

1s

Hemijska industrija

Vol. 78

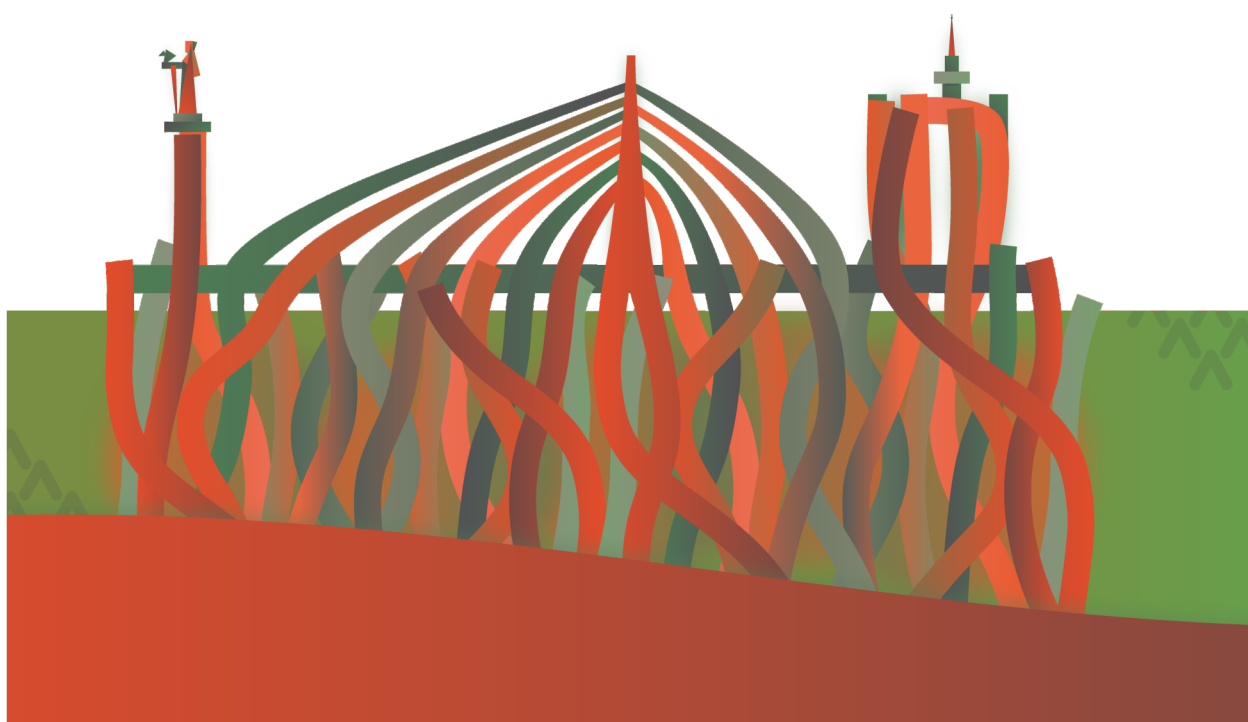
Časopis Saveza hemijskih inženjera Srbije

Chemical Industry

Supplementary Issue

ExcellMater Conference 2024 Abstracts

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





Chemical Industry
Химическая промышленность

Hemijska industrija

Časopis Saveza hemijskih inženjera Srbije
Journal of the Association of Chemical Engineers of Serbia
Журнал Союза химических инженеров Сербии

VOL. 78

Beograd, mart 2024.

Broj 1s

Izdavač

Savez hemijskih inženjera Srbije
Beograd, Kneza Miloša 9/I

Glavni urednik

Bojana Obradović

Zamenica glavnog i odgovornog urednika

Emila Živković

Pomoćnik glavnog i odgovornog urednika

Ivana Drvenica

Urednici

Jelena Bajat, Dejan Bezbradica, Ivana Banković-Ilić,
Dušan Mijin, Marija Nikolić, Đorđe Veljović, Tatjana
Volkov-Husović

Članovi uredništva

Nikolaj Ostrovski, Milorad Cakić, Željko Čupić, Miodrag
Lazić, Slobodan Petrović, Milovan Purenović,
Aleksandar Spasić, Dragoslav Stojiljković, Radmila
Šećerov-Sokolović, Slobodan Šerbanović, Nikola
Nikačević, Svetomir Milojević

Članovi uredništva iz inostranstva

Dragomir Bukur (SAD), Jiri Hanika (Češka Republika),
Valerij Meshalkin (Rusija), Ljubiša Radović (SAD),
Constantinos Vayenas (Grčka)

Likovno-grafičko rešenje naslovne strane

Milan Jovanović

Redakcija

11000 Beograd, Kneza Miloša 9/I

Tel/fax: 011/3240-018

E-pošta: shi@ache.org.rs

www.ache.org.rs

Izlazi kvartalno, rukopisi se ne vraćaju

Za izdavača: Ivana T. Drvenica

Sekretar redakcije: Slavica Desnica

Izdavanje časopisa pomaže

Republika Srbija, Ministarstvo nauke, tehnološkog
razvoja i inovacija

Uplata pretplate i oglasnog prostora vrši se na tekući
račun Saveza hemijskih inženjera Srbije, Beograd, broj
205-2172-71, Komercijalna banka a.d., Beograd

Menadžer časopisa i kompjuterska priprema

Aleksandar Dekanski

Štampa

Razvojno-istraživački centar grafičkog inženjerstva,
Tehnološko-metalurški fakultet, Univerzitet u
Beogradu, Karnegijeva 4, 11000 Beograd

Indeksiranje

Radovi koji se publikuju u časopisu *Hemijska Industrija*
indeksiraju se preko *Thompson Reuters Scitific®* servisa
Science Citation Index - Expanded™ i *Journal Citation
Report (JCR)*

Guest Editor:

Ana Janković

Department of Physical Chemistry and Electrochemistry

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

SADRŽAJ/CONTENTS

Editorial

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

Bojana Obradović 1

Tissue engineering and *in vitro* tissue and organ culture models

Translational studies of engineered human tissues

Gordana Vunjak-Novakovic 3

Regenerative engineering: designing grafts, processes and signals

Ivan Martin 4

Cartilage bioreactors: where we are and where we are going!

Mauro Alini 5

Ex vivo testing of biomaterials for intervertebral disc repair using organ culture bioreactors

Sibylle Grad 6

Engineering of multicellular systems by hydrodynamic waves

Tiziano Serra 7

Sound based assembly of spatially organized porous constructs

Greta Cocchi, Riccardo Tognato, Lorenzo Moroni, Tiziano
Serra 8

Development of an *in vitro* branched vasculature using bioprinting technique in combination with sacrificial materials

Natalija Stojanovic, Nadja Hansen, Horst Fischer 9

Unraveling the transcriptome profile of pulsed electromagnetic field stimulation in bone regeneration using an *in vitro* investigation platform

Farah Daou, Rana Zarean Hafdaran, Beatrice Masante,
Stefano Gabetti, Giovanni Putame, Eleonora Zenobi,
Federico Mochi, Cristina Bignardi, Federica Dell'Atti,
Francesco Favero, Costantino Del Gaudio, Diana Massai,
Andrea Cochis, Lia Rimondini 10

Whey protein isolate: a versatile dairy-derived hydrogel for bone and vascular tissue engineering and antimicrobial applications

Timothy E. L. Douglas 11

Innervation of the musculoskeletal system in physiological and pathological conditions: Insights from organ-on-a-chip models

Meriem Lamghari 12

Extracellular vesicles derived from mesenchymal stem/stromal cells derived from dental pulp of exfoliated teeth induce osteogenic differentiation

SADRŽAJ nastavak
CONTENTS Continued

Marija Milivojević, Maja Kosanović, Marina Bekić, Miodrag Čolić, Đorđe Janačković, Sergej Tomić	13
Examination of the effects of X-ray phase contrast imaging dose on DNA in mesenchymal stem cells by comet assay	
Lada Živković, Biljana Spremo Potparević, <u>Vladan Bajić</u> , Jovan Brankov, Wei Zhou, Eric Brey	14
β-glucan-enriched fraction from mosaic puffball induces inflammation in an <i>in vitro</i> 3D bovine chondrocytes model	
Predrag Petrović, Eda Çiftçi, Zhen Li, Sibylle Grad	15
Composite based on resveratrol and selenium as an antioxidative component in tissue engineering	
Nina Tomić, Dragana Mitić Ćulafić, Nenad Filipović, Tea Ganić, Maja Kuzmanović, Magdalena M. Stevanović.....	16
Cancer research	
Chemotherapy and novel proton radiotherapy in spatially advanced multicellular models of pancreatic cancer: On the design of platform for enabling low cost animal free preclinical treatment testing	
Eirini G. Velliou	17
Bioengineering for creating biomimetic microenvironments: bioreactors and biomaterials	
Jasmina Stojkowska, Jovana Zvicer, Jelena Petrovic, Ivana Banićević, Mia Milošević, Bojana Obradović.....	18
A 3D <i>in vitro</i> cell culture model based on perfused bone-like scaffolds for healthy and pathological bone research	
Ivana Banićević, Mia Milošević, Jelena Petrović, Ksenia Menshikh, Milena Milivojević, Milena Stevanović, Radmila Janković, Andrea Cochis, Elena Della Bella, Martin Stoddart, Lia Rimondini, Jasmina Stojkowska, Bojana Obradović.....	19
Doxorubicin and quercetin combined effect on SAOS-2 cells grown in 2D and 3D model systems	
Luka Bojić, Jelena Pejić, Jasmina Stojkowska, Milena Stevanović, Aleksandra Medić, Isidora Petrović, Milena Milivojević	20
Adaptable alginate-based microfibers for 3D <i>in vitro</i> cultures of cancer cells: an anticancer drug testing model	
Jelena Petrović, Elżbieta Pańczyszyn, Marco Corazzari, Ivana Banićević, Milena Milivojević, Luka Bojić, Milena Stevanović, Miodrag Dragoj, Milica Pešić, Radmila Janković, Bojana Obradović, Jasmina Stojkowska	21
Biomimetic tumor engineering to enhance drug discovery – Bioengineered Tumor	
Bojana Obradović, Jasmina Stojkowska, Jovana Zvicer, Milena Milivojević, Radmila Janković, Miodrag Dragoj, Ivan Jančić	22
Human amniotic membrane homogenate: A novel biomaterial-based strategy to impede migration and invasion of bladder cancer cells	
Aleksandar Janev, Taja Železnik Ramuta, Urška Dragin Jerman, Hristina Obradović, Maja Čemažar, Mateja Erdani Kreft	23
Polymer gels and composites for biomedical applications	
Designing biopolymer scaffolds and oral mucoadhesive films for controlled drug delivery	
Petar Uskoković, Anđela Radisavljević, Marija Jovanović, Dušica Stojanović, Vesna Radojević	24
Evaluation of crosslinked gelatin-polyvinylpyrrolidone scaffold for application in drug delivery and tissue engineering	
Marija Jovanović, Miloš Petrović, Dušica Stojanović, Nataša Nataša Radulović, Danijel Pantelić, Vesna Radojević, Petar Uskoković	25
Electrospun poly(ε-caprolactone) nanofiber mats with gallic acid and glucosamine sulfate for cartilage repair	
Anđela Radisavljević, Dušica Stojanović, Huan Meng, Zhen Li, Sibylle Grad, Petar Uskoković	26

Extracellular vesicles derived from mesenchymal stem/stromal cells derived from dental pulp of exfoliated teeth induce osteogenic differentiation

Marija Milivojević^{1,*}, Maja Kosanović², Marina Bekić², Miodrag Čolić³, Đorđe Janačković^{1,4} and Sergej Tomić²

¹Innovation Center of the Faculty of Technology and Metallurgy Ltd, Belgrade, Serbia

²Institute for the Application of Nuclear Energy, INEP, Belgrade, Serbia

³Serbian Academy of Sciences and Arts, Belgrade, Serbia

⁴Faculty of Technology and Metallurgy, Belgrade, Serbia

Keywords: Large bone defects; bone regeneration; extracellular vesicles; internalization

Hem. Ind. **78(15)** 13 (2024)

Available on-line at the Journal web address: <http://www.ache.org.rs/HI/>

INTRODUCTION: Large bone defects in the field of orthopedic surgery remains challenging, primarily due to restricted regenerative capacity of bone tissue. The biomimetic bone implants could improve the osteoregeneration process, but the optimal composition for biomimetics remains unknown. Considering the great potential of extracellular vesicles (EVs) derived from mesenchymal stem/stromal cells (MSCs) in regenerative medicine, our aim was to investigate the osteoinductive potential of EVs derived from MSCs from the dental pulp of human exfoliated deciduous teeth (SHEDs) either undifferentiated or those undergone differentiation into osteoblasts (osteoSHED-EVs), for potential use in biomimetic bone implants.

EXPERIMENTAL: SHEDs were isolated from the dental pulp of 5 different donors of deciduous teeth and subjected to characterization by Flow cytometry (FCM). EVs-SHED and EVs-osteoSHED were isolated by sequential ultracentrifugation, and analysed by Western blot, NTA, and electron microscopy. Uptake of PKH67-labelled EVs by SHED was analysed by confocal microscopy and FCM. The effects of EVs on osteogenic differentiation of SHED cells were analysed by monitoring RUNX2 and BMP2 expression by RT-PCR.

RESULTS AND DISCUSSION: SHEDs displayed typical MSC morphology and phenotype, as well as potential to differentiate into osteoblasts as confirmed by FCM, alkaline phosphatase activity, Alizarin red S staining, and gene expression analysis. Both types of EVs were internalized by SHED, as shown by the confocal microscopy and FCM after 4h and 24h incubation, and no significant differences were observed between the two EVs types. Importantly, the osteogenic differentiation of SHEDs cultivated in basal medium was significantly improved in the presence of osteoSHED-EVs, as shown by the upregulation of early osteogenic genes RUNX2 and BMP2.

CONCLUSIONS: These findings significantly improved our understanding on the potential of EVs derived from SHEDs in osteoinduction, laying the groundwork for developing targeted methods that utilize EVs from SHED as biomimetics for effective repair of bone defects.

Acknowledgements: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract No. 451-03-68/2023-14/200135, 451-03-9/2023-14/200287).

*Corresponding author E-mail: mmilivojevic@tmf.bg.ac.rs

