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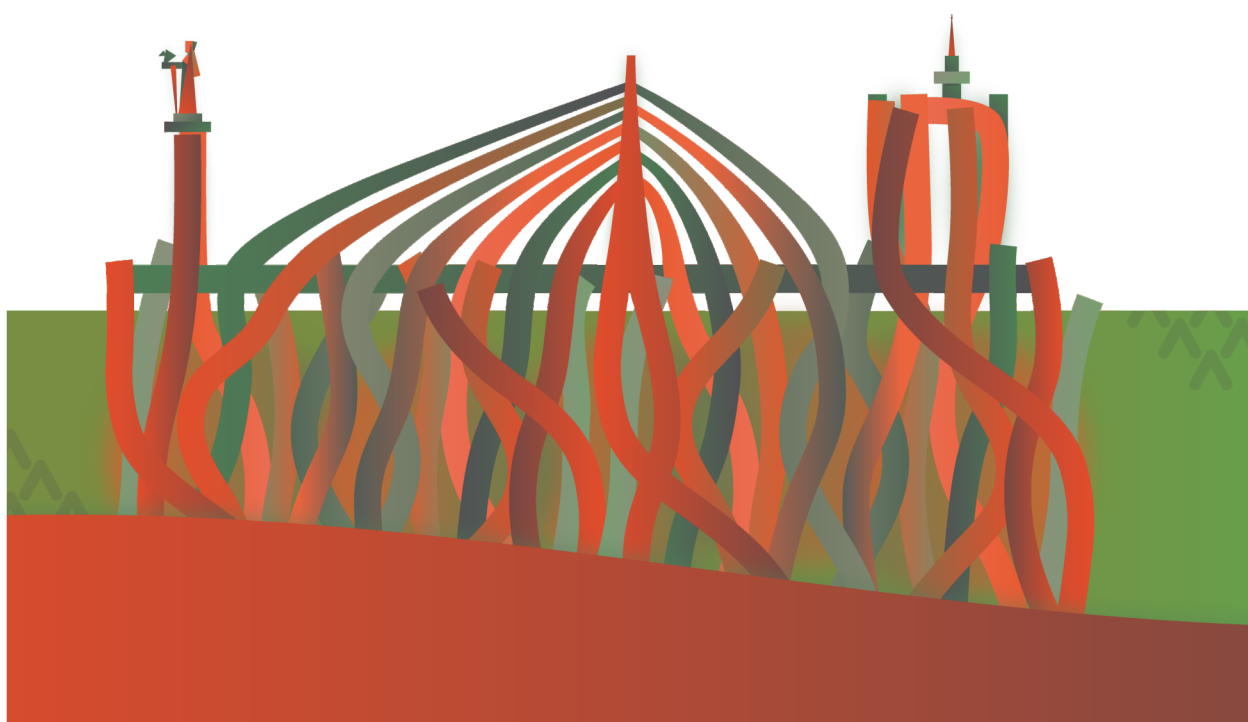
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**Innovative biomaterials
for novel medical devices
Conference 2024**





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Emila Živković

Pomoćnik glavnog i odgovornog urednika

Ivana Drvenica

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Redakcija

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Tel/fax: 011/3240-018

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Štampa

Razvojno-istraživački centar grafičkog inženjerstva,
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Guest Editor:

Ana Janković

Department of Physical Chemistry and Electrochemistry

Faculty of Technology and Metallurgy, University of Belgrade Belgrade, Serbia

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Characterization of *Vaccinium myrtillus* leaf extract-loaded liposomes

Muna Rajab Elferjane^{1,2*}, Milena Milošević³, Vojislav Ćirić^{4,5}, Petar Batinić⁶, Branko Bugarski², Aleksandar Marinković² and Aleksandra A. Jovanović⁷

¹Faculty of Nursing and Health Sciences, University of Misurata, Misurata, Libya

²Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

³Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

⁴Clinical Center Niš, Endocrinology, Diabetes and Metabolic Diseases Clinic, Niš, Serbia

⁵Faculty of Medicine, University of Niš, Niš, Serbia

⁶Institute for Medicinal Plants Research "Dr Josif Pančić", Belgrade, Serbia

⁷Institute for the Application of Nuclear Energy INEP, University of Belgrade, Belgrade, Serbia

Keywords: Bilberry; encapsulation efficiency; liposomal particles; polydispersity index; size; stability

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INTRODUCTION: *Vaccinium myrtillus* L. leaves contain bioactive components, such as polyphenols, stilbenes, iridoid glycosides, fatty acids, and fibers [1]. However, polyphenols possess low solubility, stability, and bioavailability, thus the encapsulation of the mentioned active principles in different carriers is necessary [2]. Liposomes are widely used as a carrier for the encapsulation, preservation, and controlled release of polyphenols in various products [3]. Therefore, the aims of the presented research are the development and characterization of *V. myrtillus* leaf extract-loaded liposomes via the determination of encapsulation efficiency, particle size, polydispersity index (PDI), zeta potential, and mobility.

EXPERIMENTAL: The liposomes with encapsulated extract were prepared employing the proliposome procedure [3]. Encapsulation efficiency was indirectly calculated by the polyphenol concentration determined in the supernatant. Particle size, PDI, zeta potential, and mobility were measured by the photon correlation spectroscopy in Zetasizer. Every measurement was examined three times at 25°C.

RESULTS AND DISCUSSION: The encapsulation efficiency of polyphenols was >85 %. The liposomes contained only phospholipids resulting in a more rigid membrane [4] providing the prevention of the leakage of the encapsulated polyphenols, as well as a higher encapsulation efficiency. The diameter and PDI of the liposomes were 5408.7±56.4 and 0.249±0.049 nm, respectively confirming that higher liposomal vesicles possessed lower PDI values [4]. The zeta potential and mobility were -5.02±0.25 mV and -0.315±0.016 μmcm/Vs, respectively. Zeta potential possessed negative values that are related to the exposure of the phosphate group lying in an outer plane concerning the choline groups [4]. The mobility of liposomes represents a function of the size, zeta potential, and lipid composition. The liposomal vesicles with lower membrane fluidity also show low mobility. The changes in the mobility of the liposomes were attributed to the membrane fluidity and ability to deform. Additionally, when flavonoids (also presented in *V. myrtillus* extract) are adsorbed at the surface of the liposomes, it can decrease their mobility [5].

CONCLUSIONS: The beneficial effects of bioactive principles from *V. myrtillus* leaves on human health and their sensitivity highlight the application of liposomal particles as a carrier for *V. myrtillus* extract and their potential implementation in foods, functional foods, pharmaceuticals, and cosmetics.

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*Corresponding author E-mail: muna_rajab2014@yahoo.com



Stability of liposomal particles with encapsulated coumarin derivate

Aleksandra A. Jovanović^{1,*}, Edina Avdović², Ana Plečić¹, Natalija Čutović³, Branko Bugarski⁴ and Zoran Marković^{2,5}

¹Institute for the Application of Nuclear Energy INEP, University of Belgrade, Belgrade, Serbia

²Institute for Information Technologies, University of Kragujevac, Kragujevac, Serbia

³Institute for Medicinal Plants Research "Dr Josif Pančić", Belgrade, Serbia

⁴Faculty of Technology and Metallurgy, University of Belgrade, Belgrade, Serbia

⁵State University of Novi Pazar, Department of Natural Science and Mathematics, Novi Pazar, Serbia

Keywords: Liposomes; mobility; polydispersity index; vesicle size; zeta potential

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INTRODUCTION: Coumarin derivatives possess several biological effects, including anti-inflammatory, antioxidant, anticoagulant, antitumor, insecticidal, anthelmintic, hypnotic, antifungal, and HIV protease inhibition properties [1,2]. Due to their solubility in organic solvents and insolubility in water and body fluids, their bioavailability is significantly low. Thus, they can be encapsulated into liposomal particles with the aim of overcoming the mentioned disadvantage [3]. Hence, in the present study, coumarin derivate was encapsulated in phospholipid liposomes and their stability was monitored for 60 days in terms of vesicle size, polydispersity index (PDI), zeta potential, and mobility.

EXPERIMENTAL: Coumarin derivate-loaded liposomes were prepared by mixing 0.1 g of coumarin derivate, 1 mL of dimethyl sulfoxide, 2 mL ethanol, 1 g of phospholipids, and 7.5 mL of water in the proliposome technique [4]. Vesicle size, PDI, zeta potential, and mobility were determined during 60 days of storage at 4°C using the photon correlation spectroscopy and Zetasizer Nano Series, Nano ZS (Malvern Instruments, United Kingdom). Every measurement was performed in triplicates at room temperature. The statistical analysis was performed by using the analysis of variance and Duncan's *post hoc* test (STATISTICA 7.0). The differences were considered statistically significant at $p < 0.05$, $n = 3$.

RESULTS AND DISCUSSION: The vesicle size varied from 1669.0 ± 55.1 (1st day) to 1583.5 ± 78.8 nm (60th day). Due to a relatively high absolute value of zeta potential at the beginning, the absence of a significant change in the size was expected. PDI value, as a measure of the particle size distribution, significantly increased during the 60-day study, from 0.231 ± 0.043 to 0.497 ± 0.079 indicating the existence of a non-uniform system [5]. A single phospholipid provides the liposomal population with significantly lower PDI (better uniformity) in comparison to the commercial phospholipid mixture employed in the present study [3]. The zeta potential and mobility significantly decreased (absolute value), from -29.43 ± 0.55 to -14.43 ± 1.00 mV, and from -2.307 ± 0.043 to -1.127 ± 0.086 $\mu\text{mcm/Vs}$, respectively. After 60 days of storage, the liposomes had significantly higher PDI, but lower zeta potential and mobility, indicating their instability. However, even though the zeta potential value was low on the 60th day, there was no occurrence of fusion and fission confirmed by the absence of statistically significant changes in the diameter of liposomes.

CONCLUSIONS: Coumarin derivate-loaded liposomes were unstable during 60-day storage at 4°C, resulting in changes in PDI value, zeta potential, and mobility, therefore additional experiments for improving their stability should be performed.

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*Corresponding author E-mail: ajovanovic@inep.co.rs