

UNIVERSITY OF NIŠ
Faculty of Technology, Leskovac

BOOK OF ABSTRACTS
13th SYMPOSIUM
“ Novel Technologies and Economic Development ”

Leskovac, October, 18 - 19, 2019

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Faculty of Technology, Leskovac

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CONTENS

PLENARY LECTURES

Massimo De Marchi, Carmen L. Manuelian

NOVEL APPLICATIONS OF INFRARED TECHNOLOGIES IN DAIRY INDUSTRY

Ljubica Tasić

TAILOR-MADE NANOMATERIALS FOR HUMAN BENEFIT

Miroslav Komljenović

GEOPOLYMERS - INORGANIC POLYMERS WITHIN THE CONCEPT OF SUSTAINABLE DEVELOPMENT

Anita Tarbuk, Sandra Flinčec Grgac, Tihana Dekanić

CAPILLARITY OF HOSPITAL PROTECTIVE TEXTILES

Milorad Cakić

NANO-BIOCOMPLEXES BASED ON OLIGOSACCHARIDES AND THEIR DERIVATIVES

Milena Kostić, Ljubiša Nikolić

CONTEMPORARY DENTAL MATERIALS

Anđelka Tomašević, Slobodan Petrović, Dušan Mijin

PHOTOCHEMICAL PROCESSES FOR REMOVAL OF CARBAMATE PESTICIDES FROM WATER

Section: FOOD ENGINEERING

Posters

Dušica Ilić, Nataša Vitošević, Tamara Popović, Vesna Nikolić,

Ljiljana Stanojević

THE INFLUENCE OF THE PROCESSING ON THE ANTIOXIDANT ACTIVITY OF ARONIA LIQUEUR

Marija Petrović, Predrag Vukosavljević, Snežana Zlatanović,

Sonja Veljović, Stanislava Gorjanović

UTILIZATION OF THE CHOKEBERRY POMACE FOR PRODUCTION OF LIQUEUR WITH HIGH CONTENT OF PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY

Nada Nikolić, Jelena Mitrović, Ivana Karabegović, Gordana Stojanović,

Miodrag Lazić

A CONTENT AND COMPOSITION OF FREE PHENOLIC COMPOUNDS OF CHIA (*Salvia hispanica* L.) SEEDS

Jelena Mitrović, Nada Nikolić, Ivana Karabegović, Miodrag Lazić,

Ljubiša Nikolić

THE EFFECT OF SOLVENTS ON REDUCING POWER AND FERRIC REDUCING ANTIOXIDANT POWER OF FREE POLYPHENOLS FROM NETTLE (*Urtica dioica* L.) SEEDS

Maja Ivić, Marija Jokanović, Vladimir Tomović, Branimir Pavlić, Snežana Škaljac, Branislav Šojić	
INFLUENCE OF MARINATION PROCESS WITH ADDITION OF SATUREJA MONTANA ESSENTIAL OIL ON LIPID OXIDATION OF COOKED PORK CHOPS	41
Branislav Šojić, Vladimir Tomović, Sunčica Kocić-Tanackov, Branimir Pavlić, Marija Jokanović, Maja Ivić, Snežana Škaljac	
EFFECT OF GINGER ESSENTIAL OIL ON MICROBIOLOGICAL QUALITY OF COOKED PORK SAUSAGES	42
Dragana Stanisavljević, Sofija Đorđević, Ivana Karabegović, Dragan Veličković, Branislav Zlatković, Novica Ranđelović, Miodrag Lazić	
CHEMICAL ANALYSIS OF ESSENTIAL OIL OF <i>Nepeta nuda</i> L.	43
Dragan T. Veličković, Mirjana N. Virijević, Ljiljana P. Stanojević, Jelena S. Stanojević, Ivana S. Mošić, Grozdan R. Stamenković	
CAPSAICIN, PHENOLS AND FLAVONOIDS QUANTIFICATION IN LESKOVAC AND HABANERO HOT PEPPERS	44
Vesna Gojković Cvjetković, Željka Marjanović-Balaban, Radoslav Grujić	
FOOD ALLERGENS – METHODS FOR GLIADIN AND GLUTENIN DETERMINATION	45
Ivana Karabegović, Marko Malićanin, Stojan Mančić, Sandra Stamenković Stojanović, Nada Nikolić, Miodrag Lazić	
EFFECTS OF NON-SACCHAROMYCES YEASTS ON QUALITY AND SENSORY CHARACTERISTIC OF CHARDONNAY WINES	46
Bojana Danilović, Bojana Milićević, Natalija Đorđević, Dragiša Savić	
INHIBITORY EFFECT OF SAGE ESSENTIAL OIL AGAINST <i>Escherichia coli</i> DURING STORAGE OF MINCED PORK	47
Milan Ilić, Miljojka Mijailović, Miljana Marković, Svetomir Milojević, Tomislav Trišović	
PRODUCTION OF THE WILD BLACKBERRY AND BLUEBERRY DISTILLATE	48
Ivana Kostić, Tatjana Anđelković, Darko Anđelković, Danica Bogdanović, Milica Branković, Tatjana Cvetković, Gordana Kocić	
INVESTIGATION OF AMMONIUM HYDROXIDE EFFECT ON DEHP EXTRACTION FROM MILK SAMPLES	49
Section: BIOCHEMICAL ENGINEERING	51
Posters	
Sandra Stamenković Stojanović, Ivana Karabegović, Vladimir Beškoski, Nada Nikolić, Miodrag Lazić	
INFLUENCE OF CULTIVATION CONDITIONS ON THE GROWTH AND BIOMASS YIELD OF <i>BACILLUS SUBTILIS</i>	53
Jovana Đuran, Zorana Rončević, Jovana Grahovac, Bojana Bajić, Siniša Dodić, Aleksandar Jokić, Jelena Dodić	
XANTHAN PRODUCTION ON INDUSTRIAL WASTEWATER USING DIFFERENT <i>Xanthomonas campestris</i> STRAINS	54

Section: TECHNOLOGY AND SUSTAINABLE DEVELOPMENT 119

Posters

- Dragana Marković Nikolić, Goran Petković, Aleksandar Zdravković, Tanja Nikolić, Danijela Stojadinović, Novica Stanković, Miodrag Šmelcerović**
GREEN CONVERSION OF GOURD SHELL BIOMASS INTO VALUE ADDED PRODUCT: ANALYSIS AND VALORISATION 121
- Ljiljana Takić, Ivana Mladenović Ranisavljević, Dejan Vasović, Nenad Živković**
DEVIATION OF THE WATER QUALITY OF THE DANUBE IN SERBIA FROM THE REQUIREMENTS OF THE WFD 122
- Bratislav Ž. Todorović, Dragan T. Stojiljković, Marija Prekajski Đorđević, Sanja M. Petrović, Amer M. Juma, Nebojša Č. Mitić, Staniša T. Stojiljković**
GEOTHERMAL WATER FROM VG-2 BOREHOLE AT VRANJSKA BANJA, SERBIA: XRD CHARACTERIZATION 123
- Zorica Eraković, Stanko Žerajić, Ivana Mladenović Ranisavljević**
CONSTRUCTION WASTE MATERIAL FLOW MANAGEMENT ON THE TERRITORY OF JABLANICA DISTRICT 124
- Danijela Stojadinović, Tanja Nikolić, Dragana Marković Nikolić, Goran Petković, Novica Stanković, Aleksandar Zdravković, Miodrag Šmelcerović**
VALORIZATION OF SOIL QUALITY OF THE TOWN OF KRUŠEVAC FROM THE ASPECT OF CHEMICAL POLLUTION BY HEAVY METALS 125

Section: INORGANIC CHEMICAL TECHNOLOGY 127

Posters

- Đorđe Z. Novković, Jovica Đ. Bogdanov, Zlate S. Veličković, Zoran J. Bajić**
OPTIMIZATION OF Cu_2O AND ALUMINIUM THERMITE COMPOSITION USING RESPONSE SURFACE METHODOLOGY 129
- Marija Šuljagić, Predrag Vulić, Dejan Jeremić, Aleksandar S. Nikolić, Goran Petković, Ljubica Andjelković**
THE IMPACT OF SYNTHESIS METHOD AND STARCH-COATING ON THE MAGNETIC PROPERTIES OF NANOMETRIC COBALT FERRITE 130

Section: ADVANCED MATERIALS 131

Posters

- Djordje Veljović, Giuma Ayoub, Maja Ležaja Zebić, Vesna Miletić, Tamara Matić, Rada Petrović, Djordje Janačković**
DIFFERENT SINTERED CALCIUM PHOSPHATE INSERTS AS MATERIALS FOR DENTIN REPLACEMENT 133
- Sandra Veljković, Aleksandra Ćurčić, Gordana Topličić-Ćurčić**
FUNCTION AND UNDERLYING MECHANISMS OF OLED DEVICES MATERIALS 134
- Snežana Đorić-Veljkić, Predrag Janković, Sofija Rančić, Momčilo Kocić, Marija Stojanović-Krasić**
NOVEL MATERIALS FOR OPTICAL FIBERS 135

FUNCTION AND UNDERLYING MECHANISMS OF OLED DEVICES MATERIALS

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Novel materials for the organic light emitting diode (OLED) could have wide application due to their characteristics. Innovations and very quality solutions, lead to application in many areas: in mobile telephones, tablets, displays for digital camera, TVs, in automotive industry, but also as a key part of the innovative luminary products. One promising application could be for windows which might be the source of artificial light when the daylight has gone. Such new equipment is improved to reduce electricity consumption, but one of the main reasons is to make artificial light more similar to daylight and more pleasant to the eye.

It should be emphasized that OLEDs lead to the new lighting design platform that could enable the true integration of lighting and architecture, something that was not possible in the earlier stage. Namely, OLED light sources could be directly embedded onto architectural materials and could also be used to create decorative lighting applications, as well as free-form luminous objects.

OLED light sources are made up of very thin organic layers and they are bright when the current passes through them. It is observed that several materials and techniques could be used for producing. The most used molecules in OLED components include organic-metal composites, like polymer Alq₃ - aluminum tris(8-hydroxyquinoline), which was used in the first device that emitted light. In the recent technology hybrid light-emitting layer was developed which used non-conducting polymers doped with light-emitting, conductive molecules. Technologies which can be used in production are organic vapor phase deposition, organic vapor jet printing and nanopatterning. These technologies are very similar to chemical vapor deposition but with improved sequences.

In general, OLED structure consists of several thin organic films which are between two electrode layers. When the voltage is applied to the circuit, electrons and holes are inserted in thin organic films. After that, the carriers move through the structure under the influence of the field, recombine and create excitons. There is a variety in the way of excitation, so a few OLED types can be observed. The oldest way of production is Passive Matrix OLED where row and column selection is the ideal type for small, cheap screens. Active-matrix OLED is an upgraded version and it is used for reducing energy consumption. Transparent OLED is based on idea that all elements should be transparent. Flexible OLED is the most resistive OLED of all and it finds application in mobile phones, watches and jewelry. White OLED is very interesting for application as sources of light, while phosphorescent OLED uses principles of electrophosphorescence to convert electricity from OLED to the light.

The goal of this research is to elucidate function mechanisms in materials applied in OLED devices and possibilities of future research in this area, but also to point out the benefits of their application.