MULTIFUNCATIONAL BIOMATERIALS AS PROTECTING AND ENHANCING MEDIA FOR NATURAL BIO-ACTIVE COMPOUNDS

A. Meghea[1], I. Lacatusu[1], N. Badea[1], L. Lupascu[2],
[1]*University Politehnica of Bucharest,* [2]*Chemistry Institute – Science Academy of Moldova*

INTRODUCTION

There is a significant shift in the scientific approaches in obtaining nanostructured delivery systems for encapsulation of natural compounds, instead of using synthetic compounds. Polyphenolic compounds originated from plants possess a high spectrum of biological activity including optical, antioxidant, antibacterial and others. In this respect, the utilization of nanoscale systems loaded with polyphenols instead of using free compounds can improve the *in vivo* bio-availability, combined with the enhancing of the main properties of the compound of interest.

The purpose of this investigation was focused on the evaluation of the behavior of a natural bio-active polyphenolic extract (*Rosemary Extract – RE*) at encapsulation into two different matrices, in order to achieve optimized systems used for developing multifunctional biomaterials.

METHODS

The methodology approch is based on the idea to develop the synthesis of some adequate nanostructured systems in order to encapsulate natural bioactive products which may compensate and even improve the specific properties of synthesis chemicals. For obtaining of hybrid silica matrices a templated sol-gel synthesis was used, while new materials based on *Rosemary Extract* loaded into lipid nanoparticles were prepared by a modified high shear homogenization method.

RESULTS

Adequate nanostructured systems were produced with promising fluorescent and antioxidant properties.

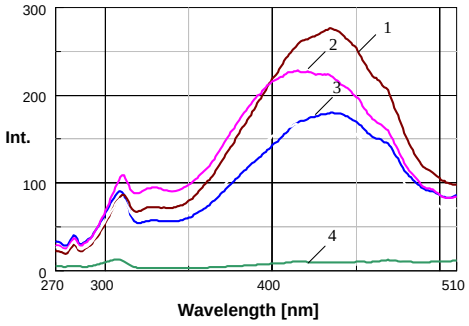

Fig. 1: *The fluoroescence behavior of Rosemary Extract (RE) after encapsulation into hybrid silica matrices, at different TEOS:OMEOS:ASA molar ratio: (1) 1:0.02:0.11 (2) 1:0.02:0.15 (3) 1:0.01:0.11, compared with free RE (4)*

The investigated matrices were: (1) a hybrid silica network formed by hydrolysis and polycondensation of TEOS and OMEOS templated with an alkyl succenyl anhydride (ASA) and (2) a complex lipid core obtained by a melting emulsification method, using biocompatible lipids and ionic and non-ionic emulsifiers.

According to fluorescence measurements (figure 1), a significant enhancement of optical signal was obtained when *RE* was entrapped in a hybrid matrix formed at a molar ratio of TEOS:OMEOS = 8:1, with a high content of ASA, as compared with 6:1 molar ratio.

Regarding the second type of matrix, the mixture of wax and glyceride-based lipid nanoparticles comprising similar composition of natural extract mixture were found to enhance the antioxidant activity of *RE.* As can be seen from figure 2, the AA of the nanoparticles loaded with *RE* was enhanced by 24% for RE-SLN prepared with 0.33% *RE* and 84% for RE-SLN prepared with 0.17%, respectively, as compared with the alcohol solutions of active compounds.

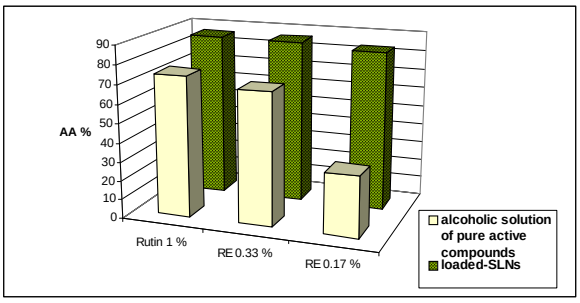

Fig. 2: *Antioxidant capacity of solid lipid nanoparticles (SLN) loaded with Rosemary Extract:*

DISCUSSION & CONCLUSION

In this study, the fluorescent properties and antioxidant activity of a natural extract were enhanced by loading *Rosemary Extract* into two carrier systems, using a templated sol-gel technique and melting homogenization. The encapsulation of *RE* that contains polyphenolic compounds with optical and antioxidant properties into hybrid silica and lipid matrices is a highly challenging task, the nanostructures thus obtained representing an important step in its utilization as precursors for multifunctional biomaterials.

ACKNOWLEDGEMENTS: The authors gratefully acknowledge the Bilateral project Romania - Moldova Nr.429/15.06.2010 for its financial support.