.

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