PORPHYRIN-CONTAINING PVA CRYOGEL MEMBRANES: LOADING, MICROSCOPIC AND SPECTROSCOPIC CHARACTERIZATION, AND RELEASE STUDIES

Stefan Varga[1], Silvia Patachia[1], Silvia Mihaila[1], Abilio Sobral[2], Arthur Valente[2]
[1]Department of Chemistry, Transilvania University of Brasov, Bd. Eroilor Nr. 29, 500036 Brasov, Romania
[2]Department of Chemistry, University of Coimbra, R. Larga, 3004-535 Coimbra, Portugal
Email: stefanvrg@gmx.de

The photodynamic therapy of cancer has recently attracted significant attention, being an important treatment option for malignant tumours of different locations. This method is based on the singlet oxygen production in tumoral tissue, by a photosensitization reaction which takes place when a porphyrin photosensitizer (which is found in the tumor) is irradiated with visible laser light [1].

In the last years, an increasing number of studies have examined porphyrin structures for PDT[2]. Among the structures with high photosensitizing ability, the meso-substituted porphyrins play an important role [3]. The main disadvantage is the poor solubility in water of the majority of this type of photosensitizers, which causes problems with drug delivery to the tumoral site.

In the present study, we have incorporated two hydrophobic porphyrins, Tm(OH)PP (5,10,15,20-meso-tetra-(m-hydroxy-phenyl)-porphyrin) and Tp(NH_2)PP (5,10,15,20-meso-tetra-(p-amino-phenyl)-porphyrin) in PVA hydrogel membranes obtained by the technique of repeated freezing and thawing. PVA hydrogels are biocompatible, bioresorbable and non-toxic, with a good mechanical resistance and thus are well suited for biomedical and pharmaceutical applications [4-6].

We have characterized the porphyrin-containing hydrogel membranes by scanning electron microscopy and studied the loading and release process from a kinetic standpoint. The loaded PVA gel is suitable for application as drug delivery vehicle.

The obtained results constitute a step forward towards the development of controlled release devices for hydrophobic photosensitizers in a clinical setting [7].

Acknowledgment: We acknowledge the helpful discussions with Prof. Rodica Ion from the ICECHIM Institute in Bucharest.

References:

1. R. Bonnett, Photosensitizers of the porphyrin and phthalocyanine series for photodynamic therapy, Chem. Soc. Rev., **24** (1995) 19 - 33
2. Q. Peng et al., Correlation of subcellular and intratumoral photosensitizer localization with ultrastructural features after photodynamic therapy, Ultrastruct Pathol., **20(2)** (1996), pp. 109-129
3. D. Caminos et al., Photodynamic inactivation of Escherichia coli by novel meso-substituted porphyrins by 4-(3-N,N,N-trimethylammoniumpropoxy)phenyl and 4-(trifluoromethyl)phenyl groups, Photochem. Photobiol. Sci., **5** (2006), pp. 56 - 65
4.S. Patachia, Ch. 8. Blends based on poly(vinyl alcohol) and the products based on this polymer In: Handbook of Polymer blends and composites, Ed. by C. Vasile, A. Kulshreshtha, RAPRA Technology Ltd, (2003), pp. 288-365.
5. S. Patachia, R. Ion, S. Varga, M. Rinja, Porphyrin encapsulation in nanostructured hydrogels. Journal of Optoelectronics and Advanced Materials **9(6)**, (2007), pp. 1816-1820.
6. S. Varga, S. Patachia, R. Ion, Development of controlled release devices for photodynamic therapy of cancer , Pollack Periodica, **2(2)** (2007), pp. 131-140.

7. S. Varga, Silvia Patachia, Rodica Ion, Nanostructured PVA hydrogel materials as vehicles for the encapsulation and controlled release of porphyrin-based cancer therapeutics, Bulletin of the Transilvania University of Brasov: Supplement Bramat, **4** (2007), pp. 153-160.