UNIVERSITY OF EAST SARAJEVO

FACULTY OF TECHNOLOGY ZVORNIK

IX INTERNATIONAL CONGRESS IA

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY EEM2025

BOOK OF ABSTRACTS

CO-ORGANIZED BY

UNION OF ENGINEERS AND TECHNICIANS OF SERBIA
Belgrade, Serbia

FACULTY OF TECHNOLOGY
Novi Sad, Serbia

INSTITUTE OF PHYSICS
Belgrade, Serbia

FACULTY OF TECHNOLOGY AND METALLURGY
Belgrade, Serbia

FACULTY OF TECHNOLOGY
Banja Luka,
Bosnia and Herzegovina

INSTITUTE "DR JOSIF PANČIĆ"
Belgrade, Serbia

FACULTY OF FOOD TECHNOLOGY
Osijek, Croatia

UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY ZVORNIK

BOOK OF ABSTRACTS

IX INTERNATIONAL CONGRESS

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

EEM2025

UNDER THE AUSPICES OF

MINISTRY OF ECONOMY AND ENTREPRENEURSHIP OF THE REPUBLIC OF SRPSKA

AND

ACADEMY OF SCIENCES AND ARTS OF THE REPUBLIC OF SRPSKA

BIJELJINA, APRIL 02 – 04, 2025
REPUBLIC OF SRPSKA
BOSNIA AND HERZEGOVINA

PUBLISHER
UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY
Karakaj 34a, 75 400 Zvornik
Republic of Srpska, B&H
Phone: +387 56 260 190
e-mail: sekretar@tfzv.ues.rs.ba
web:https://eem.tfzv.ues.rs.ba/

FOR PUBLISHER
Dragan Vujadinović, PhD, dean

DOMAIN
ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

PUBLISHED: 2025

ISBN: 978-99955-81-52-7

COMPOSITE HYDROGEL WITH SILVER NANOPARTICLES AND MUSHROOM B-GLUCAN EXTRACT AS POTENTIAL WOUND DRESSING

Tomislav Marković[1], Jasmina Stojkovska[1], Jovana Zvicer[1], Bojana Balanč[2], Aleksandra Jovanović[3], Branko Bugarski[1], Predrag Petrović[2]

[1]University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia
*[2]University of Belgrade, Innovation Center of the Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia, bisailovic@tmf.bg.ac.rs**
[3]University of Belgrade, Institute for the Application of Nuclear Energy INEP, Banatska 31b, Belgrade, Serbia

Abstract

Puffballs are a group of macrofungi that produce enclosed, globose fruiting bodies. When young, they have a solid white interior (gleba), which turns into a powdery, brown spore-bearing mass as they mature. These fungi have been used in folk medicine worldwide, primarily as wound dressings. Since fungal β-glucans are known to aid in wound healing, this study utilized the β-glucan-enriched fraction from the pestle puffball (Lycoperdonexcipuliforme) to synthesize silver nanoparticles (AgNPs), which were incorporated into alginate-based hydrogels for potential wound treatment. Silver nanoparticles were synthesized via a hydrothermal method using silver nitrate, sodium citrate, and varying concentrations of β-glucan extract as stabilizing agents: 0.4 mg/mL (S1), 0.8 mg/mL (S2), 1.6 mg/mL (S3), and 2.4 mg/mL (S4). Particle size was approximately 30 nm for all samples, with zeta potential ranging from -22.3 to -13, increasing with the extract concentration. A one-year stability study at room temperature showed minimal changes in UV-VIS spectra and particle size distribution, despite relatively low zeta potential, suggesting steric stabilization by β-glucan extract. To assess stability in physiological conditions, samples were diluted in 0.85% NaCl solution, and size distribution and UV-VIS absorption were monitored for seven days. Sample S4 exhibited the highest stability and was selected for further experiments. Its antibacterial activity was tested against common wound-infecting bacteria, Staphylococcus aureus and Pseudomonas aeruginosa, using the broth microdilution method. The minimum inhibitory concentration (MIC) was 35 μg/mL for both strains, with minimum bactericidal concentrations (MBC) of 120 μg/mL and 240 μg/mL, respectively. S4 was then used to prepare an alginate-based hydrogel, and a release study was conducted to assess the product's potential efficacy. The hydrogel was made by mixing equal volumes of AgNP suspension and 4% sodium alginate solution, with the addition of 4% $CaCl_2$ solution in a circular mold. The release study, conducted in TRIS buffer (50 mM) with 0.85% NaCl at varying pH levels over 72 hours, showed pH-dependent release. At pH 8.5 (similar to that of infected wounds), an effective AgNP concentration (~35 μg/mL) was reached after ~3 hours, increasing to ~100 μg/mL after 72 hours. These results suggest that fungal β-glucans are excellent stabilizing agents for AgNPs and that the combination of β-glucans' immunostimulatory and AgNPs' antibacterial properties may have a synergistic effect in the treatment of infected wounds. Hydrogel containing AgNPs both prolonged, and pH-dependent release of the particles.

Keywords: *wound dressing, hydrogel, silver nanoparticles, β-glucan, mushrooms, puffballs*

Acknowledgment: *This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contract No.451-03-136/2025-03/ 200135, 451-03-137/2025-03/ 200135, 451-03-136/2025-03/ 200287 and 451-03-136/2025-03/200019)*

STORAGE STABILITY OF THE LIPOSOMAL SYSTEM WITH ENCAPSULATED *VACCINIUM MYRTILLUS* EXTRACT

Amjed Karkad[1,2], Muna Rajab Elferjane[2,3], Milena Milošević[4], Andrea Pirković[5], Diana Lupulović[5], Aleksandar Marinković[2], Aleksandra Jovanović[5*]

[1]Elmergib University, Faculty of Medical Technology, Msallata, Libya
[2] University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, Belgrade, Serbia
[3] University of Misurata, Faculty of Nursing and Health Sciences, Alshowahda Park, 3rd Ring Road, Misurata, Libya
[4] University of Belgrade, Institute of Chemistry, Technology and Metallurgy, National Institute of the Republic of Serbia, Njegoševa 12, Belgrade, Serbia
*[5] University of Belgrade, Institute for the Application of Nuclear Energy INEP, Banatska 31b, Belgrade, Serbia, ajovanovic@inep.co.rs**

Abstract

Vaccinium myrtillus fruits and leaves show significant economic importance due to their application in food, functional food, pharmaceutical, cosmetic, and healthcare products. Bilberry leaves contain valuable components, such as phenolic acids, flavonoids, procyanidins, anthocyanins, fatty acids, and dietary fibers. The mentioned compounds possess various biological potentials, including antioxidant, anti-inflammatory, antimicrobial, regenerative, astringent, lipid-lowering, and anti-diabetic properties. With the aim of improving storage stability, biodistribution, and bioavailability, as well as providing controlled release of bioactive compounds, V. myrtillus extract was encapsulated in the liposomal vesicles, and their storage stability and stability after UV irradiation were monitored. Vesicle size, polydispersity index (PDI), and zeta potential were determined in the 60-day storage study at 4°C. The liposome size varied in a narrow range. PDI values were between 0.294 and 0.338 (for the non-treated sample) and 0.249 and 0.437 (for the UV-irradiated sample). The zeta potential was -5.02 mV on the 1st day and -9.16 mV on the 60th day for non-treated liposomes, while for UV-irritated, the zeta potential amounted to -3.93 mV on the 1st day and -8.22 mV on the 60th day. In both types of the sample, there was no significant change in the vesicle size during storage, while the zeta potential (absolute value) increased. Additionally, the PDI value increased in the UV-irradiated liposomes. The beneficial effects of bioactive principles from bilberry leaf on human health highlight the application of liposomes as a carrier for its extract and their potential implementation in food, functional food, pharmaceutical, and cosmetic formulations.

Keywords: *bilberry, liposomal particles, polydispersity index, storage stability, zeta potential.*