

Faculty of Technology and Metallurgy

Department of chemical engineering

Scientific field (Frascati Manual)

Physical chemistry, Polymer science, Electrochemistry (dry cells, batteries, fuel cells, corrosion metals, electrolysis)

Chemical process engineering

Technologies involving identifying the functioning of DNA, proteins and enzymes and how they influence the onset of disease and maintenance of well-being (gene-based diagnostics and therapeutic interventions (pharmacogenomics, gene-based therapeutics)

Biomaterials (as related to medical implants, devices, sensors)

Brief description of expertise

Process and equipment designs and analyses, thermo-hydraulic heat exchanger calculation, revamping, reconstruction and optimization in Petrochemical and Oil industry. Heat and power integration, energy synthesis in chemical and process industry. Renewable and conventional energy resource options. Experimental determination and simulations of thermodynamic and transport properties, such as: densities, viscosities, surface and interfacial tension of multicomponent liquid mixtures. Multiphase systems design. Chemical engineering equipment design. Nonlinear process dynamics and development of non-stationary processes and techniques. Adsorption and development of adsorption processes. Mathematical modeling and simulation of complex chemical engineering processes. Process intensification through dynamic operations and application of alternative forms of energy. Modeling and optimization of reaction and separation systems. Software development for environmental protection. Isolation, separation and characterization of biologically active compounds (antioxidants, organic iron) from natural sources; Novel encapsulation technologies for designing of new biocatalysts and biologically active compounds with improved stability and controlled delivery; Design of bioreactor systems with immobilized biocatalysts. Production of calcium-oxide based catalyst from chicken egg-shell. Optimization of the biodiesel production from recycled vegetable oils. In the areas of chemical, biochemical and biomedical engineering focusing on following topics: cartilage tissue engineering, biomimetic bioreactors, which mimic physiological conditions in vivo (e.g. bioreactor with dynamic compression), packed bed, fluidized bed and gas-lift reactors and bioreactors, characterization of novel biomaterials under biomimetic bioreactor conditions, nanocomposite hydrogels in different forms (microbeads, microfibers), especially based on alginate and polyvinyl alcohol with incorporated silver nanoparticles, kinetics of adsorption and other processes (e.g. heavy metal adsorption onto zeolites).

Keywords

biomedical engineering, multiphase systems, process intensification, Immobilization/encapsulation, controlled delivery, biodiesel production, biowaste, heterogeneous transesterification, bioreactors, process design, numerical simulation, Green chemistry, environmental systems software development, mathematical modeling, non-linear dynamics, adsorption processes

Commercial services

Biomimetic bioreactor systems for cell and tissue cultures as well as for characterization of novel biomaterials for biomedical and pharmaceutical applications

Packed bed, fluidized bed and gas-lift reactors for reactions in two-phase and three-phase systems

Development of nanocomposite biomaterials with controlled release of active substances for applications in medicine, pharmaceutical and food industry

Consulting in tissue cultures
Consulting in bioreactor development and scale-up
Consulting in intellectual property protection
Multiphase systems design
Chemical engineering equipment design
Mathematical modelling of complex processes
Development of software for Environmental Impact Assessment
Development of dynamic models of processes and plants for chemical industry
Design of dietetic supplements based on plant extracts and compounds with antioxidant activity for applications in food technology and pharmacy
Design of hemi-iron based supplements for anemia treatment and diagnostics
Design of processes for transformation of wasted slaughterhouse blood to highly valuable products
Design of cell-based therapeutic formulations
Design of polymer-based therapeutic formulations
Process design
Experimental determination of density, viscosity, refractive index of pure fluids and mixtures

Realized and current projects

A) NATIONAL PROJECTS

Title	Project ID	Funding source	Duration
Synthesis, production process development, and application of nanostructured multifunctional materials of defined properties	III45019	Ministry of Education and Science, Republic of Serbia	2011-2015
Development of novel immobilization and enzyme techniques for production of biocatalysts and biologically active substances with the aim to increase food competitiveness, quality and safety	III46010	Ministry of Education and Science, Republic of Serbia	2011-2015

Title	Project ID	Funding source	Duration
Development of efficient chemical engineering processes based on transport phenomena research and process intensification	ON172022	Ministry of the Republic of Serbia	2011-2015
Development of the process and the pilot plant for liquid waste treatment in pesticides factory	451-01-00065/2008-01/10	GALENKA-FITOFARMACIJA-NESTING-MN RS	2008-2009
Software Application for Environmental Impact Assessment	ID 358	Program MiniGrants of Serbian Innovation Fund financed by the European Union and controlled by the World Bank	2013-2014
Development and utilization of novel and traditional technologies in production of competitive food products with added value for national and global market-Creating wealth from wealth of Serbia	III46010	MPNTR	2011-2015
Interactions of immobilized cells, tissues and biologically active molecules in bioreactor systems	142075	Ministry of Science of Republic of Serbia	2006-2010
Application of Chemical Thermodynamics to Transport Phenomena of Multicomponent Multiphase Systems	142064	Ministry of Science of Republic of Serbia	2006.-2010

Title	Project ID	Funding source	Duration
New industrial and environmental aspects of chemical thermodynamics to improve chemical processes with multiphase and multicomponent systems	172063	Ministry of Education and Science, Republic of Serbia	2011-2015

Eggshell based catalyst production and its application in biodiesel production from recycled vegetable oil	IP 1-38	Ministry of Education and Science, Republic of Serbia	2014-2015
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B) INTERNATIONAL PROJECTS

Title	Project ID	Funding source	Duration
From nano to macro biomaterials (design, processing, characterization, modeling) and applications to stem cells regenerative orthopedic and dental medicine (NAMABIO)	COST Action MP1005	European Commission	2011-2015

The Gender in Science and Technology LAB (GENIS LAB)	SIS 266636	European Commission	2011-2015
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"Biomimetic bioreactor systems for biomedical applications - BIOMIMETIKA"	E!6749	Ministry of Education, Science and Technolgical Development, Republic of Serbia	2012-2014
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Experimental investigation of mass transport limitations in adsorption, based on the Nonlinear Frequency Response method	-	BASF, Ludwigshafen, Germany	2008-2009
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Title	Project ID	Funding source	Duration
Heating a liquid stream by direct vapour condensation – computer modelling and simulations	-	Proctor & Gamble, Newcastle, UK	2010
Advanced materials and electric swing adsorption process for CO2 capture (MATESA)	608534	European Commission, Directorate General for Research & Innovation - 7th Framework Program (FP7), Theme Energy	2013-2016
Modeling, optimization and dynamic analysis of fixed bed and milli-structured reactors for Fischer-Tropsch synthesis	NPRP 7-559-2-211	Qatar Foundation through National Priorities Research Program	2015-2018
Natural Zeolites in Water quality system	E!4208	MPNTR i EK	2008-2011
Stabilization of natural bioactive compounds: study of encapsulation techniques and release studies	Bilateral project	Ministry of Science and Ministry of Science of Republic of Slovenia	2011-2012
Immobilized Yeast Cells in Hydrogel Carriers for Bioproduction of Alcohols, SEE-ERA.NET, FP6	ID 10859 SEE-ERA.NET Pilot Joint Call	MNRS and EK	2008

Applicable research results

PROTOTYPE

Title	Basic characteristics	Beneficiary
Biomimetic bioreactor with dynamic compression	Specially designed bioreactor with dynamic compression for cell and tissue cultures as well as for biomaterial characterization under conditions mimicking those in articular cartilage in vivo, which may replace certain animal studies; it provides application of different regimes of compression and	-

Title	Basic characteristics	Beneficiary
Pilot-plant for hemoglobin separation from slaughterhouse blood	Membrane pilot-scale bioreactor system consisting of bioreactor, filters and dialysis unit, system of reservoirs, system of pumps and valves; the basic principle of Hb separations is gradual hemolysis, the final product is sterile Hb suitable for veterinary applications.	"Turković d.o.o.", Sjenica, Serbia

PRODUCT

Title	Basic characteristics	Beneficiary
Envigo – software application of Environmental Impact Assessment	Web based expert system and software for Environmental Impact Assessment to be used commercially by environmental experts for broad variety of investment projects	Environmental service and consultant companies, independent environmental experts, environmental divisions of large companies
Salviva® -human artificial saliva	Salviva® formulation is a substitute for human saliva, approved microbiologically quality and apyrogenicity, potential users are pharmaceutical industry and clinics	Inovaioni centar TMF-a

TECHNICAL SOLUTION

Title	Basic characteristics	Beneficiary
Plant for dimethyl-amine attenuation from emission gasses	The attenuation plant consists of scrubber and the catalytic reactor for dimethyl-amine degradation, with heat recuperation system.	Galenika-Fitofarmacija a.d., Beograd-Zemun, Batajnički drum bb.
Plant for organic vapours attenuation from emission gasses	The attenuation plant consists of active carbon filters for organic vapors attenuation from air drawn from insecticides and pesticides production lines	Galenika-Fitofarmacija a.d., Beograd-Zemun, Batajnički drum bb

Title	Basic characteristics	Beneficiary
Plant for the formulation of new group of herbicides based on isopropyl amine with closed system process and the attenuation of vapours and particles emission	The reactor for the formulation of a group of herbicides was modified and the present industrial system for emission gasses attenuation was adjusted in order to minimize the emission of isopropyl amine vapors to the environment.	Galenika-Fitofarmacija a.d., Beograd-Zemun, Batajnički drum bb.
Dichlorbenile attenuation from emission gasses plant	The plant consists of filter, scrubber and heat recuperation system. The reactor was optimized in order to reduce the amount of gasses to be cleaned	Galenika-Fitofarmacija a.d., Beograd-Zemun, Batajnički drum bb.
Liquid waste treatment plant in pesticides factory	The plant consists of fluidized bed catalytic reactor for thermal treatment of waste, with emission gasses attenuation	Galenika-Fitofarmacija a.d., Beograd-Zemun, Batajnički drum bb.
Unit for determination of density of fluids at high pressures and temperatures	The principle of operation of the new unit is that the vibrating tube of densimeter is based on inducing vibrations hard work (pipes) in which there is a fluid to be tested and observing its resonant frequency.	Namenska, Trstenik, Srbija

Intellectual property

PATENT

Title	Owner	Inventor	Reg. No
Production of alginate microbeads with incorporated silver nanoparticles	Faculty of technology and metallurgy, University of Belgrade	Obradović B., Mišković-Stanković V., Jovanović Ž., Stojkowska J.	53508

PATENT APPLICATION

Title	Owner	Inventor	Reg. No
Hydrophylic solution for physical cross-linking and storage of hydrogels based on polyvinyl alcohol in different forms	Faculty of technology and metallurgy, University of Belgrade	Obradović B., Vidović S., Nikolić A., Munćan M.	P-2014/0032

Title	Owner	Inventor	Reg. No
Polymer nanocomposites with incorporated silver nanoparticles and honey	Faculty of technology and metallurgy, University of Belgrade	Stojkovska J., Obradovic B.	P-2014/0200

TRADEMARK

Title	Owner	Inventor	Reg. No
Envigo	Eon Plus d.o.o. Belgrade	-	In the procedure of publishing of trademark

SOFTWARE

Title	Owner	Inventor	Reg. No
Envigo –software application of Environmental Impact Assessment	Eon Plus d.o.o. Belgrade	Nikola Nikačević	5841

Licenses

Name	Last name	Type of license	License No
Mirjana	Kijevcanin	371 – Chief designer of technological processes	371J30710
Vera	Sudar Lucic	371 – Chief designer of technological processes	371C46205
Zeljko	Grbavcic	371 – Chief designer of technological processes	371C93306
Tatjana	Kaludjerovic Radoicic	371 – Chief designer of technological processes	371L45612

Industry group (according to "Gazette RS", No. 54/10)

Architectural and engineering activities and related technical consultancy
 Technical testing and analysis
 Higher education

PhD thesis within the unit done according to the industry needs

Name	Last name	Title	Year	Mentor
Jelena	Milanović	Immobilization of some aromatic compounds - process optimization	2011	Branko Bugarski

Name	Last name	Title	Year	Mentor
Mihal	Djuris	Investigation of the fluidization characteristics of polydisperse mixtures of non-spherical particles	2014	Zeljko Grbavcic
Milos	Vasic	Mathematical modelling and optimization of the drying process	2014	Zeljko Grbavcic
Mirko	Stijepovic	Modeling and energy optimization of the catalytic naphtha reforming process	2010	Mirjana Kijevcanin
Vuk	Spasojevic	Thermodynamic analysis and modeling of process for removal of carbon dioxide from flue gases	2014	Slobodan Serbanovic

Staff list within the unit

Name	Last name	Teaching/scientific title
Ljiljana	Zivanic	-
Marko	Stamenic	Associate
Branko	Bugarski	Professor
Mirjana	Kijevcanin	Professor
Bojana	Obradovic	Professor
Menka	Petkovska	Professor
Nevenka	Boskovic Vragolovic	Associate professor
Emila	Zivkovic	Associate professor
Nikola	Nikacevic	Associate professor
Ivona	Radovic	Associate professor

Name	Last name	Teaching/scientific title
Jovan	Jovanovic	Assistant professor
Tatjana	Kaludjerovic Radoicic	Assistant professor
Milan	Milivojevic	Assistant professor
Rada	Pjanovic	Assistant professor
Zeljko	Grbavcic	Professor emeritus
Danica	Brzic	Teaching assistant
Radojica	Pesic	Teaching assistant
Vera	Sudar Lucic	Teaching assistant
Ivana	Pajic Lijakovic	Senior research fellow
Verica	Djordjevic	Research fellow scientist
Jelena	Vuksanovic	Associate researcher
Nikola	Grozdanic	Associate researcher
Ivana	Djukic	Assistant researcher
Luka	Zivkovic	Assistant researcher
Jovana	Zvicer	Assistant researcher
Gorica	Ivanis	Associate researcher
Marija	Jecmenica Ducic	Assistant researcher
Divna	Majstorovic	Associate researcher
Ivana	Madzovska	Assistant researcher
Andrea	Osmokrovic	Associate researcher
Radoslava	Pravilovic	Associate researcher
Danijela	Slavnic	Assistant researcher
Jasmina	Stojkovska	Associate researcher
Mina	Jovanovic	Associate researcher
Danijela	Kostic	Assistant researcher
Srdjan	Vidovic	Assistant researcher
Srdjan	Pejanovic	Associate professor
Ivana	Kostic	Associate researcher
Bojana	Balanc	Associate researcher

Name	Last name	Teaching/scientific title
Kata	Trifkovic	Associate researcher
Aleksandra	Jovanovic	Assistant researcher
Katarina	Bukara	Assistant researcher
Predrag	Petrovic	Assistant researcher
Natasa	Obradovic	Assistant researcher
Ivana	Damjanovic	Assistant researcher
Dusan	Grozdanic	Professor
Slobodan	Serbanovic	Professor