

**NASTAVNO-NAUČNOM VEĆU
TEHNOLOŠKO-METALURŠKOG FAKULTETA
UNIVERZITETA U BEOGRADU**

Odlukom Nastavno-naučnog veća Tehnološko-metalurškog fakulteta Univerziteta u Beogradu od 05.11.2020. godine, imenovani smo u Komisiju za ocenu ispunjenosti uslova za izbor dr Ivane Lukić u zvanje VIŠI NAUČNI SARADNIK u oblasti Tehničko-tehnoloških nauka. Na osnovu pregleda i analize dostavljenog materijala i uvida u dosadašnji rad dr Ivane Lukić, a u skladu sa Zakonom o naučno-istraživačkoj delatnosti i Pravilnikom o postupku i načinu vrednovanja, i kvantitativnom iskazivanju naučno-istraživačkih rezultata istraživača, podnosimo sledeći

I Z V E Š T A J

1. OPŠTI BIOGRAFSKI PODACI

Dr Ivana Lukić je rođena 08.03.1979. godine u Beogradu, gde je završila osnovnu školu i gimnaziju. Tehnološko-metalurški fakultet Univerziteta u Beogradu upisala je školske 1997/1998. godine. Diplomirala je septembra 2004. sa prosečnom ocenom 8,31 i ocenom 10 na diplomskom radu. Magistarske studije je završila na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu i položila sve predviđene ispite sa ocenom 10. Magistarsku tezu pod naslovom „Sinteza metil estara masnih kiselina sa heterogenim katalizatorom tipa kalijum-oksidi ili cink-oksidi na aluminosilikatnom nosaču” odbranila je u julu 2007. godine. Doktorsku disertaciju pod nazivom „Kinetika heterogene metanolize svežeg i korišćenog biljnog ulja” odbranila je 14.07.2015. godine na Tehnološko-metalurškom fakultetu, Univerziteta u Beogradu.

Od 2005. do 2007. godine dr Ivana Lukić je kao istraživač pripravnik bila angažovana na naučno-istraživačkom projektu Ministarstva za nauku i zaštitu životne sredine Republike Srbije pod nazivom „Razvoj tehnologije sinteze biodizela” TR6742 u okviru programa za tehnološki razvoj. Od aprila 2008. do 2011. godine bila je zaposlena na projektu tehnološkog razvoja „Razvoj kontinualnih postupaka alkoholize biljnih ulja na niskoj, umerenoj i povišenoj temperaturi” TR 19062 koji je finansiralo Ministarstvo za nauku i tehnološki razvoj Republike Srbije. Od 2011. do 2019. godine bila je angažovana kao istraživač saradnik, a zatim i kao naučni saradnik na realizaciji projekta interdisciplinarnih istraživanja Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima” (III 45001).

Tokom 2005. godine pohađala je SOCRATES/ERASMUS Intenzivni kurs “Basics, Developments, Research and Industrial Applications in High Pressure Chemical Engineering Processes” u Pragu, Češka Republika, kao i kurseve International summer schools “Instrumental analysis-GC/MS” u Novom Sadu i “Instrumental analysis-HPLC” u Beogradu. Tokom 2009. godine završila je obuku za nacionalnog eksperta u okviru Centra za čistiju proizvodnju pod okriljem organizacije UNIDO (United Nations Industrial Development Organization). U okviru COST akcije CA18125 učestvovala je u stručnoj obuci u okviru kursa “Training School: Aerogels processing, modelling and environmental-driven applications” koja je održana 2019. godine u Koimbri, Portugal.

U periodu 2011-2012. godine bila je angažovana na projektu bilateralne saradnje između Republike Srbije i Narodne Republike Kine “Heterogeneous process of biodiesel synthesis –

catalyst preparation, characterization and testing”. Takođe, u periodu 2014-2015. godine bila je angažovana na naučno-istraživačkom projektu između Republike Srbije i Narodne Republike Kine, pod nazivom “Pilot research on heterogeneous biodiesel production”. Trenutno učestvuje u realizaciji projekta Evropske kooperacije u Nauci i Tehnologiji (COST): “Green Chemical Engineering Network towards upscaling sustainable processes” broj CA18224 (2019-2023) kao zamenik člana upravnog odbora i “Advanced Engineering and Research of aeroGels for Environment and Life Sciences” (2019-2023) broj CA18125 kao participant.

Najveći deo naučno-istraživačkog rada dr Ivana Lukić posvetila je razvoju i unapređenju tehnologija sinteze biodizela, pre svega heterogeno katalizovanoj metanolizi biljnih ulja. Bavila se sintezom i karakterizacijom različitih katalizatora za dobijanje biodizela, analizom uticaja parametara na brzinu procesa i matematičkim modelovanjem kinetike procesa metanolize. Pored toga, poslednjih godina sfera njenog interesovanja je oblast primene natkritičnih fluida. Ova istraživanja odnose se na razvoj procesa za dobijanje biodegradabilnih materijala sa antimikrobnim i antioksidativnim dejstvom upotrebom zelenog rastvarača (natkričnog ugljenik (IV)-oksida), sa potencijalnom primenom u industriji hrane, farmaciji i medicini.

Rezultati njenog naučno-istraživačkog rada objavljeni su u vrhunskim međunarodnim časopisima izuzetnih vrednosti (M21a - 5 radova), vrhunskim međunarodnim časopisima (M21 - 7 radova), istaknutim međunarodnim časopisima (M22 - 1 rad), časopisima međunarodnog značaja (M23 - 8 radova), vodećem časopisu nacionalnog značaja (M51 - 1 rad), monografiji nacionalnog značaja (M44 - 1 rad) i međunarodnim knjigama (bez kategorije - 2 poglavlja). Takođe, rezultati su saopšteni na skupovima međunarodnog (M33 - 8 radova i M34 - 20 radova) i nacionalnog značaja (M63 - 3 rada i M64 - 6 radova). Pored toga, koautor je 7 tehničkih rešenja (M83 - 3 i M85 - 4).

2. PREGLED DOSADAŠNJEG NAUČNOG I STRUČNOG RADA

Dosadašnji naučni i stručni rad dr Ivane Lukić obuhvata objavljene naučne radove, saopštenja na skupovima u zemlji i inostranstvu i tehnička rešenja u periodu 2004-2020. godine. Posebno su izdvojeni radovi posle osnivanja Komisije za pisanje referata za izbor u zvanje naučni saradnik (2016-2020). Klasifikacija naučno-istraživačkih rezultata izvršena je prema Pravilniku o postupku i načinu vrednovanja i kvantitativnom iskazivanju naučno-istraživačkih rezultata istraživača („Službeni glasnik RS“, br. 24/2016, 21/2017 i 38/2017).

2.1. SPISAK RADOVA OBJAVLJENIH PRE IZBORA U ZVANJE NAUČNI SARADNIK

Rad u vrhunskom međunarodnom časopisu izuzetnih vrednosti (M21a=10)

1. **Lukić I.**, Kesić Ž., Maksimović S., Zdujić M., Liu H., Krstić J., Skala D., Kinetics of sunflower and used vegetable oil methanolysis catalyzed by CaO·ZnO, *Fuel* 113 (2013) 367–378. doi:10.1016/j.fuel.2013.05.093; ISSN:0016-2361; IF(2013)=3,406; Engineering, Chemical13/133. Broj heterociteta=50
2. Kesić Ž., **Lukić I.**, Brkić D., Rogan J., Zdujić M., Liu H., Skala D., Mechanochemical preparation and characterization of CaO·ZnO used as catalyst for biodiesel synthesis, *Applied Catalysis A: General* 427–428 (2012) 58–65. doi:10.1016/j.apcata.2012.03.032; ISSN: 0926-860X; IF(2011)=3,903; 20/205 Environmental Sciences. Broj heterociteta=56
3. Glišić S., **Lukić I.**, Skala D., Biodiesel synthesis at high pressure and temperature: Analysis of energy consumption on industrial scale, *Bioresource Technology* 100 (24) (2009) 6347–6354. doi:10.1016/j.biortech.2009.07.024; ISSN:0960-8524; IF(2008)=4,453; Energy & Fuels 2/67. Broj heterociteta=48

4. **Lukić I.**, Krstić J., Jovanović D., Skala D., Alumina/silica supported K_2CO_3 as a catalyst for biodiesel synthesis from sunflower oil, *Bioresource Technology* 100 (20) (2009) 4690–4696. doi: 10.1016/j.biortech.2009.04.057; ISSN:0960-8524; IF(2008)=4,453; Energy & Fuels 2/67. Broj heterocitata=138

Rad u vrhunskom međunarodnom časopisu (M21=8)

5. **Lukić I.**, Kesić Ž., Skala D., Kinetic of heterogeneous biodiesel synthesis using supported ZnO as catalyst, *Chemical Engineering & Technology* 37 (11) (2014) 1–7. doi: 10.1002/ceat.201300714; ISSN:0930-7516; IF(2014)=2,442; Engineering, Chemical (33/135). Broj heterocitata=7
6. Maksimovic S., Kesić Z., **Lukic I.**, Milovanovic S., Ristic M., Skala D., Supercritical fluid extraction of curry flowers, sage leaves, and their mixture, *The Journal of Supercritical Fluids* 84 (2013) 1–12. doi:10.1016/j.supflu.2013.09.003; ISSN:0896-8446; IF(2013)=2,571; 27/133 Engineering, Chemical. Broj heterocitata=13

Rad u međunarodnom časopisu (M23=3)

7. Kesić Ž., **Lukić I.**, Zdujić M., Jovalekić Č., Liu H., Skala D., Mechanochemical synthesis of $CaO \cdot ZnO \cdot K_2CO_3$ catalyst: Characterization and activity for methanolysis of sunflower oil, *Chemical Industry and Chemical Engineering Quarterly* 21 (1–1) (2015) 1–12. doi:10.2298/CICEQ131026041K; ISSN:1451-9372; IF(2014)=0,892; 89/134 Engineering, Chemical. Broj heterocitata=6
8. **Lukić I.**, Kesić Ž., Maksimović S., Zdujić M., Krstić J., Skala D., Kinetics of heterogeneous methanolysis of sunflower oil with $CaO \cdot ZnO$ catalyst: Influence of different hydrodynamic conditions, *Chemical Industry and Chemical Engineering Quarterly* 20 (3) (2014) 425–439. doi:10.2298/CICEQ130514025L; ISSN:1451-9372; IF(2014)=0,892; 89/134 Engineering, Chemical. Broj heterocitata=13
9. Miladinović M.R., **Lukić I.Z.**, Stamenković O.S., Veljković V.B., Skala D.U., Heterogena bazno katalizovana metanoliza biljnih ulja: presek stanja, *Hemijska industrija* 64 (2) (2010) 63–80. doi:10.2298/HEMIND100304012M; ISSN:0367-598X; IF(2011)=0,205; 120/133 Engineering, Chemical. Broj heterocitata=6
10. **Lukic I.**, Krstic J., Glisic S., Jovanovic D., Skala D., Biodiesel synthesis using $K_2CO_3/Al-O-Si$ aerogel catalyst, *Journal of Serbian Chemical Society* 75 (6) (2010) 789–801. doi: 10.2298/JSC090707047L; ISSN:0352-5139; IF(2011)=0,879; 103/154 Chemistry, Multidisciplinary. Broj heterocitata=19

Saopštenje sa međunarodnog skupa štampano u celini (M33=1)

11. **Lukić I.**, Kesić Ž., Skala D., Kinetic of heterogeneous biodiesel synthesis using supported ZnO as catalyst, 6th International Symposium on High Pressure Processes Technology, Belgrade, Serbia, September 8-11, 2013, P25 - HPAF, Proceedings on CD 256-261, ISBN 978-86-905111-2-9
12. Maksimovic S., Kesić Z., **Lukic I.**, Milovanovic S., Ristic M., Skala D., SFE of sage leaves, curry flowers and their mixture, 6th International Symposium on High Pressure Processes Technology, Belgrade, Serbia, September 8-11, 2013, P37 - HPFP, Proceedings on CD 298-309, ISBN 978-86-905111-2-9
13. Kesić Ž., **Lukić I.**, Zdujić M., Liu H., Skala D., Mechanochemically Synthesized $CaO \cdot ZnO$ Catalyst For Biodiesel Production, 20th International Congress of Chemical and Process Engineering - CHISA 2012, Praha, Czech Republic, Procedia Engineering, Volume 42, 2012, 1278-1287, ISBN 1877-7058

14. **Lukić I.**, Orlović A., Skala D., Alumina/silica aerogel with potassium-oxide as heterogeneous catalyst for biodiesel synthesis, 11th European Meeting on Supercritical Fluids, Barcelona, Spain, 2008, Full text on USB
15. **Lukić I.**, Orlović A., Skala D., Preparation of Heterogeneous Catalyst for Biodiesel Synthesis, AIChE Annual Meeting 2007, Salt Lake City, USA, Full Text on CD

Saopštenje sa međunarodnog skupa štampano u izvodu (M34=0,5)

16. **Lukić I.**, Kesić Ž., Zdujić M., Skala D., Pretreatment of used vegetable oil using CaO and CaO·ZnO for biodiesel production, 21st International Congress of Chemical and Process Engineering CHISA 2014, August 23-27, 2014, Prague, Czech Republic, Book Of Abstracts, p. 89, P 3.82 Number 0474.
17. Kesić Ž., **Lukić I.**, Zdujić M., Skala D., Homogeneous-heterogeneous catalytic effect of CaO·ZnO/K₂CO₃ during biodiesel synthesis, 21st International Congress of Chemical and Process Engineering, August 23-27, 2014, Prague, Czech Republic, P3.40
18. Kesić Ž., **Lukić I.**, Zdujić M., Mojović Lj., Skala D., Synthesis and testing of heterogeneous catalyst for biodiesel, Natalia V. Skorodumova Igor A. Pašti (Eds.) 1st Workshop Materials Science ForEnergy Related Applications, September 26-27, 2014, University of Belgrade, Faculty of Physical Chemistry, Belgrade, Serbia, Book Of Abstracts, pp. 52-54, ISBN 978-86-82139-49-2
19. Kesić Ž., **Lukić I.**, Zdujić M., Jovalekić Č., Shao Y., Liu H., Skala D., Characterization of mechanochemically synthesized CaO·ZnO·K₂CO₃, Advanced Ceramics and Applications II, Belgrade, September 30–October 1, 2013, Program and the Book of Abstracts, p. 45, ISBN 978-86-915627-1-7
20. Kesić Ž., **Lukić I.**, Zdujić M., Jovalekić Č., Shao Y., Liu H., Skala D., Biodiesel synthesis based on CaO·ZnO·K₂CO₃ as catalyst, Advanced Ceramic and Applications II, Belgrade, September 30–October 1, 2013, Program and the Book of Abstracts, p. 46, ISBN 978-86-915627-1-7
21. **Lukić I.**, Kesić Ž., Maksimović S., Zdujić M., Liu H., Skala D., Kinetics of sunflower oil methanolysis catalyzed by CaO·ZnO, International Symposium on Catalysis for Clean Energy and Sustainable Chemistry, CCESC 2012, Madrid, Spain, June 27-29 2012, abstract USB
22. **Lukić I.**, Kesić Ž., Zdujić M., Jovanović D., Liu H., Skala D., Mechanochemical preparation of CaO·ZnO – catalyst for fatty acids methyl esters synthesis, The First Serbian Ceramic Society Conference, Advanced Ceramics and Application Conference, Beograd, May 10-11, 2012, S3.6, Book of abstracts, p.18, ISBN 978-86-915627-0-0
23. Kesić Ž., **Lukić I.**, Zdujić M., Jovanović D., Liu H., Skala D., Characterization of mechanochemically synthesized CaO·ZnO/K₂O catalyst, The First Serbian Ceramic Society Conference, Advanced Ceramics and Application Conference, Beograd, 2012, P10, Book of abstracts, p. 28, ISBN 978-86-915627-0-0
24. Kesić Ž., **Lukić I.**, Zdujić M., Liu H., Skala D., Mechanochemically synthesized CaO/ZnO catalyst for biodiesel production, 20th International Congress of Chemical and Process Engineering - CHISA 2012, Praha, Czech Republic, Book of abstracts CD ROM, P5.115
25. **Lukić I.**, Orlović A., Krstić J., Jovanović D., Skala D., Preparation of xerogel catalyst with ZnO as active component for biodiesel synthesis, 2nd International Congress on Biodiesel: The Science and The Technologies, Munich, Germany, 2009, abstract
26. Glišić S., **Lukić I.**, Savić M., Orlović A., Skala D., Kinetics of vegetable oil alchocolysis under methanol supercritical conditions, 29th International Conference of Solution Chemistry, Portorož, 2005, Section FP4, Book of abstract, p. 248

Poglavlje u monografiji nacionalnog značaja (M44=2)

27. Skala D., **Lukić I.**, Brkić D., Ivanović J., „Mikroreaktori“, poglavlje u monografiji „Kataliza u naučnim i obrazovnim programima i u društvenom razvoju Srbije“, urednik Paula Putanov, Izdavač: Srpska akademija nauka i umetnosti, Ogranak Novi Sad, 2010 (Beograd: Čigoja), str 181–220, ISBN 978-86-81125-79-3

Rad u vodećem časopisu nacionalnog značaja (M51=2)

28. Skala D., Glišić S., **Lukić I.**, Orlović A., “Biodizel II Novi koncept dobijanja biodizela - Transesterifikacija u natkritičnim uslovima metanola“, *Hemijska industrija* 58 (4) 2004, 176-185, ISSN 0367–598X

Saopštenje sa nacionalnog skupa štampano u celini (M63=0,5)

29. **Lukić I.**, Skala D., Homogeneous contribution in methanolysis reaction catalysed by alumina/silica supported K_2CO_3 , VIII simpozijum Savremene tehnologije i privredni razvoj, Leskovac, 2009, Sekcija HI-5, CD ROM
30. **Lukić I.**, Orlović A., Krstić J., Jovanović D., Skala D., Preparation of catalyst with ZnO as active component for biodiesel synthesis, 47. Savetovanje Srpskog hemijskog društva, Beograd, 2009, HI-06, CD ROM
31. **Lukić I.**, Stamenić M., Orlović A., Skala D., Metanoliza suncokretovog ulja katalizovana kalijum oksidom (K_2O) na alumosilikatnom nosaču, VII simpozijum Savremene tehnologije i privredni razvoj, Leskovac, 2007, Sekcija HI-21, Full text CD ROM

Saopštenje sa nacionalnog skupa štampano u izvodu (M64=0,2)

32. **Lukić I.**, Kesić Ž., Zdujić M., Liu H., Skala D., Mehanohemijaska sinteza i karakterizacija Ca odnosno Zn-glicerolata i primena kao katalizatora za sintezu biodizela, 52. Savetovanje SHD, 29 i 30. maj 2015., Novi Sad, Knjiga izvoda radova str. 53, HI P10
33. **Lukić I.**, Kesić Ž., Zdujić M., Skala D., Biodiesel synthesis from waste vegetable oil using heterogeneous $CaO \cdot ZnO$ catalyst, 7. Simpozijum Hemija i zaštita životne sredine EnviroChem 2015, 9-12. jun 2015, Palić, Knjiga izvoda radova str. 310-311, P 5/7
34. Kesić Ž., **Lukić I.**, Zdujić M., Liu H., Skala D., Heterogeneous synthesis of Biodiesel using $CaO \cdot ZnO \cdot K_2O$ as catalyst, 50. savetovanje SHD 14-15 jun 2012. u Beogradu, Knjiga izvoda radova str. 41
35. **Lukić I.**, Orlović A., Skala D., Kalijum-oksidi ili cink-oksidi na alumosilikatnom nosaču kao heterogeni katalizatori za sintezu biodizela, Čistije tehnologije i novi materijali - put u održivi razvoj, 2009, Abstrakt sekcija B7 str 49

Odbranjena doktorska disertacija (M71=6)

36. Kinetika heterogene metanolize svežeg i korišćenog biljnog ulja, Tehnološko-metalurški fakultet, Beograd, 2015

Odbranjen magistarski rad (M72=3)

37. Sinteza metil estara masnih kiselina sa heterogenim katalizatorom tipa kalijum-oksidi ili cink-oksidi na alumosilikatnom nosaču, Tehnološko-metalurški fakultet, Beograd, 2007

Tehnička rešenja (M83)

38. Skala D., Orlović A., Žižović I., Glišić S., Stamenić M., **Lukić I.**, Tehnološki postupak pripreme heterogenog katalizatora za sintezu metil estara masnih kiselina – MEMK na povišenim temperaturama i pritiscima, Projekat 6742B MNŽŽS, NIS Rafinerija Pančevo i TMF, 2007

39. Skala D., Orlović A., Žižović I., Glišić S., Stamenić M., **Lukić I.**, Tehničko rešenje procesa heterogeno katalizovane sinteze metil estara masnih kiselina – MEMK, Projekat 6742B MNŽŽS, NIS Rafinerija Pančevo i TMF, 2006
40. Skala D., Orlović A., Žižović I., Glišić S., Stamenić M., **Lukić I.**, Tehničko rešenje procesa nekatalitičke sinteze metil estara masnih kiselina– MEMK, Projekat 6742B MNŽŽS, NIS Rafinerija Pančevo i TMF, 2006

Učešće u projektima (pre izbora u zvanje naučni saradnik)

1. Nacionalni projekat „Razvoj tehnologije sinteze biodizela” Tehnološki razvoj, TR 6742, Ministarstvo za nauku i zaštitu životne sredine Republike Srbije (2005-2007)
2. Nacionalni projekat „Razvoj kontinualnih postupaka alkoholize biljnih ulja na niskoj, umerenoj i povišenoj temperaturi” Tehnološki razvoj, TR 19062, Ministarstvo za nauku i tehnološki razvoj Republike Srbije (2008-2011)
3. Nacionalni projekat „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima” Integralno-interdisciplinarna istraživanja, III 45001, Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije (2011-2019)
4. Međunarodni projekat “Heterogeneous process of biodiesel synthesis – catalyst preparation, characterization and testing” (2011-2012) projekat bilateralne saradnje između Republike Srbije i Narodne Republike Kine
5. Međunarodni projekat “Pilot research on heterogeneous biodiesel production” (2014-2015) naučno-istraživački projekat između Republike Srbije i Narodne Republike Kine

2.2. SPISAK RADOVA OBJAVLJENIH POSLE IZBORA U ZVANJE NAUČNI SARADNIK

Rad u međunarodnom časopisu izuzetnih vrednosti (M21a=10)

1. **Lukić I.**, Kesić Ž., Zdujić M., Skala D., Calcium diglyceroxide synthesized by mechanochemical treatment, its characterization and application as catalyst for fatty acid methyl esters production, *Fuel* 165 (2016) 159–165. doi:10.1016/j.fuel.2015.10.063; ISSN: 0016-2361; IF(2016)=4,601; 13/135 Engineering, Chemical. Broj heterocitata=19

Rad u vrhunskom međunarodnom časopisu (M21=8)

2. **Lukić I.**, Vulić J., Ivanović J., Antioxidant activity of PLA/PCL films loaded with thymol and/or carvacrol using scCO₂ for active food packaging, *Food Packaging and Shelf Life*, 26 (2020) 100578. doi:10.1016/j.fpsl.2020.100578; ISSN: 2214-2894; IF(2019)=4,244; 20/139 Food Science & Technology. Broj heterocitata=0
3. Zdujić M., **Lukić I.**, Kesić Ž., Janković-Častvan I., Marković S., Jovalekić Č., Skala D., Synthesis of CaO–SiO₂ compounds and their testing as heterogeneous catalysts for transesterification of sunflower oil, *Advanced Powder Technology* 30 (6) (2019) 1141–1150. doi:10.1016/j.appt.2019.03.009; ISSN: 0921-8831; IF(2019)=4,217; 30/143 Engineering, Chemical. Broj heterocitata=5
4. Liu H., **Lukić I.**, Miladinović M.R., Veljković V.B., Zdujić M., Zhu X., Zhang Y., Skala D.U., Continuous biodiesel production under subcritical condition of methanol –Design of pilot plant and packed bed reactor with MnCO₃/Na-silicate catalyst, *Energy Conversion and Management* 168 (2018) 494–504. doi:10.1016/j.enconman.2018.05.028; ISSN: 0196-8904; IF(2018)=7,181; 12/103 Energy and Fuels. Broj heterocitata=2
5. Nasreen S., Liu H., Ali Qureshi L., Sissou Z., **Lukić I.**, Skala D., Cerium–manganese oxide as catalyst for transesterification of soybean oil with subcritical methanol, *Fuel Processing Technology* 148 (2016) 76–84. doi:10.1016/j.fuproc.2016.02.035; ISSN: 0378-3820; IF(2015)=3,847; 18/135 Engineering, Chemical. Broj heterocitata=11

6. Kesić Ž., **Lukić I.**, Zdujić M., Jovalekić Č., Veljković V., Skala D., Assessment of CaTiO_3 , CaMnO_3 , CaZrO_3 and $\text{Ca}_2\text{Fe}_2\text{O}_5$ perovskites as heterogeneous base catalysts for biodiesel synthesis, *Fuel Processing Technology* 143 (2016) 162–168. doi:10.1016/j.fuproc.2015.11.018; ISSN: 0378-3820; IF(2015)=3,847; 18/135 Engineering, Chemical. Broj heterocitata=24

Rad u istaknutom međunarodnom časopisu (M22=5)

7. Pajnik J., **Lukić I.**, Dikić J., Asanin J., Gordić M., Misic D., Zizovic I., Korzeniowska M., Application of Supercritical Solvent Impregnation for Production of Zeolite Modified Starch-Chitosan Polymers with Antibacterial Properties, *Molecules* 25 (20) (2020) 4717 doi:10.3390/molecules25204717; ISSN:1420-3049; IF(2019)=3,267; 70/177 Chemistry, Multidisciplinary. Broj heterocitata=0

Rad u međunarodnom časopisu (M23=3)

8. Zhang Y., Liu H., Zhu X., **Lukić I.**, Zdujić M., Shen X., Skala D., Biodiesel synthesis and kinetic analysis based on MnCO_3/Na silicate as heterogeneous catalyst, *Journal of Serbian Chemical Society* 83 (3) (2018) 345–365. doi:10.2298/JSC170612005Z; ISSN:0352-5139; IF(2017)=0,828; 140/172 Chemistry, Multidisciplinary. Broj heterocitata=1
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Učešće u projektima (posle izbora u zvanje naučni saradnik)

1. Nacionalni projekat „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima” Integralno-interdisciplinarna istraživanja, III 45001, Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije, (2011–2019)
2. Međunarodni projekat “Green Chemical Engineering Network towards upscaling sustainable processes” broj CA18224 koji finansira Evropska kooperacija u Nauci i Tehnologiji (COST) u periodu (2019-2023)
3. Međunarodni projekat “Advanced Engineering and Research of aeroGels for Environment and Life Sciences” broj CA18125 koji finansira Evropska kooperacija u Nauci i Tehnologiji (COST) u periodu (2019-2023)

2.3. PET NAJZNAČAJNIJIH NAUČNIH OSTVARENJA OD PRETHODONG IZBORA U ZVANJE

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3. Liu H., **Lukić I.**, Miladinović M.R., Veljković V.B., Zdujić M., Zhu X., Zhang Y., Skala D.U., Continuous biodiesel production under subcritical condition of methanol –Design of

- pilot plant and packed bed reactor with $\text{MnCO}_3/\text{Na-silicate}$ catalyst, *Energy Conversion and Management* 168 (2018) 494–504. doi:10.1016/j.enconman.2018.05.028; ISSN: 0196-8904; IF(2018)=7,181; 12/103 Energy and Fuels. Broj heterocitata=2
4. Kesić Ž., Lukić I., Zdujić M., Jovalekić Č., Veljković V., Skala D., Assessment of CaTiO_3 , CaMnO_3 , CaZrO_3 and $\text{Ca}_2\text{Fe}_2\text{O}_5$ perovskites as heterogeneous base catalysts for biodiesel synthesis, *Fuel Processing Technology* 143 (2016) 162–168. doi:10.1016/j.fuproc.2015.11.018; ISSN: 0378-3820; IF(2015)=3,847; 18/135 Engineering, Chemical. Broj heterocitata=24
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Četiri od navedenih pet naučnih ostvarenja su rezultat rada na nacionalnom projektu III45001 „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima” koji je bio finansiran od strane Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije, dok je peti rad rezultat naučno-istraživačkog projekta između R Srbije i NR Kine, pod nazivom “Pilot research on heterogeneous biodiesel production”.

2.4. ANALIZA RADOVA KOJI KANDIDATKINJU KVALIFIKUJU ZA IZBOR U ZVANJE VIŠI NAUČNI SARADNIK

Naučno-istraživački rad dr Ivane Lukić nakon izbora u prethodno zvanje može se podeliti u dve grupe. Prva, dominantna grupa radova posvećena je razvoju i unapređenju tehnologija sinteze biodizela, pre svega istraživanjima iz oblasti heterogeno katalizovane metanolize rafiniranih i korišćenih biljnih ulja. Pored sinteze i karakterizacije katalizatora, i ispitivanja njihove efikasnosti i stabilnosti u sintezi biodizela, posebna pažnja posvećena je analizi kinetike procesa metanolize, pri čemu je korišćen kinetički model razvijen u okviru doktorske disertacije kandidatkinje i testirana mogućnost njegove primene za određivanje brzine procesa metanolize pri različitim operativnim uslovima uključujući i upotrebu različitih katalitičkih materijala.

Najveći deo istraživanja iz oblasti biodizela odnosi se na upotrebu kalcijum oksida. CaO , bilo kao čisto jedinjenje, mešoviti oksid ili na nosaču, zbog svoje velike aktivnosti, niske cene i mogućnosti dobijanja iz otpadnih sirovina, jedan je od najviše ispitivanih heterogenih katalizatora za sintezu biodizela. U okviru ovih istraživanja kandidatkinje, različiti katalizatori na bazi CaO dobijeni su mehanohemijskim putem i nakon detaljne karakterizacije (TGA/DTA, XRD, SEM-EDS, FTIR, N_2 adsorpcija-desorpcija, određivanje baznosti metodom Hammetovih indikatora, rastvorljivosti u metanolu i raspodele veličine čestica), korišćeni u reakciji metanolize suncokretovog ulja u šaržnom reaktoru. U radu 2.2/1 pokazano je da se mehanohemijskim tretmanom suspenzije CaO i glicerola u trajanju od 5 h i uz dodatak male količine metanola pred kraj mlevenja može dobiti kalcijum digliceroksid (CaDG). Pripremljeni katalizator je testiran u metanolizi suncokretovog ulja pri različitim procesnim parametrima: količina katalizatora, intenzitet mešanja, temperatura i molski odnos metanol:ulje. Nađeno je da je glavna prednost korišćenja CaDG kao katalizatora smanjenje otpora prenosa mase u početnim stupnjevima metanolize, jer u njegovom prisustvu dolazi do boljeg dispergovanja metanola u ulju uz stvaranje fine disperzije ove dve praktično nemešljive tečnosti. Kinetički model, prethodno razvijen u okviru doktorske disertacije, primenjen je za simulaciju metanolize suncokretovog ulja korišćenjem CaDG kao katalizatora, i nađeno je da on dobro opisuje eksperimentalne rezultate. Za razliku od CaDG , potpuna sinteza cink glicerolata mehanohemijskim putem nije postignuta (2.2/23).

Sinteza, karakterizacija i ispitivanje katalitičke aktivnosti serije mešovityh oksida perovskitske strukture CaTiO_3 , CaMnO_3 , CaZrO_3 i $\text{Ca}_2\text{Fe}_2\text{O}_5$ prikazani su u publikacijama 2.2/6, 2.2/13, 2.2/24 i 2.2/27. Rezultati XRD i EDS analize potvrdili su da su dobijeni čisti, jednofazni materijali, međutim pokazano je da čisti perovskiti ne poseduju katalitičku aktivnost na temperaturi od 60 °C u metanolizi suncokretovog ulja, dok se na temperaturi od 165 °C postižu visoki prinosi već nakon 2 h reakcije. Smeše prahova CaO i silika-gela (SiO_2) u molarnim odnosima 1:1, 1,5:1, 2:1 i 3:1 mehanohemijski su tretirane sa dodatkom vode, i dobijeni materijal žareni sa ciljem sintetizovanja jedinjenja CaSiO_3 , $\text{Ca}_3\text{Si}_2\text{O}_7$, Ca_2SiO_4 i $\text{CaO}/\text{Ca}_2\text{SiO}_4$ dvofazne smeše (2.2/3, 2.2/14, 2.2/22 i 2.2/27). Katalitička aktivnost ovako dobijenih kalcijum silikatnih jedinjenja sa različitim odnosom Ca/Si ispitivana je u transesterifikaciji triacilglicerola (suncokretovo ulje) sa metanolom. Uzorci nominalnog sastava $2\text{CaO}\cdot\text{SiO}_2$ i $3\text{CaO}\cdot\text{SiO}_2$ žareni na 700 °C, kao i uzorak $3\text{CaO}\cdot\text{SiO}_2$ žaren na 900 °C pokazali su visoku aktivnost sa konverzijom triacilglicerola i prinosom metil estara masnih kiselina (MEMK) većim od 96%. Aktivnost ovih uzoraka je pripisana prisustvu slobodnog CaO definisanog kompleksnom smešom $\text{CaO}/\text{Ca}_2\text{SiO}_4$. Ispitivana je i stabilnost i deaktivacija katalizatora sa osnovom CaO , i to $\text{CaO}\cdot\text{ZnO}$ i $3\text{CaO}\cdot\text{SiO}_2$ mešovityh oksida u reakciji transesterifikacije suncokretovog ulja na 60 °C, kao i mogućnost ponovnog korišćenja (2.2/3 i 2.2/17). Katalizator nominalnog sastava $3\text{CaO}\cdot\text{SiO}_2$ pokazao je dobru stabilnost, sa prinosom većim od 97% tokom četiri ciklusa, dok je za $\text{CaO}\cdot\text{ZnO}$ uočen pad aktivnosti posle trećeg uzastopnog korišćenja. Karakterizacija katalizatora posle reakcije pokazala je da je uočena deaktivacija katalizatora verovatno posledica blokade aktivnih centara adsorpcijom organskih jedinjenja iz reakcione smeše.

U dvostepenom procesu sinteze MEMK, CaO je primenjen u prvom stupnju procesa za predtretman korišćenog ulja sa ciljem da se adsorpcijom uklone slobodne masne kiseline (2.2/26). Adsorpcioni proces je efikasan, ekološki metod, u kom se troši malo energije, uz minimalne gubitke ulja. Nakon toga, u drugom stupnju, izvedena je reakcija metanolize tretiranog ulja korišćenjem mehanohemijski dobijenog $\text{CaO}\cdot\text{ZnO}$ čvrstog katalizatora na temperaturi od 60 °C pri čemu je ostvaren visok prinos MEMK od 96% već nakon 15 minuta reakcije. Pepeo ljuske oraha, koji se sastoji od metalnih oksida, uglavnom CaO i K_2O , pokazao je dobru katalitičku aktivnost u metanolizi suncokretovog ulja sa prinosom većim od 98% već nakon 10 min (2.2/29). Rad 2.2.10 je pregledni rad u kom je detaljno obrađena primena katalizatora na bazi CaO u sintezi biodizela. Analizirane su mogućnosti primene čistog CaO kao i različitih baznih jedinjenja sa CaO kao aktivnom komponentom, načini njihove pripreme, aktivnost u procesu transesterifikacije, kinetika procesa, kao i mogućnosti unapređenja postojećih i razvoja novih procesa dobijanja biodizela korišćenjem ovog tipa katalizatora.

Za proizvodnju biodizela većeg kapaciteta kontinualni procesi imaju prednost u odnosu na šaržne jer poboljšavaju ukupni ekonomski efekat, obezbeđujući nižu proizvodnu cenu i uniformniji kvalitet proizvoda, a olakšavaju i kontrolu procesa. Publikacije 2.2/4, 2.2/8, 2.2/9 i 2.2/25, proistekle iz međunarodnog naučno-istraživačkog projekta sa Kinom, posvećene su razvoju katalizatora koji je pogodan za primenu u kontinualnom procesu, kao i analizi kinetike procesa kako bi se dobili podaci koji će omogućiti projektovanje cevnog reaktora sa pakovanim slojem katalizatora. U radu 2.2/9 MnCO_3 je korišćen u transesterifikaciji sojinog ulja pri subkritičnim uslovima metanola i različitim procesnim parametrima: količina katalizatora, temperatura i molski odnos metanol:ulje. Najpre je pokazana visoka aktivnost i dobra stabilnost u šaržnom reaktoru, što je zatim potvrđeno i pri kontinualnoj transesterifikaciji u maloj HPLC koloni, gde je i nakon 17 dana konverzija triacilglicerola bila skoro potpuna. Karakterizacija (XRD, SEM/EDS, FTIR) je pokazala da tokom 370 h kontinualnog procesa nije došlo do promene kristalne strukture katalizatora, već samo do adsorpcije organskih jedinjenja na aktivne centre, kao i izluživanja Mn. Takođe je pokazano da kompleksni kinetički modeli, koji se zasnivaju na prenosu mase i hemijskoj reakciji na površini katalizatora, mogu

veoma efikasno da predvide konverziju triacilglicerola. Cilj daljeg istraživanja bio je da se MnCO_3 pripremi u obliku granula kako bi bio pogodan za primenu u većem, industrijskom postrojenju. MnCO_3 je pomešan sa Na-silikatom i odnos polaznih komponentata je optimizovan da bi se ekstrudiranjem dobile čestice odgovarajuće čvrstoće i prečnika 0,99–1,99 mm (2.2/8). Katalizator je testiran pri različitim radnim uslovima (količina katalizatora, temperatura, vreme reakcija i molski odnos metanol:ulje) u šaržnom reaktoru (2.2/8 i 2.2/25). Utvrđeno je i da dobijeni katalizator ima dobru stabilnost, sa ostvarenih 99% konverzije triacilglicerola i 97,5% prinosa MEMK posle 8 uzastopnih ciklusa korišćenja. Kinetika procesa transesterifikacije analizirana je korišćenjem 3 modela: jednostavnog modela nepovratne reakcije prvog reda, kao i 2 kompleksna modela, pri čemu je najbolje slaganje sa eksperimentalnim podacima postignuto primenom modela koji je razvijen u okviru doktorske disertacije kandidatkinje. Primenjene su različite tehnike karakterizacije katalizatora pre reakcije i posle 9 ciklusa uzastopnog korišćenja, i utvrđeno je da dolazi do izluživanja Na i Mn, pogotovo u prvom ciklusu, nakon čega ono postaje značajno slabije. Na osnovu rezultata ispitivanja u laboratorijskim uslovima projektovano je pilot postrojenje za sintezu biodizela iz sojinog ulja pri subkritičnim uslovima metanola i u prisustvu $\text{MnCO}_3/\text{Na-silikata}$ kao heterogenog katalizatora (2.2/4). Analizirana je kinetika reakcije metanolize izvedene eksperimentalno u šaržnim uslovima na temperaturi od 175 °C i pritisku od 25 bar pri molskom odnosu metanol:ulje 18:1 i različitim količinama katalizatora (5, 10 i 20 % u odnosu na masu ulja), a dobijeni podaci su iskorišćeni za projektovanje cevnog reaktora sa pakovanim slojem katalizatora kao glavne jedinica pilot postrojenja kapaciteta 100 L/dan. Projektovano pilot postrojenje testirano je pri različitim operativnim uslovima. Praćen je rad pilot postrojenja kao i proces metanolize u toku 85 h kontinualnog rada i analizirani su maseni bilansi procesa. Postignuti su visoki stepen konverzije sojinog ulja (99,8 %) i prinos MEMK (>97,5 %), pri čemu je karakterizacijom utvrđeno da nije došlo do strukturnih promena katalizatora.

U radu 2.2/11 analizirana je kinetika reakcije transesterifikacije na visokoj temperaturi katalizovana različitim katalizatorima. Primenjena su tri modela: model reakcije prvog reda, kao i dva kompleksna modela – model sa promenljivim redom reakcije i model koji uključuje otpor prenosu mase i hemijsku reakciju na površini katalizatora. Rad 2.2/5 bavi se sintezom, karakterizacijom i testiranjem katalitičke aktivnosti katalizatora na bazi Ce i Mn oksida u metanolizi sojinog ulja pri subkritičnim uslovima metanola. Katalizator je pokazao dobru aktivnost i stabilnost čak i pri sadržaju vode i slobodnih masnih kiselina u ulju od 1,5 i 3%.

Druga grupa radova dr Ivane Lukić odnosi se na oblast primene natkritičnih fluida. Ova istraživanja obuhvataju proces impregnacije bioaktivnih komponenata na biodegradabilne polimerne filmove, kao i ekstrakcije iz biljnih sirovina, uz pomoć natkritičnog ugljenik (IV)-oksida u cilju dobijanja materijala sa antimikrobnim i antioksidativnim dejstvima koji mogu imati primenu u industriji hrane, farmaciji i medicini. Polimerni filmovi poli (mlečne kiseline)/poli (ϵ -kaprolaktona) (PLA/PCL) dobijeni su metodom izlivanja a zatim imregnirani timolom, karvakrolom ili njihovom smešom upotrebom natkritičnog CO_2 na temperaturi od 40 °C, pritisku od 100 bar i vremenu impregnacije od 5 h (2.2/.2, 2.2/15 i 2.2/28). Analizirane su morfološke, strukturne i mehaničke osobine dobijenih filmova, kao i njihova antioksidativna aktivnost i sadržaj polifenola. Takođe je ispitana i kinetika otpuštanja aktivne supstance u destilovanoj vodi i modelovana primenom četiri modela od kojih su Korsmeyer-Peppas i Weibull modeli pokazali najbolje slaganje sa eksperimentalnim podacima (2.2/2). Rezultati su ukazali na veliki potencijal dobijenih filmova kao materijala za aktivno pakovanje hrane. Za istu namenu pripremljeni su i biodegradabilni filmovi na bazi skroba i hitozana i imregnirani timolom primenom natkritičnog CO_2 (2.2/7 i 2.2/21). Dodatak prirodnog zeolita povećao je kapacitet filmova omogućivši prinos impregnacije od 24%, a ovi filmovi pokazali su i jaku antibakterijsku aktivnost protiv bakterija *Staphylococcus aureus* i *Escherichia coli*. Superiornost natkritične imregnacije u odnosu na klasičnu, vlažnu impregnaciju, pokazana je u

slučaju prirodnog zeolita-klinoptilolita koji je impregniran timolom u svrhu dobijanja dezificijensa sa dokazanim antibakterijskim dejstvom (2.2/12). Natkritična ekstrakcija iz semena badelja upoređena je sa konvencionalnom metodom ekstrakcije u aparaturi po Soxhletu upotrebom *n*-heksana i etanola (2.2/16). Iako su obe metode omogućile izdvajanje slične količine ekstrakta, hemijskom analizom utvrđeno je da etanolni ekstrakt sadrži najveću količinu bioaktivne komponente silimarina. Integrisani process ekstrakcije iz matičnjaka i impregnacije pamučne gaze pomoću natkritičnog CO₂, uspešno je izveden sa ciljem da se dobije materijal sa antivirusnom aktivnošću za potencijalnu topikalnu primenu (2.2/18).

2.5. CITIRANOST NAUČNIH RADOVA (bez autocitata) PREMA BAZI SCOPUS

(na dan 22.10.2020)

Radovi dr Ivane Lukić citirani su ukupno 472 puta (bez autocitata svih autora), dok je Hiršov indeks (*h*-indeks) 12, odnosno 11 (bez autocitata), prema Scopus bazi na dan 22.10.2020. Citirani su sledeći radovi:

Zdujić M., Lukić I., Kesić Ž., Janković-Častvan I., Marković S., Jovalekić Č., Skala D., Synthesis of CaO–SiO₂ compounds and their testing as heterogeneous catalysts for transesterification of sunflower oil, *Advanced Powder Technology* 30 (6) (2019) 1141–1150.

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KVALITATIVNA OCENA NAUČNIH REZULTATA

3. KVALITET NAUČNIH REZULTATA

3.1. Naučni nivo, značaj i primenljivost rezultata

Naučna aktivnost dr Ivane Lukić posvećena je razvoju i unapređenju tehnologija sinteze biodizela, pre svega istraživanjima iz oblasti heterogeno katalizovane metanolize biljnih ulja. Pored sinteze i karakterizacije katalizatora, i ispitivanja njihove aktivnosti i stabilnosti u sintezi biodizela, posebna pažnja posvećena je analizi kinetike procesa metanolize, kao i definisanju kinetičkog modela i testiranju mogućnosti njegove primene za određivanje brzine procesa metanolize pri različitim operativnim uslovima. Pored toga, poslednjih godina njeno interesovanje prenelo se na oblast primene natkritičnih fluida. Ova istraživanja odnose se na proces impregnacije bioaktivnih komponenti na biodegradabilne polimerne filmove, kao i ekstrakcije bioaktivnih jedinjenja iz biljnih sirovina uz pomoć natkritičnog ugljenik (IV)-oksida u cilju dobijanja materijala sa antimikrobnim i antioksidativnim dejstvima koji mogu imati primenu u industriji hrane, farmaciji i medicini. Na osnovu sprovedenih istraživanja razvijeni su novi postupci i katalizatori za sintezu biodizela kao i postupci za dobijanje unapređenih materijala za pakovanje hrane i definisano je 7 tehnička rešenja (4 nakon izbora). U dosadašnjem naučno-istraživačkom radu objavila je ukupno 21 naučni rad kategorije M20 od kojih su 5 radova u vrhunskom međunarodnom časopisu izuzetnih vrednosti (M21a) (1 nakon izbora u prethodno zvanje), 7 radova u vrhunskom međunarodnom časopisu (M21) (5 nakon izbora u prethodno zvanje), 1 rad u istaknutom međunarodnom časopisu (M22) (nakon izbora u prethodno zvanje) i 8 radova u časopisu međunarodnog značaja (M23) (4 nakon izbora u prethodno zvanje) sa ukupnim zbirom impakt faktora **58,400** od čega **34,304** posle izbora u prethodno zvanje. Do sada, radovi su ukupno citirani **582** puta, odnosno **472** puta bez autocitata svih autora, što ukazuje na njihov naučni nivo i uticajnost u ovoj istraživačkoj oblasti i potvrđuje njihov visok kvalitet. Rad M21a objavljen u časopisu *Bioresource Technology* (IF=4,453), na kom je dr Ivana Lukić prvi autor, citiran je **138** puta (bez autocitata svih autora). Od radova koji su objavljeni nakon prethodnog izbora u zvanje, najveći broj heterocitata (**38**) ima revijski rad kategorije M23 (2.2/10) kome je kandidatkinja dala doprinos analizom kinetike reakcije i uticaja operativnih uslova na sintezu biodizela primenom katalizatora na bazi CaO, a veliki broj puta (**19**) citiran je i rad (2.2/1) kategorije M21a koji je objavljen u vrhunskom međunarodnom časopisu izuzetnih vrednosti sa impakt faktorom **4,601**, a na kom je kandidatkinja prvi autor. Dr Ivana Lukić dala je posebne doprinose u razvoju heterogeno katalizovanih procesa metanolize biljnih ulja, pre svega definisanju kinetičkog modela i testiranju mogućnosti njegove primene za određivanje brzine procesa metanolize pri različitim operativnim uslovima u okviru tima koji je realizovao nekoliko projekata koje je finansiralo Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije, a čiji su rezultati objavljeni u 16 originalnih naučnih radova od kojih su dva rada zasnovana direktno na rezultatima doktorske disertacije kandidatkinje, a još 5 radova bavilo se kinetičkim modelom razvijenim u okviru disertacije. U okviru međunarodnog projekta učestvovala je u analizi kinetike procesa kako bi se dobili podaci koji će omogućiti projektovanje cevnog reaktora sa pakovanim slojem katalizatora kao glavne jedinice pilot postrojenja, a kao rezultat objavljen je jedan rad kategorije M21 u vrhunskom međunarodnom časopisu impakt faktora **7,181** i 2 rada M23 kategorije.

Praktičan značaj postignutih rezultata ispitivanja koje je kandidatkinja realizovala u okviru projekta koji je finansiran od strane Ministarstva prosvete, nauke i tehnološkog razvoja Republike Srbije potvrđuje 7 tehničkih rešenja od kojih su 4 nakon izbora u prethodno zvanje (2.2/26, 2.2/27, 2.2/28 i 2.2/29), a koja je Matični naučni odbor za Materijale i hemijske tehnologije prihvatio u kategoriji M85. Tehnička rešenja 2.2/26, 2.2/27 i 2.2/29 odnose se na

sintezu biodizela primenom heterogenih katalizatora, dok je je tehničko rešenje 2.2/28 bazirano na rezultatima ispitivanja dobijanja biodegradabilnih filmova impregniranih timolom koji se mogu primeniti za dobijanje aktivnog pakovanja.

3.2. Uticajnost, citiranost i parametri kvaliteta časopisa

U svom dosadašnjem radu dr Ivana Lukić je bila autor/koautor 22 naučna rada i to u vrhunskim međunarodnim časopisima izuzetnih vrednosti (M21a) 5 radova, u vrhunskim međunarodnim časopisima (M21) 7 radova, u istaknutom međunarodnom časopisu (M22) 1 rad, u međunarodnim časopisima (M23) 8 radova i 1 naučni rad objavljen u vrhunskom časopisu nacionalnog značaja (M51). Jedan rad je objavljen u međunarodnom časopisu sa impakt faktorom većim od 7, četiri rada u časopisu sa impakt faktorom većim od 4, pet radova u časopisima sa impakt faktorom većim od 3, dva radu u časopisima sa impakt faktorom većim od 2 i četiri rada u časopisima sa impakt faktorom manjim od 1. Ukupan zbir impakt faktora časopisa objavljenih radova je **58,400**.

Posle izbora u prethodno zvanje, kandidatkinja je autor/koautor 11 naučnih radova, od toga 1 rad u vrhunskom međunarodnom časopisu izuzetnih vrednosti (M21a), 5 radova u vrhunskim međunarodnim časopisima (M21), 1 rad u istaknutom međunarodnom časopisu (M22) i 4 rada u međunarodnim časopisima (M23). Ukupan zbir impakt faktora časopisa u kojima je kandidatkinja objavila radove posle izbora u prethodno zvanje je **34,304**. Jedan rad je objavljen u međunarodnom časopisu sa impakt faktorom većim od 7, tri rada u časopisu sa impakt faktorom većim od 4, tri rada u časopisima sa impakt faktorom većim od 3 i četiri rada u časopisima sa impakt faktorom manjim od 1.

Citiranost radova prema Scopus bazi podataka (na dan 22.10.2020) iznosi ukupno **582**, odnosno **472** bez autocitata svih autora, dok je Hiršov indeks (*h*-indeks) **12**, odnosno **11** (bez autocitata). Velika pozitivna citiranost radova kandidata ukazuje na aktuelnost, uticajnost, kvalitet i značaj objavljenih radova. Radovi kandidatkinje su citirani u uticajnim časopisima M21a kategorije: Chemical Society Reviews (IF=42,846), Progress in Energy and Combustion Science (IF=28,938), Applied Catalysis. B: Environmental (IF=16,683), Renewable and Sustainable Energy Reviews (IF=10,556), Chemical Engineering Journal (IF=10,652), Applied Energy (IF=8,426), Energy Conversion and Management IF=8,208), Bioresource Technology (IF=6,669). Rad u časopisu Bioresource Technology, na kom je dr Ivana Lukić prvi autor, citiran je 138 puta (bez autocitata).

3.3. Ocena samostalnosti kandidatkinje

U toku dosadašnjeg naučno-istraživačkog rada, dr Ivana Lukić je pokazala visok stepen samostalnosti u organizaciji naučnog rada, osmišljavanju istraživanja, kreiranju i izvođenju eksperimenata, interpretaciji dobijenih rezultata i pisanju publikacija koje se u najvećem broju odnose na istraživanja iz oblasti sinteze i karakterizacije katalizatora za dobijanje biodizela, njihove aktivnosti u procesu metanolize, kao i analize i modelovanja kinetike procesa. Pokazala je spremnost za sticanje novih znanja i multidisciplinarni pristup kroz ispitivanja u novim naučnim oblastima koja se odnose na procese pod visokim pritiscima upotrebom natkritičnog CO₂. Doprinos u koautorskim radovima ogleda se u eksperimentalnom izvođenju procesa metanolize i procesa pod visokim pritiscima, primeni kinetičkih modela za simulaciju procesa metanolize, karakterizaciji materijala, kao i analizi i diskusiji dobijenih rezultata i pisanju publikacija. Objavila je ukupno 22 rada, 3 poglavlja, 37 saopštenja na konferencijama u zemlji i inostranstvu i 7 tehničkih rešenja. Prosečan broj autora po radu za radove iz kategorije M20 je 5,52, a kandidatkinja je prvi autor u 7 radova, a drugi autor u 9 radova M20 kategorije.

Dr Ivana Lukić je rukovodila projektnim zadatkom „Proces dobijanja biodizela iz jestivih i korišćenih biljnih ulja primenom katalizatora dobijenih mehanohemijskim tretmanom” koji je obuhvatao ispitivanje katalitičke aktivnosti različitih materijala dobijenih mehanohemijskom sintezom u procesu heterogeno katalizovane sinteze biodizela, analizu uticaja procesnih parametara na brzinu procesa i matematičko modelovanje kinetike procesa metanolize, kao i karakterizaciju sintetisanih katalizatora i proizvoda metanolize u okviru projekta III 45001 „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima”. Trenutno, dr Ivana Lukić rukovodi zadatkom „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima“ u okviru Plana rada NIO - Tehnološko-metalurškog fakulteta, Univerziteta u Beogradu za 2020. godinu. Kao dokazi, priložene su potvrda rukovodioca projekta III45001 i rešenje dekana TMF (Prilog 4).

Kandidatkinja je učestvovala u izradi tri završna, jednog diplomskog i dva master rada i dve doktorske disertacije koji su odbranjeni na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu.

Dr Ivana Lukić je recenzirala 31 rad kategorije M20 (*Renewable and Sustainable Energy Reviews, Fuel, Fuel Processing Technology, Journal of Cleaner Production, Journal of Advanced Research, Industrial Crops and Products, Bioresource Technology, Industrial and Engineering Chemistry Research, Chemical Engineering & Technology, Energy and Fuel, Green Chemistry Letters and Reviews, Reaction Kinetics, Mechanisms and Catalysis, Chemical Industry and Chemical Engineering Quarterly*). Kao dokaz, priložene su potvrde o recenziranju (Prilog 1).

3.4. Angažovanost u formiranju naučnih kadrova

Pored naučno-istraživačkog rada, dr Ivana Lukić je dala značajan doprinos u formiranju naučnih kadrova učestvovanjem u izradi završnih, diplomskih, master i doktorskih radova. Kandidatkinja je učestvovala u izradi dva master rada: „Antibakterijska aktivnost kompozita prirodni zeolit/timol” Teodore Todorović (2020) i „Sinteza, karakterizacija i potencijalna primena kompozita prirodni zeolit/karvakrol” Sanje Vučić (2020). Takođe, učestvovala je u izradi dve doktorske disertacije: Željke Kesić pod nazivom „Sinteza i karakterizacija katalizatora na bazi mešovitih oksida kalcijuma i drugih metala i ispitivanje njihove aktivnosti u procesu heterogeno katalizovane sinteze biodizela“ (2017) i Svetolika Maksimovića pod nazivom „Ekstrakcija iz smilja (*Helichrysum italicum*) i impregnacija čvrstih nosača ekstraktom primenom natkritičnog ugljenik(IV)-oksida” (2017) koje su urađene u okviru projekta III45001 i odbranjene na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu. U realizaciji ovih disertacija rukovodila je eksperimentalnim ispitivanjima aktivnosti sintetizovanih katalizatora u procesu metanolize suncokretovog ulja i učestvovala u izvođenju hidrodestilacije i ekstrakcije iz smilja primenom natkritičnog CO₂, bila je uključena i u analizu i diskusiju rezultata i pisanje publikacija, a rezultati su objavljeni u radovima kategorije M21a (2.1/2), M21 (2.1/6) i M23 (2.1/7). Kao dokaz, priloženi su zajednički radovi i zahvalnice (Prilog 2).

3.5. Normiranje broja poena prema broju koautora

Prema kriterijumima Pravilnika o postupku i načinu vrednovanja i kvantitativnom iskazivanju naučno-istraživačkih rezultata, normiranju podležu jedan rad kategorije M21 i jedan rad kategorije M22, što je uzeto u obzir pri kvantitativnom iskazivanju naučno-istraživačkih rezultata kandidatkinje.

3.6. Rukovođenje projektima, potprojektima i zadacima

U toku angažovanja na projektu III 45001 pod nazivom „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima”, dr Ivana Lukić je rukovodila projektnim zadatkom „Proces dobijanja biodizela iz jestivih i korišćenih biljnih ulja primenom katalizatora dobijenih mehanohemijskim tretmanom” koji je obuhvatao ispitivanje katalitičke aktivnosti različitih materijala u procesu heterogeno katalizovane sinteze biodizela, analizu uticaja procesnih parametara na brzinu procesa i matematičko modelovanje kinetike procesa metanolize, kao i karakterizaciju sintetisanih katalizatora i proizvoda metanolize. Trenutno, dr Ivana Lukić rukovodi zadatkom „Nanostrukturni funkcionalni i kompozitni materijali u katalitičkim i sorpcionim procesima“ u okviru Plana rada NIO - Tehnološko-metalurškog fakulteta, Univerziteta u Beogradu za 2020. godinu. Potvrda o rukovođenju projektnim zadatkom rukovodioca projekta III45001 i rešenje dekana TMF su priloženi kao dokaz (Prilog 4).

4. OSTALI POKAZATELJI USPEHA U NAUČNOM RADU

Recenzije naučnih radova

Dr Ivana Lukić recenzirala je 31 rad iz kategorije M20:

- *Renewable and Sustainable Energy Reviews: RSER-D-18-01718, RSER-D-18-01718R1, RSER-D-18-01718 R2 (2018)*
- *Fuel: JFUE-D-12-01220 (2012), JFUE-D-14-00617 (2014), JFUE-D-18-02145 (2018), JFUE-D-18-04681 (2018), JFUE-D-20-07050 (2020)*
- *Fuel Processing Technology: FUPROC_2017_1033 (2017), FUPROC_2019_959 (2019)*
- *Journal of Cleaner Production: JCLEPRO-D-19-05537 (2019), JCLEPRO-D-20-19257 (2020)*
- *Journal of Advanced Research: JARE-D-18-01855 (2018)*
- *Industrial Crops and Products: INDCRO-D-20-03238 (2020)*
- *Bioresource Technology: BITE-D-12-01618 (2012)*
- *Industrial and Engineering Chemistry Research: ie-2017-04963f (2017), ie-2017-04963f.R1 (2017)*
- *Chemical Engineering & Technology: ceat.201500228 (2015), ceat.201600057 (2016), ceat.201600250 (2016)*
- *Energy and Fuels: ef-2016-01257d (2016)*
- *Green Chemistry Letters and Reviews GCL-2017-0145 (2017), GCL-2017-0145.R1 (2017), GCL-2017-0145.R2 (2017)*
- *Reaction Kinetics, Mechanisms and Catalysis: REAC-D-14-00153 (2014), REAC-D-14-00340 (2014), REAC-D-16-00141 (2016), REAC-D-16-00421 (2016), REAC-D-17-00650 (2017), REAC-D-20-00039 (2020)*
- *Chemical Industry and Chemical Engineering Quarterly: CICEQ_4116 (2015)*

Kao dokaz, dostavljene su potvrde o recenziranju (Prilog 1).

KVANTITATIVNA OCENA NAUČNIH REZULTATA

Pregled ukupnih koeficijenata naučne kompetentnosti dr Ivane Lukić posle izbora u naučno zvanje naučni saradnik je prikazan u Tabeli 1.

Tabela 1. Pregled ukupnih koeficijenata naučne kompetentnosti

Naziv grupe	Vrsta rezultata	Oznaka rezultata	Vred. koef.	Br. radova	Σ
Radovi objavljeni u naučnim časopisima međunarodnog značaja	Rad u vrhunskom međunarodnom časopisu izuzetnih vrednosti	M21a	10	1	10
	Rad u vrhunskom međunarodnom časopisu	M21	8	5	38,67*
	Rad u istaknutom međunarodnom časopisu	M22	5	1	4,17*
	Rad objavljen u međunarodnom časopisu	M23	3	4	12
Saopštenje sa međunarodnih skupova	Saopštenje sa međunarodnog skupa štampano u celini	M33	1	3	3
	Saopštenje sa međunarodnog skupa štampano u izvodu	M34	0,5	9	4,5
Saopštenje sa skupova nacionalnog značaja	Saopštenje sa nacionalnog skupa štampano u izvodu	M64	0,2	2	0,4
Tehnička rešenja i razvojna rešenja	Novo tehničko rešenje u fazi realizacije	M85	2	4	8
Ukupno					80,74

*Jedan rad kategorije M21 i jedan rad M22 su normirani (6,67 umesto 8 poena i 4,17 umesto 5).

Minimalni kvantitativni zahtevi za sticanje naučnog zvanja viši naučni saradnik za tehničko-tehnološke i biotehničke nauke

Diferencijalni uslov od prvog izbora u zvanje naučni saradnik do izbora u zvanje viši naučni saradnik	Neophodno	Ostvareno
Ukupno	50	80,74
Obavezni (1): M10+M20+M31+M32+M33+M41+M42+M51+M80+M90+M100	40	75,84
Obavezni (2) M21+M22+M23+M81-85+M90-96+M101-103+M108	22	72,84
M21+M22+M23	11	64,84
M81-85+M90-96+M101-103+M108	5	8

ZAKLJUČAK

Na osnovu uvida u priloženu dokumentaciju i ostvarenih kvantitativnih i kvalitativnih rezultata kandidatkinje, Komisija za utvrđivanje naučne kompetentnosti konstatuje da rezultati naučno-istraživačkog rada dr Ivane Lukić predstavljaju značajan naučni doprinos razvoju novih postupaka sinteze biodizela. Dr Ivana Lukić je objavila ukupno 22 rada, 37 saopštenja na konferencijama, 7 tehničkih rešenja i 3 poglavlja. Ukupan zbir impakt faktora objavljenih radova kandidatkinje iznosi **58,400**, citirani su **472** puta (bez autocitata svih autora), a Hiršov indeks (*h-index*) je **12**, odnosno **11** bez autocitata što ukazuje na njihovu veliku uticajnost. Nakon izbora u prethodno zvanje kandidatkinja je objavila ukupno 11 radova i to 1 rad u

vrhunskom međunarodnom časopisu izuzetnih vrednosti (M21a), 5 radova u vrhunskim međunarodnim časopisima (M21), 1 rad u istaknutom međunarodnom časopisu (M22), 4 rada u međunarodnim časopisima (M23), 12 saopštenja na skupovima međunarodnog i 2 saopštenja na skupovima nacionalnog značaja, 2 poglavlja u međunarodnim knjigama (nekategorisano) i 4 tehnička rešenja kategorije M85 priznata od Matičnog naučnog odbora za materijale i hemijske tehnologije. Kandidatkinja je pokazala izuzetan nivo samostalnosti i kreativnosti u organizaciji naučnog rada, planiranju i realizaciji eksperimenata, analizi i obradi rezultata, kao i u pisanju radova. Pored angažovanja u realizaciji nacionalnih projekata, dr Ivana Lukić je bila angažovana na dva međunarodna projektu, a trenutno je angažovana na realizaciji još 2 međunarodna projekta. Rezultati naučno-istraživačkog rada dr Ivane Lukić predstavljaju značajan naučni doprinos razvoju novih postupaka sinteze biodizela, posebno razvoju heterogeno katalizovanog procesa i kinetičkog modela koji može imati primenu u projektovanju industrijskog postrojenja za proizvodnju biodizela. Kroz rukovođenje projektnim zadacima i učešćem u izradama završnih, diplomskih i master radova i doktorskih disertacija kandidatkinja je pokazala sposobnost samostalnog organizovanja naučnog rada.

Na osnovu detaljne analize dosadašnjeg rada i ostvarenih rezultata, Komisija smatra da su postignuti rezultati naučno-istraživačkog rada kandidatkinje značajni i da dr Ivana Lukić ispunjava sve uslove za sticanje naučnog zvanja VIŠI NAUČNI SARADNIK u oblasti Tehničko-tehnoloških nauka u skladu sa Pravilnikom o postupku i načinu vrednovanja i kvantitativnom iskazivanju naučno-istraživačkih rezultata istraživača ("Sl. glasnik RS" br. 24/2016, 21/2017 i 38/2017). Komisija predlaže Nastavno-naučnom veću Tehnološko-metalurškog fakulteta u Beogradu da ovaj izveštaj prihvati i isti prosledi Ministarstvu prosvete, nauke i tehnološkog razvoja Republike Srbije na konačno usvajanje.

U Beogradu, 25.11.2020. godine

ČLANOVI KOMISIJE:

Dr Aleksandar Orlović, redovni profesor
Univerzitet u Beogradu, Tehnološko-metalurški fakultet
Naučna oblast Hemijsko inženjerstvo

Dr Nikola Nikačević, redovni profesor
Univerzitet u Beogradu, Tehnološko-metalurški fakultet
Naučna oblast Hemijsko inženjerstvo

Dr Jugoslav Krstić, viši naučni saradnik
Univerzitet u Beogradu, Institut za hemiju, tehnologiju i metalurgiju
Naučna oblast Hemija