

SYNTHESIS AND CHEMICAL, STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF HYDROSOLUBLE MONO- OR MULTI-PORPHYRIN DERIVATIVES AND OF BIODEGRADABLE POLYMERIC MATERIALS OF MICROBIAL ORIGIN

Emilio Scamporrino (Full professor)

e-mail escamporrino@unict.it

Alberto Ballistreri (Full professor)*

Placido Mineo (Assistant professor)

* Faculty of Pharmacy

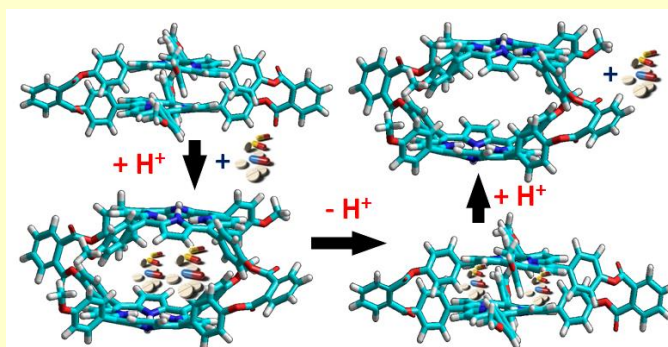


Fig.1 Changing of cavity size of a Water soluble Cyclic-Porphyrin as a consequence of the pH variation.

Our search is devoted to synthesize new alternative water-soluble porphyrin compounds devoid of electric charges and able to interact with molecular systems of biological interest for treatment of neoplastic diseases, diagnostic for image and the qualitative and quantitative determination of important biological analytes (1). Our search is also devoted to structural characterization of biodegradable and biocompatible polymeric materials, obtained by bacterial fermentation and chemical synthesis, able to be utilized in environmental, medical-surgical and pharmaceutical field (2).

Keywords: Water-soluble porphyrins; Molecular-Sensors; MALDI-TOF MS; Biopolyesters;

1. Porphyrin Derivatives

There is an increasing interest in the use of porphyrin compounds as "smart molecules" in the pharmacological treatment of neoplastic diseases, diagnostic for image and the qualitative and quantitative determination of important biological analytes. In some applications, the necessary hydro-solubility of these systems has been overcome by the introduction of electrically charged units in peripheral positions of the porphyrin ring. However, this expedient does not guarantee the permanence of the molecules in solution and, furthermore, the electric charges make the porphyrin compound unable to cross the cell wall.

The objective of our work is the synthesis of new alternative water-soluble porphyrin compounds devoid of electric charges and able to interact with molecular systems of biological interest. In particular, the activity is devoted to the synthesis and structural characterization of new water-soluble mono- and multi-porphyrins with linear polyethylenglicolic segments linked in peripheral

porphyrin ring structures. Some of our synthesized compounds, containing one or two porphyrin units, are resulted active in the molecular recognition of amino acids and study on more complex structures of biological interest (such as polypeptides and proteins) are in an advanced state of research. In particular, new multi-porphyrin derivatives, able to form complexes with bio-compounds and/or drugs and to allow their transport, with a three dimensional form (systems commonly called "molecular boxes") or with a planar extension ("molecular disks" systems), have been synthesized. The goal of this research can be summarized in an attempt to prepare "smart" molecules able to fulfil new and specific functions of recognition and/or transport of biomolecules. The structural characterization of the synthesized samples is performed by means of chromatographic techniques, MALDI-TOF mass spectrometry, ¹H-NMR, ¹³C-NMR, FT-IR, etc.. Molecular and functional properties of the more suitable molecules (and those of the corresponding host/guest systems) is also studied by means of spectropolarimetry (circular dichroism) and UV-visible spectroscopy.

2. Biodegradable and biocompatible polyesters

Poly(3-hydroxybutyrate-co- ϵ -caprolactone) copolymers have been obtained from the corresponding homopolymers (PHB and PCL) and poly(3-hydroxybutyrate-co-3-hydroxyvalerate-co- ϵ -caprolactone) terpolymers from the P(HB-co-HV) copolymer and PCL by using an acid catalized transesterification reaction. By a solvent deposition technique most samples gave micro- and nanoparticles potentially useful in the drug-delivery. Recently, some other biodegradable polyesters have been obtained by microbial fermentation from *Brassica carinata* oil and from very long chain fatty acids.

Collaborations

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- CNR Istituto per la Chimica e Tecnologia dei Polimeri, Catania
- CNR- Istituto per i Processi Chimico-Fisici, Messina
- Dipartimento di Scienze Microbiologiche, Università di Messina

Selected Publications

- 1) DATTILO S., MINEO P., SCAMPORRINO E., SPINA E., VITALINI D. (2010). Synthesis and Characterization of New Copolyacrylates Containing Porphyrin Units as Pendant Groups and Their Use as Sensors. JOURNAL OF POLYMER SCIENCE. PART A, POLYMER CHEMISTRY, vol. 47; in press.
- 2) SCAMPORRINO E., MINEO P., SCAMPORRINO A., DATTILO S., VITALINI D., ALICATA R. (2009). Polyethersulfone-Epoxy Terminated Materials as Thermosetting Resins for Microelectronic Devices. JOURNAL OF POLYMER SCIENCE. PART A, POLYMER CHEMISTRY, vol. 47; p. 5682-5689, ISSN: 0887-624X
- 3) D. VITALINI, E. SPINA, S. DATTILO, P. MINEO, SCAMPORRINO E. (2008). Synthesis, Characterization and Nucleotidic Chain Cleavage Ability of Uncharged Water- Soluble Poly(ethylene glycol)-Fullerene Derivatives with an Amphiphilic Character. JOURNAL OF POLYMER SCIENCE. PART A, POLYMER CHEMISTRY, vol. 46; p. 2145-2153, ISSN: 0887-624X
- 4) RICCO L, CASAZZA E, MINEO P, RUSSO S, SCAMPORRINO E. (2008). "Nature of a Low Molar Mass Peak in Anionic Poly(ϵ -caprolactam). Main Aspects of its Formation". MACROMOLECULES, vol. 41; p. 3904-3911, ISSN: 0024-9297
- 5) A. GULINO, I. FRAGAL, SCAMPORRINO E., D. VITALINI (2007). Similarities and Differences among Monolayers of a Free Base Porphyrin and Its Copper Complex: Synthesis and Characterization of a Luminescent Copper(II) Porphyrin Monolayer. JOURNAL OF PHYSICAL CHEMISTRY. C, NANOMATERIALS

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Patents:

18) SCAMPORRINO E., VITALINI D, MINEO P, ALICATA R (2008). "Copolieteresolfoni-epossidati termoindurenti auto-catalizzati: preparazione ed uso come colle isolanti ad alta prestazione per assemblaggi in microelettronica". N° CT2008A000003. Università di Catania

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