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ZVORNIK

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**ENGINEERING, ENVIRONMENT AND MATERIALS
IN PROCESS INDUSTRY
EEM2025**

BOOK OF ABSTRACTS

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

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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 (*Lycoperdon excipuliforme*) 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 μ g/mL for both strains, with minimum bactericidal concentrations (MBC) of 120 μ g/mL and 240 μ g/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% CaCl₂ 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 μ g/mL) was reached after ~3 hours, increasing to ~100 μ g/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

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STORAGE STABILITY OF THE LIPOSOMAL SYSTEM WITH ENCAPSULATED VACCINIUM MYRTILLUS EXTRACT

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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-irradiated, 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.