УНИВЕРЗИТЕТ У БЕОГРАДУ
ПОЉОПРИВРЕДНИ ФАКУЛТЕТ
ИНСТИТУТ ЗА ПРЕХРАМБЕНУ ТЕХНОЛОГИЈУ И БИОХЕМИЈУ
КАТЕДРА ЗА КОНЗЕРВИСАЊЕ И ВРЕЊЕ

ИЗБОРНОМ ВЕЋУ ФАКУЛТЕТА

На основу Закона о науци и истраживањима („Службени гласник РС“, бр. 49/19), Правилника о стицању истраживачких и научних звања („Службени гласник РС“, бр. 159/2020) и одлуке Изборног већа Пољопривредног факултета Универзитета у Београду, бр. 300/7-6 од 27.04.2023. године (на основу чланова 29. и 46. Статута Пољопривредног факултета Универзитета у Београду) именовани смо за чланове Комисије за припрему и подношење Извештаја ради спровођења поступка за стицање научног звања научни сарадник за област: Биотехничке науке, грану: Прехрамбено инжењерство, научну дисциплину: Прехрамбена биотехнологија и ужу научну дисциплину: Технологију вина кандидаткиње др Николине Живковић (рођена Лисов), истраживача-сарадника Пољопривредног факултета Универзитета у Београду.

У складу са Законом о науци и истраживањима („Службени гласник РС“, бр. 49/19), Правилником о стицању истраживачких и научних звања („Службени гласник РС“, бр. 159/2020), а на основу прегледа и анализе достављене документације, комплетног увида и оцене досадашњег научно-истраживачког рада кандидаткиње, Комисија у саставу:

1. Др Александар Петровић, ванредни професор Пољопривредног факултета у Београду (Председавајући комисије),
2. Др Саша Деспотовић, ванредни професор Пољопривредног факултета у Београду и
3. Др Урош Чакар, научни сарадник Фармацеутског факултета у Београду

подноси следећи

ИЗВЕШТАЈ

о компетенцијама кандидаткиње др Николине Живковић (рођена Лисов), истраживача-сарадника Пољопривредног факултета Универзитета у Београду, за избор у научно звање научни сарадник.

1. БИОГРАФСКИ ПОДАЦИ

Кандидаткиња Николина Живковић (рођена Лисов) рођена је 02. марта 1990. године у Требињу, Босна и Херцеговина. Основно и средње образовање (Гимназија,

општи смер) стекла је у Билећи. Пољопривредни факултет, Студијски програм Прехрамбена технологија, модул Технологија конзервисања и врења, уписала је школске 2008/09. године. Основне академске студије завршила је у септембру 2012. године, са просечном оценом 9,30 (девет, 30/100), одбранивши завршни рад под насловом "Ензими и ензимски препарати у енологији" са оценом 10 (десет). Школске 2012/13. године уписала је мастер акдемске студије Студијски програм Прехрамбена технологија, које је завршила са просечном оценом 9,00 (девет, 00/100). У новембру 2013. године одбранила је мастер рад под називом "Карактеристике производње и особине вина произведених по барик поступку", са оценом 10 (десет). Докторске академске студије на Пољопривредном факултету Универзитета у Београду, студијски програм Прехрамбена технологија уписала је школске 2014/15. године. Положила је све испите предвиђене планом и програмом докторских студија са просечном оценом 9,43 (девет, 43/100). Докторску дисертацију под насловом „Динамика садржаја биолошки активних фенолних једињења грожђа сорте Cabernet Sauvignon током фенофаза сазревања, примарне прераде, винификације и утицај на антиоксидативни капацитет вина" одбранила је 20.07.2022. године пред комисијом у саставу: Др Александар Петровић, доцент, Универзитет у Београду, Пољопривредни факултет; Др Саша Матијашевић, ванредни професор, Универзитет у Београду, Пољопривредни факултет; Др Горица Вуковић, виши научни сарадник, Институт за заштиту биља и животну средину, Београд; Др Љиљана Гојковић Букарица, редовни професор, Универзитет у Београду, Медицински факултет; Др Урош Чакар, научни сарадник, Универзитет у Београду, Фармацеутски факултет, чиме је стекла звање Доктор наука технолошког инжењерства.

Кандидаткиња је била наставник групе технолошких предмета у Пољопривредној школи (ЈУ Центар средњих школа) у Требињу на одређено време од 4 месеца током 2014. године. Наставу је изводила на следећим предметима: Познавање сировина, Хигијена и санитација, Машине и уређаји и Практична настава.

У периоду од априла 2016. до маја 2018. године била је ангажована као стипендиста Министарства просвете, науке и технолошког развоја Републике Србије на пројекту „Развој технологије производње црвеног вина и дијететских производа из вина богатих биолошки активним полифенолима са кардиопротективним дејствима" (евиденциони бр. пројекта ТР 31020) на Медицинском факултету Универзитета у Београду, а од маја 2018. године ангажована је као сарадник на истом пројекту у звању истраживач приправник. Изабрана је у звање истраживач сарадник на седници одржаној 24.09.2020. године (број 300/ 9-5) од стране Изборног већа Пољопривредног факултета Универзитета у Београду, на период од четири године. Члан је пројекта COST Action CA 17111 INTEGRAPE (Data integration to maximise the power of omics for grapevine improvement).

2. БИБЛИОГРАФИЈА

Категоризација радова објављених у часописима међународног значаја извршена је

на основу КОБСОН листе, а радова објављених у домаћим научним часописима на основу Одлуке матичног одбора Министарства просвете, науке и технолошког развоја Републике Србије о категоријама домаћих научних часописа из области биотехнологије и пољопривреде за 2018. годину.

РАДОВИ ОБЈАВЉЕНИ У НАУЧНИМ ЧАСОПИСИМА МЕЂУНАРОДНОГ ЗНАЧАЈА (М20)

Рад у међународном часопису (М23=3)

1. **Lisov, N**., Petrovic, A., Cakar, U., Jadranin, M., Tesevic, V., Gojkovic-Bukarica, Lj. (2020). Extraction kinetic of some phenolic compounds during Cabernet Sauvignon alcoholic fermentation and antioxidant properties of derived wines. Mac. J. of Chem. and Chem. Eng., vol. 39(2): 185-196. https://doi.org/10.20450/mjcce.2020.2060

2. Nikolić, D., Ranković-Vasić, Z., Petrović, A., Matijašević, S., **Lisov, N.**, Plavšić, I. (2022). Characteristics of newly created grapevine varieties Vožd and Vladun. Genetika, 54 (3): 991-1004. https://doi.org/10.2298/GENSR2203991N

Рад у националном часопису међународног значаја (М24=3)

3. Petrović, A., **Lisov, N.**, Čakar, U., Marković, N., Matijašević, S., Cvejić, J., Atanacković, M., & Gojković Bukarica, Lj. (2019). The effects of Prokupac variety clones and vinification method on the quantity of resveratrol in wine. Food and Feed Research, 46, 189-198. DOI 10.5937/FFR1902189P
   К/(1+0,2(н-7)), н > 7; (1 x 2,50 = 2,50)

ЗБОРНИЦИ СКУПОВА МЕЂУНАРОДНОГ ЗНАЧАЈА (М30)

Саопштење са међународног скупа штампано у целини (М33=1)

4. Banjanin, T., **Lisov, N.**, Petrović, A., Ranković-Vasić, Z., Blesić, M. (2019). The quality of grape and wine of Merlot and Blatina varieties in the agroecological conditions of the Trebinje vineyard. *VIII International symposium on agricultural sciences "AgroRes 2019"* (pp. 69-76). Trebinje, Bosnia and Herzegovina.
5. Ranković-Vasić, Z., Petrović, A., **Lisov, N.**, Matijašević, S., Vujadinović-Mandić, M., Vuković, A., Muždalo, S., Nikolić, D. (2019). Properties of grapevine hybrid '14362' obtained from crossing combination Red Traminer × Early Muscat. *VIII International symposium on agricultural sciences "AgroRes 2019"* (pp. 43-49). Trebinje, Bosnia and Herzegovina. **К/(1+0,2(н-7)), н > 7; (1 x 0,83 = 0,83)**
6. Rankovic-Vasic, Z., Sivcev, B., Petrovic, A., **Lisov, N.**, Nikolic, D. (2018). Proizvodna i tehnološka vrednost novostvorene sorte vinove loze - Vladun. *Znanstveno stručni skup s*

međunarodnim sudjelovanjem "130 godina organiziranoga vinogradarstva i vinarstva u Bosni i Hercegovini" (pp. 402-412). Mostar, Bosna i Hercegovina.

7. **Lisov, N.**, Čakar, U., Petrović, A., Madzgalj, V., & Gojković- Bukarica, Lj. (2018). Extraction kinetics of some phenolic compounds during vinification of grape variety Cabernet Sauvignon and its antioxidant properties. *6th Workshop Specific methods for safety and quality "Vinca Institute of Nuclear Sciences"* (pp. 21-24). Belgrade, Serbia. ISBN 978-86-7306-148-1
8. Petrović, A., **Lisov, N.,** Plavšić, I., Madžgalj, V., Ranković-Vasić, Z., Nikolić, D. (2020). Influence of some enological treatments on trans-resveratrol and total phenolic content in wine. IX International Symposium on Agricultural Sciences AgroReS 2020, Banja Luka, 24. September 2020, Bosnia and Herzegovina, Book of proceedings, p.71-77.
9. **Lisov, N.**, Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2020). Dynamic of total phenolic content cv. Cabernet Sauvignon during ripening and impact on antioxidant capacity of wine. XI International Scientific Agricultural Symposium "Agrosym 2020", October 08-09, 2020, Bosnia and Herzegovina, Book of proceedings, p.159-163.
10. **Lisov, N.,** Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2021). Influence of sulfur dioxide and ascorbic acid on phenolic acids in Cabernet Sauvignon wine. XII International Scientific Agricultural Symposium "Agrosym 2021", October 07-10, 2021, Bosnia and Herzegovina, Book of proceedings, pp.702-706.
11. **Lisov, N.,** Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2021). Effects of thermovinification and carbonic maceration on polyphenols extraction of cv. Cabernet Sauvignon. X International Symposium on Agricultural Sciences AgroReS 2021, May 27-29, Trebinje, Bosnia and Herzegovina, Book of proceedings, p.78-84.
12. **Lisov, N.,** Petrović, A., Plavšić, I., Gojković Bukarica, Lj. (2022). Extraction kinetics of phenolic acids during prolonged maceration time and vinification of Cabernet Sauvignon grape variety. XI International Symposium on Agricultural Sciences AgroReS 2022, May 26-28, Trebinje, Bosnia and Herzegovina, Book of proceedings, p. 108-113, ISBN 978-99938-93-82-0
13. Plavšić, I., **Lisov, N.**, Gajević, S., Sredović Ignjatović, I., Petrović, A. (2022). Comparison of different extraction methods for quantification of individual phenolic compounds in wine by liquid chromatography. XIII International Scientific Agriculture Symposium „AGROSYM 2022" (pp. 541-544), Book of proceedings, Jahorina, October 06-09, 2022, Bosnia and Herzegovina, 978-99976-987-3-5
14. Čakar, U., **Lisov, N.**, Plavšić, I., Petrović, A., Krstić, D., Stanković, I., Đorđević, B. (2021). Phenolic profile of plum wines and their activity in the protection against free radicals. 7th Workshop Specific methods for safety and quality "Vinca Institute of Nuclear Sciences" (pp. 164-167). Belgrade, Serbia. ISBN 978-86-7306-163-4
15. **Lisov, N.**, Plavšić, I., Čakar, U., Petrović, A., Gojković-Bukarica, Lj. (2021). Comparison of extraction kinetics of phenolic compounds during spontaneous and inoculated fermentation cv. Cabernet Sauvignon. 7th Workshop Specific methods for

safety and quality "Vinca Institute of Nuclear Sciences" (pp. 184-187). Belgrade, Serbia. ISBN 978-86-7306-163-4

16. Petrovic, A., **Lisov, N.**, Plavsic-Janjatovic, I., Sredovic-Ignjatovic, I., Mitrovic, D. (2023). The influence of the enological tannins application on the phenolic composition of wine. 1st International symposium on Biotechnology. XXVIII Savetovanje o biotehnologiji sa međunarodnim učešćem. 17-18 of March, Cacak, 2023. Book of Proceedings, pp. 523-533.
17. Petrović, A., Plavšić-Janjatović, I., **Lisov, N.**, Čebela, M., Čakar, U., Stanković, I., Đorđević, B. (2023). Antioxidant properties and biological activity of fruit wines. 1st International symposium on Biotechnology. XXVIII Savetovanje o biotehnologiji sa međunarodnim učešćem. 17-18 of March, Cacak, 2023. Book of Proceedings, pp. 405-413.

<u>Рад саопштен на скупу међународног значаја штампан у изводу (M34=0,5)</u>

18. Čakar, U., Grozdanić, N., Petrović, A., **Lisov, N.**, Vajs, V., Nastasijević, B., & Đorđevic, B. (2019). Antioxidant, antiradical and in vitro investigation of health properties of sour cherry wine. *Pharmacy and Pharmaceutical Science World Congress* "FIP 2019". Abu Dhabi, United Arab Emirates. https://www.fip.org/abstracts?page=abstracts&action=item&item=21818
19. Čakar, U., **Lisov, N.**, Petrović, A., Madžgalj, V., & Bukarica, Lj. (2019). Influence of technological process on antioxidant capacity of wines from Cabernet sauvignon variety. *Pharmacy and Pharmaceutical Science World Congress* "FIP 2019". Abu Dhabi, United Arab Emirates. https://www.fip.org/abstracts?page=abstracts&action=item&item=21816
20. **Lisov, N.**, Madzgalj, V., Čakar, U., Despotović, S., Petrović, A., & Gojković- Bukarica, Lj. (2018). Dynamics of some polyphenolic compounds during vinification of grape varieties Cabernet Sauvignon. *Book of Abstracts of the 9th Central European Congress on Food „Food Science for Well-Being - CEFood "* (pp. 69). Sibiu, Romania. ISBN 978-606-12-1546-1
21. Petrović, A., **Lisov, N.**, Madzgalj, V., Čakar, U., Despotović, S., & Gojković-Bukarica, Lj. (2018). Extraction kinetic of resveratrol and total phenolic compounds during vinification of grape varieties Merlot and Smederevka. *Book of Abstracts of the 9th Central European Congress on Food „Food Science for Well-Being - CEFood "* (pp. 72). Sibiu, Romania. ISBN 978-606-12-1546-1
22. **Lisov, N.**, Čakar, U., Madžgalj, V., & Petrović, A. (2018). Effect of maceration duration of grapes variety Cabernet Sauvignon on kinetics extraction of some polyphenols and antioxidant properties of wine. *IV International Congress "Food Technology, Quality and Safety"* (pp. 119). Novi Sad, Serbia. ISBN 978-86-7994-054-4
23. **Lisov, N.**, Čakar, U., Petrović, A., & Gojkovic-Bukarica, Lj. (2019). Influence of maceration time of grape pomace Cabernet Sauvignon on extraction kinetics of some polyphenols and anti-DPPH radical activity of wines. *X International Scientific*

Agricultural Symposium "Agrosym 2019" (pp. 440-441). Jahorina, Bosnia and Herzegovina.

24. Čakar, U., Petrović, A., Pejin, B., **Lisov, N.**, Živković, M., Vajs, V., & Đorđević, B. (2018). An insight into quality of apricot and sweet cherry fruit wines. *IV International Congress "Food Technology, Quality and Safety"* (pp. 118). Novi Sad, Serbia. ISBN 978- 86-7994-056-8
25. Petrovic, A., Jovic, S., **Lisov, N.**, Gojkovic-Bukarica, Lj. (2018). Global warming-Challenge to the modern enology. *HUMBOLDT-Kolleg*. (pp. 157). Belgrade, Serbia. ISBN:978-86-7299-278-6
26. Petrovic, A., Jovic, S., Gojkovic-Bukarica, Lj., **Lisov, N.** (2018). Uticaj načina prerade grožđa i vinifikacije na sadržaj resveratrola u vinu. *Unifood Conference* (pp. 56). Beograd, Srbija. ISBN: 978-86-7522-060-2
27. Sivčev, B., Ranković-Vasic, Z., Petrović, A., **Lisov, N.**, Radovanović, V., & Milišić, K. (2018). Karakteristike grožđa i vina pet klonova sorte merlo u beogradskom rejonu, Srbija. *Unifood Conference* (pp. 32). Beograd, Srbija. ISBN: 978-86-7522-060-2
28. Čakar, U., Janković, M., Petrović, A., **Lisov, N.**, Čakar, M., Vajs, V., & Đorđević, B. (2018). Comparison of antioxidant profile of sour cherry wine and raspberry wine. *78th FIP World Congress of Pharmacy and Pharmaceutical Sciences*. Glasgow, Scotland. https://www.fip.org/abstracts?page=abstracts& action=item&item=20652
29. **Lisov, N.**, Plavšić, I., Petrović, A., Ranković-Vasić, Z., & Nikolić, D. (2020). Antioxidant properties of phenolic compounds as residues in fermented grape pomace of cv. Cabernet Sauvignon. *2nd Annual Meeting Integrape 2020 "Multi-omics data integration for genotype-phenotype association"* (pp. 55). Ljubljana, Slovenia.
30. Glišić, M., Matijašević, S., Ranković-Vasić, Z., **Lisov, N.**, Plavšić, I., Petrović, A., & Nikolić, D. (2020). Phenotypic variation of ampelographic and technological traits of newly created grapevine genotypes. *2nd Annual Meeting Integrape 2020 "Multi-omics data integration for genotype-phenotype association"* (pp. 27). Ljubljana, Slovenia.
31. Ranković-Vasić, Z., Ivanović, J., **Lisov, N.**, Petrović, A., Plavšić, I., Nikolić, D. (2020). Morphological and production-technological characteristics newly craeted grapevine variety Vožd. IX International Symposium on Agricultural Sciences AgroReS 2020, Banja Luka, 24. September 2020, Bosnia and Herzegovina, Book of Abstracts, p.83.
32. **Lisov, N.**, Plavšić, I., Čakar, U., Petrović, A., Gojković-Bukarica, Lj. (2021). Analysis of the impact of different fining agents on the phenolic compounds of Cabernet Sauvignon wines. 2nd International UNIfood Conference (pp. 173), 24th-25th September 2021 University of Belgrade, Belgrade, Serbia.
33. Čakar, U., **Lisov, N.**, Plavšić, I., Petrović, A., Stanković, I., Vajs, V., Đorđević, B. (2021). Black chokeberry fruit for wine production. 2nd International UNIfood Conference (pp.174), 24th-25th September 2021 University of Belgrade, Belgrade, Serbia.

34. **Lisov, N.**, Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2021). Influence of sulfur dioxide and ascorbic acid on phenolic acids in Cabernet Sauvignon wine. XII International Scientific Agricultural Symposium "Agrosym 2021", October 07-10, 2021, Bosnia and Herzegovina, Book of abstracts, p. 364.
35. **Lisov, N.**, Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2021). Effects of thermovinification and carbonic maceration on polyphenols extraction of cv. Cabernet Sauvignon. X International Symposium on Agricultural Sciences AgroReS 2021, May 27-29, Trebinje, Bosnia and Herzegovina, Book of abstracts, p.76.
36. **Lisov, N.**, Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2020). Dynamic of total phenolic content cv. Cabernet Sauvignon during ripening and impact on antioxidant capacity of wine. XI International Scientific Agricultural Symposium "Agrosym 2020", October 08-09, 2020, Bosnia and Herzegovina, Book of abstracts, p.154.
37. Petrović, A., **Lisov, N.**, Plavšić, I., Madžgalj, V., Ranković-Vasić, Z., Nikolić, D. (2020). Influence of some enological treatments on trans-resveratrol and total phenolic content in wine. IX International Symposium on Agricultural Sciences AgroReS 2020, Banja Luka, 24. September 2020, Bosnia and Herzegovina, Book of abstracts, p.86.
38. Čakar, U., **Lisov, N.**, Plavšić, I., Petrović, A., Bukarica Gojkovic, Lj. (2020). Red wine as a source of antioxidant properties and its phenolic profile in fuction of maceration time. World Congress of Pharmacy and Pharmaceutical Sciences, FIP DIgital 2020-2021.
39. Čakar, U., **Lisov, N.**, Petrović, A., Vajs, V., Đorđević, B. (2020). Phenolic profile and antioxidant properties of Serbian fruit. World Congress of Pharmacy and Pharmaceutical Sciences, FIP DIgital 2020-2021.
40. Čakar, U., Grozdanić, N., **Lisov, N.**, Petrović, A., Čakar, M., Đorđević, B. (2020). Stone fruit wine-potential functional food. World Congress of Pharmacy and Pharmaceutical Sciences, FIP DIgital 2020-2021.
41. **Lisov, N.**, Mitrovic, D., Sredovic Ignjatovic, I., Petrovic, A. (2022). Total phenolic content and antioxidant properties of fermented grape pomace of Cabernet Sauvignon grape variety. 1st European Symposium on Phytochemicals in Medicine and Food (pp. 48), 7th-9th September 2022, Belgrade, Serbia. ISBN 978-86-7834-408-4
42. Plavšić, I., **Lisov, N.**, Gajević, S., Sredović Ignjatović, I., Petrović, A. (2022). Comparison of different extraction methods for quantification of individual phenolic compounds in wine by liquid chromatography. XIII International Scientific Agriculture Symposium „AGROSYM 2022" (pp. 351), Book of abstracts, Jahorina, October 06-09, 2022, Bosnia and Herzegovina, 978-99976-987-2-8
43. Čakar, U., **Lisov, N.**, Plavšić, I., Petrović, A., Đorđević, B. (2022). In vitro activity and antioxidant investigation of fruit wines. 80th FIP world congress of pharmacy and pharmaceutical sciences, Seville, 18 to 22 September 2022, Spain.
44. **Lisov, N.**, Čakar, U., Plavšić, I., Petrović, A., Gojković-Bukarica, LJ. (2022). Total phenolic content and antioxidant capacity of pomace from Cabernet Sauvignon. 80th FIP

world congress of pharmacy and pharmaceutical sciences, Seville, 18 to 22 September 2022, Spain.

45. Čakar, U., **Lisov, N.**, Plavšić, I., Petrović, A., Gojković-Bukarica, LJ. (2022). Influence of different treatment of Vožd cultivar on total phenolic content and antioxidant capacity of wine. 80th FIP world congress of pharmacy and pharmaceutical sciences, Seville, 18 to 22 September 2022, Spain.
46. **Lisov, N.**, Petrović, A., Plavšić, I., Gojković Bukarica, Lj. (2022). Extraction kinetics of phenolic acids during prolonged maceration time and vinification of Cabernet Sauvignon grape variety. XI International Symposium on Agricultural Sciences AgroReS 2022, May 26-28, Trebinje, Bosnia and Herzegovina, Book of abstracts, p. 135, ISBN 978-99938-93-81-3.

ЧАСОПИСИ НАЦИОНАЛНОГ ЗНАЧАЈА (М50)

Рад у врхунском часопису националног значаја (М51=2)

47. Ranković-Vasić, Z., Nikolic, D., Petrović, A., Sivčev, B., Kostadinović, N., **Lisov, N.**, Matijašević, S. (2016). Some important agrobiological and techonolgical characteriatics of promising grapevine genotypes obtained for red wine production. *Annals of the University of Craiova–Agriculture, Montanology, Cadastre Series, Vol. XLVI/1/2016* (pp. 255-260).

ЗБОРНИЦИ СКУПОВА НАЦИОНАЛНОГ ЗНАЧАЈА (М60)

Саопштење са скупа националног значаја штампано у целини (М63=0,5)

48. **Lisov, N.**, Plavšić, I., Madžgalj, V., Petrović, D., Petrović, A., Gojković-Bukarica, Lj. (2020). Influence of maceration time cv. Cabernet Sauvignon on total phenol content and antioxidant capacity of wines. *Jubilarno XXV savetovanje o biotehnologiji sa međunarodnim učešćem* (pp. 437-442). Čačak, Srbija.

Саопштење са скупа националног значаја (М64=0,2)

49. Nikolic, D., Petrović, A., Ranković-Vasić, Z., Sivčev, B., **Lisov, N.**, Kostadinović, N. (2016). Productive technological properties of interspecific grapevine hybrid 18374. *Конгрес воћара и виноградара Србије са међународним учешћем* (pp. 93). Kragujevac, Srbija.
50. Petrović, A., **Lisov, N.**, Ranković-Vasić, Z. (2022). Savremena enološka praksa u duhu klimatskih promena. Savetovanje u okviru projekta IAPS – Sezonske prognoze vremena i prilagođavanje poljoprivredne proizvodnje na klimatske promene. 19. maj, Beograd-Zemun, ISBN 978-86-7834-400-8

МАГИСТАРСКЕ И ДОКТОРСКЕ ТЕЗЕ (М70)

Одбрањена докторска дисертација (М71)

51. **Lisov, N. M.** (2022): Dinamika sadržaja biološki aktivnih fenolnih jedinjenja grožđa sorte Cabernet Sauvignon tokom fenofaza sazrevanja, primarne prerade, vinifikacije i uticaj na antioksidativni kapacitet vina. Doktorska disertacija, Univerzitet u Beogradu – Poljoprivredni fakultet. UDK: 634.85:663.251(043.3).

3. АНАЛИЗА ПУБЛИКОВАНИХ РАДОВА

Научно-истраживачки рад кандидаткиње Николине Живковић усмерен је на проучавање здравствених ефеката фенолних једињења вина и њихових антиоксидативних својстава. Поред вина од грожђа фокус истраживања проширује на воћна вина. Бави се и истраживањима која се односе на примену најсавременијих аналитичких техника у циљу утврђивања количине појединих једињења вина, испитивањем утицаја различитих техника екстракције и третмана на количину појединих фенолних једињења издвојених из грожђа, воћа и вина. У сарадњи са колегама са Воћарско-виноградарског одсека бави се испитивањем утицаја различитих виноградарских мера и поступака на квалитет вина и примене одређених енолошких поступака на хемијски састав и сензорске карактеристике вина од воћа и грожђа.

Истраживања у оквиру докторске дисертације (**библиографска јединица број 51**) имала су за циљ добијање вина са што већим садржајем биолошки активних компонената значајних за здравље људи на основу праћења динамике уз укључивање и других параметара у технолошки процес производње.

У оквиру тога постављено је неколико специфичних циљева као што су утицај оптималног степена зрелости грожђа, утицај неких комерцијалних ензимских препарата који се примењују ради боље екстракције фенолних једињења из чврстих делова грожђа као и сојеви квасаца различите гликозидолитичке активности, а све то у оквиру примарне прераде. С тим у вези, задатак је био анализирати њихов утицај на динамику садржаја фенолних једињења током винификације. Са друге стране, значајан део докторске дисертације заузима истраживање везано за комину која заостаје као нуз производ приликом производње вина. У складу са тим, испитиван је садржај појединих фенолних једињења у узорцима превреле комине као и њихов антиоксидативни капацитет.

Примењена је и термичка и карбонска мацерација с циљем испитивања таквих видова мацерације на промене фенолног састава вина. Потребно је било утврдити и утицај растућег притиска цеђења превреле комине на повећање количине појединачних фенолних једињења као и њиховог садржаја који је заостао у комини и комини цеђеној применом различитих притисака.

Новодобијена вина отворила су пут осталим истраживањима која имају за циљ испитивање утицаја средстава за бистрење и стабилизацију вина која се уобичајено

користе на количину појединих фенолних једињења, а на крају и утицај времена одлежавања истог у судовима различитог материјала и запремине.

Научни допринос истраживања кандидаткиње у оквиру дисертације огледа се у:

- Динамика екстракције биолошки активних компоненти као што су фенолна једињења је темељно представљена и обрађена за свако испитивано једињење што је битно са аспекта добијања вина са што већим садржајем ових компоненти.
- Утврђено је оптимално време мацерције као и примена технике винификације уз укључивање одређених квасаца и ензимских препарата.
- Детаљно су описани феномени екстракције фенолних једињења из комине у вино током контакта чврсте и течне фазе и приказан садржај појединих фенолних једињења која заостају у комини након алкохолне ферментације и мацерације.
- Добијени резултати отварају могућност ка производњи вина са високим садржајем биолошки активних фенолних једињења, као и потенцијалном искоришћењу комине у фармаколошке или прехрамбене сврхе.

Имајући у виду широко истраживачко интересовање кандидаткиње највећи део њених досадашњих истраживања и објављених радова се може поделити у неколико целина. Пре свега велики део истраживања обухваћен је докторском дисертацијом и истраживањима везаним за технологију производње вина од грожђа.

Истраживања која се пре свега односе на:

- Испитивање начина примарне прераде грожђа и начина винификације који би резултирао високим садржајем биолошки активних супстанци у вину које благотворно делују на здравље људи. Истраживања су конкретно везана за испитивање утицаја различитог времена мацерације, примене различитих ензимских препарата као и сојева квасаца различите гликозидолитичке активности, на садржај укупних и појединачних фенолних једињења, као и утицај на антиоксидативни капацитет вина (**радови бр. 3, 8, 15, 19, 20, 21, 22, 26, 37, 38, 48**). Истраживања су проширена и на кинетику екстракције појединих фенолних једињења током алкохолне ферментације и продужене мацерације (**радови бр. 1, 7, 12, 46**).
- Друга група истраживања односи се на примену одређених метода у аналитици појединих фенолних једињења вина и утврђивање утицаја неких енолошких захвата и средстава на њихов садржај у вину. Испитиван је утицај различитих техника припреме узорака вина за анализу течном хроматографијом, а све са циљем детектовања вишег садржаја појединих фенолних једињења (**радови бр. 13, 42**). Анализиран је утицај додатка енолошких средстава као што су хидролизабилни и кондензовани енолошки танини, сумпордиоксид, аскорбинска киселина и средства за бистрење (желатин и

албумин у различитим концентрацијама) на садржај појединих фенолних једињења у вину (**радови бр. 10, 16, 32, 34**).

- Трећа група радова односи се на примене различитих видова винификације на новостворене црне сорте грожђа као и испитивање њиховог фенолног састава **(радови бр. 2, 5, 6, 31, 45, 49)** као и самог квалитета вина као крајњег производа.
- Следећа група радова односи се на испитивања фенолног састава превреле комине која заостаје након иконулисане ферментације и различитих периода мацерације (**радови бр. 23, 29, 41, 44**).
- Моменат бербе грожђа, у зависности од жељеног типа вина који се производи, је један од кључних фактора за квалитет вина и оптималан садржај фенолних једињења. С тим у вези анализиран је утицај степена зрелости грожђа на фенолни профил вина од грожђа сорте Cabernet Sauvignon (**радови бр. 9, 36**).
- Литература наводи да различити видови винификације доводе до већег или мањег садржаја фенолних једињења у вину. На грожђу сорте Cabernet Sauvignon примењена је дужа и краћа термичка мацерација као и карбонска мацерација са циљем одређивања садржаја фенолних једињења у новодобијеним винима (**радови бр. 11, 35**).
- Истраживања су проширена и на одређивање фенолног састава воћних вина као и њихових биолошких ефеката на људско здравље (**радови бр. 14, 17, 18, 24, 28, 33, 39, 40, 43**).
- Сведоци смо великих климатских промена и глобалног загревања па се то у великој мери одражава на квалитет грожђа, а самим тим и на квалитет вина. Предочене су одрђене мере прилагођавања виноградарства и винарства на климатске промене (**радови бр. 25, 50**).
- Један део истраживања везан је и за испитивање утицаја ампелографских и агроеколошких услова гајења различитих сорти на квалитет вина (**радови бр. 4, 27, 30, 47**).

Резултати публикованих радова кандидаткиње др Николине Живковић дају основ за развој технологије производње црвених вина са циљем искоришћења нузпроизвода технолошког процеса са аспекта фенолног садржаја и могућности екстракције биоактивних супстанци са потенцијалом примене у фармаколошке и прехрамбене сврхе. На основу анализе публикованих радова Комисија закључује да досадашња истраживања кандидаткиње припадају научној области: Прехрамбено инжењерство, научној дисциплини: Прехрамбена биотехнологија и ужој научној дисциплини: Технологија вина.

4. ЦИТИРАНОСТ ПУБЛИКОВАНИХ РАДОВА

Цитираност радова кандидаткиње др Николине Живковић утврђена је увидом у базу података Google Scholar и *Scopus*. Према *Scopus* бази података h индекс је 1. Преузето 09.05.2023.

Рад под бројем 1: Lisov, N., Petrovic, A., Cakar, U., Jadranin, M., Tesevic, V., Gojkovic-Bukarica, Lj. (2020). Extraction kinetic of some phenolic compounds during Cabernet Sauvignon alcoholic fermentation and antioxidant properties of derived wines. Mac. J. of Chem. and Chem. Eng., vol. 39(2): 185-196. https://doi.org/10.20450/mjcce.2020.2060

Цитиран 3 пута у виду хетероцитата:

1. Costa, M. H., Ferreira, D. T., Pádua, J. E., Fernandes, J. P., Santos, J. C. C., Cunha, F. A. S., Araujo, M. C. U. (2021). A fast, low-cost, sensitive, selective, and non-laborious method based on functionalized magnetic nanoparticles, magnetic solid-phase extraction, and fluorescent carbon dots for the fluorimetric determination of copper in wines without prior sample treatment. Food Chemistry, 363: 130248.
2. Madžgalj, V., Petrović, A., Čakar, U., Maraš, V., Sofrenić, I., Tešević, V. (2023). The influence of different enzymatic preparations and skin contact time on aromatic profile of wines produced from autochthonous grape varieties Krstač and Žižak. Journal of the Serbian Chemical Society, 88(1): 11-23.
3. Vajić, U. J., Živković, J., Ivanov, M., Jovović, Đ., Šavikin, K., Bugarski, B., & Mihailović-Stanojević, N. (2022). Optimization of the extraction of antioxidants from stinging nettle leaf using response surface methodology. Macedonian Journal of Chemistry and Chemical Engineering, 41(1): 119-128.

Рад под бројем 11: Lisov, N., Plavšić, I., Petrović, A., Gojković-Bukarica, Lj. (2021). Effects of thermovinification and carbonic maceration on polyphenols extraction of cv. Cabernet Sauvignon. X International Symposium on Agricultural Sciences AgroReS 2021, May 27-29, Trebinje, Bosnia and Herzegovina, Book of proceedings, p.78-84.

Цитиран 1 пут у виду хетероцитата:

1. Tahmaz, H., & Yüksel Küskü, D. (2022). Does UV light affect the total phenolic compound, anthocyanin, antioxidant capacity, and sensory profiles in wines?. International Journal of Food Science & Technology, 57(6): 3567-3577.

5. ОЦЕНА САМОСТАЛНОСТИ КАНДИДАТКИЊЕ

Кандидаткиња др Николина Живковић испољила је самосталност, спремност на преузимање иницијативе у осмишљавању и реализацији експерименталних истраживања, обради и анализи добијених резултата као и писању научних радова. Била је први аутор на 19 публикација, од којих је 1 из категорије М23, 6 из категорије М33, 11 из категорије М34 и 1 из категорије М63. Своје способности и одговорност показала је и кроз сарадњу са другим истраживачима у научно-истраживачким институцијама.

6. КВАЛИТАТИВНА ОЦЕНА НАУЧНОГ ДОПРИНОСА

Квалитативна оцена научног доприноса кандидаткиње извршена је према елементима прописаним у Прилогу 1 Правилника о стицању истраживачких и научних звања.

6.1. Квалитет научних резултата

Тематика истраживања кандидаткиње др Николине Живковић веома је актуелна и интересантна са научног и практичног становишта.
Резултати истраживања дају допринос у:

- проучавању здравствених ефеката фенолних једињења вина и њихових антиоксидативних својстава,
- примени најсавременијих аналитичких техника у циљу утврђивања количине појединих једињења вина, испитивањем утицаја различитих техника екстракције и третмана на количину појединих фенолних једињења издвојених из грожђа, воћа и вина,
- потенцијалном искоришћењу нузпроизвода који заостају након процеса производње вина, пре свега искоришћењу ферментисане комине грожђа,
- анализи утицаја различитих виноградарских мера и поступака на квалитет вина и примене одређених енолошких поступака на хемијски састав и сензорске карактеристике вина од воћа и грожђа.

Значај научних резулатата огледа се у развоју технологије црвених вина са што већим садржајем биолошки активних једињења, оптимизацији процеса екстракције поменутих једињења из ферментисане комине и апликативним могућностима у прехрамбене или здравствене сврхе.

У току досадашњег научно-истраживачког рада кандидаткиња је у сарадњи са другим ауторима објавила укупно 50 радова, од тога 3 рада у научним часописима међународног значаја (категорија М23 и М24), 43 саопштења у зборницима међународних научних скупова (категорија М33 и М34), 1 рад у врхунском часопису националног значаја (М51) и 3 саопштења на домаћим научним скуповима (категорија М63 и М64). Публиковани радови припадају научној области Биотехничке науке и пружају допринос тематици истраживања којима припадају. Радови из категорије М23 могу се разврстати на следеће области:

- *Chemistry, Multidisciplinary* (*Macedonian Journal of Chemistry and Chemical Engineering*, IF_{2021}=0,920);
- *Genetics and Heredity* (*Genetika, Beograd*, IF_{2021}=0,753);

Допринос кандидаткиње у реализацији резултата огледа се у њеном активном учествовању у свим фазама, од осмишљавања и извођења експеримената, преко обраде,

статистичке анализе, тумачења добијених резултата, до писања и презентовања научних радова. Кандидаткиња је испољила висок степен самосталности у извршењу задатака, као и способност прилагођавања тимском раду. Актуелност истраживања приказана је кроз цитираност публикованих радова (Прилог 2).

На основу увида у научно-истраживачки рад кандидаткиње и њен допринос као аутора и коаутора у публикацијама закључује се да је др Николина Живковић стекла дугогодишње истраживачко искуство и савладала савремене методе научно истраживачког рада у области технологије производње вина, различитих видова винификације, динамици екстракције појединих фенолних једињења из грожђа у вино као и антиоксидативном потенцијалу вина и ферментисане комине.

6.2. Ангажованост у формирању научних кадрова

Ангажованост кандидаткиње у формирању научних кадрова огледа се у активном учествовању у осмишљавању и реализацији завршних и мастер радова.

6.3. Нормирање броја коауторских радова

У досадашњем научно-истраживачком раду кандидаткиња је публиковала укупно 50 библиографских јединица. Сви публиковани радови припадају научној области Биотехничких наука. Број бодова за експерименталне радове са више од 7 коаутора одређен је према формули К/(1+0,2(н-7)). Ова формула примењена је за библиографске јединице под редним бројевима 3 (М24) и 5 (М33). У формули К представља вредност резултата, а н број аутора. Укупан индекс компетентности кандидаткиње након ових корекција износи 38,83. Научна област кандидаткиње захтева мултидисциплинарни приступ и ангажовање већег броја истраживача различитих ужих научних дисциплина у циљу сагледавања и решавања научне проблематике истраживања. Просечан број аутора по раду за библиографију наведену у Секцији 2, без докторске дисертације, износи 5,36.

6.4. Учешће у пројектима

У току досадашњег научно-истраживачког рада кандидаткиња је ангажована као истраживач у реализацији два пројекта (Прилог 3):

- Национални пројекат: „Развој технологије производње црвеног вина и дијететских производа из вина богатих биолошки активним полифенолима са кардиопротективним дејствима МПНТР (евиденциони број пројекта 31020) - од 2018. године.

- Међународни пројекат „Intergrape: Data integration to maximise the power of omics for grapevine improvement“, 2020 – до данас;

7. ОЦЕНА УСПЕШНОСТИ НАУЧНОГ РАДА

Кандидаткиња др Николина Живковић започела је свој научно-истраживачки рад на Пољопривредном факултету Универзитета у Београду 2016. године кроз ангажовања финансирана од стране Министарства просвете, науке и технолошког развоја у оквиру пројекта „Развој технологије производње црвеног вина и дијететских производа из вина богатих биолошки активним полифенолима са кардиопротективним дејствима“ (евиденциони бр. пројекта ТР 31020). Била је ангажована прво као стипендиста Министарства (2016-2018), а потом као запослена у звањима истраживач-приправник (2018-2020) и истраживач-сарадник (2020-данас). Докторску дисертацију је одбранила 20.07.2022. године, а током њене израде демонстрирала је систематичан приступ и висок степен самосталности, иницијативности и одговорности.

У свом досадашњем раду кандидаткиња је објавила три рада у научним часописима међународног значаја, 43 саопштења у зборницима међународних научних скупова, 1 рад у врхунском часопису националног значаја и 3 саопштења у зборницима скупова националног значаја. Према *Scopus* бази података радови кандидаткиње из категорије М23 цитирани су три пута у виду хетероцитата. Кандидаткиња је свој научни допринос остварила и кроз учешће у истраживањима у оквиру националног пројекта. Активно учествује на међународним и домаћим научним скуповима.

На основу увида у комплетну биографију и библиографију, анализе научно-истраживачког рада, доприноса и постигнутих резултата, као и активности у оквиру актуелних пројеката Комисија закључује да се кандидаткиња др Николина Живковић квалитетно и успешно бави научно-истраживачким радом. Рад кандидаткиње препознат је на националном и међународном нивоу кроз успостављање и одржавање сарадње са истраживачима из националних и међународних истраживачких институција. Анализом рада кандидаткиње установљено је да је показала велико залагање, иницијативу и одговорност али и способност прилагођавања тимском раду, широк спектар интересовања као и заинтересованост за усавршавањем. Комисија сматра да наведени показатељи успеха у научно-истраживачком раду квалификују др Николину Живковић за избор у научно звање научни сарадник.

8. КВАНТИТАТИВНА ОЦЕНА НАУЧНИХ РЕЗУЛТАТА

Др Николина Живковић се успешно бави научним радом, што се огледа по броју публикација у међународним и националним часописима. На основу приложене библиографије, Комисија је разврстала резултате приказане у Табели 1.

Табела 1. Број остварених резултата и бодова др Николине Живковић

Преглед научно истраживачких резултата	Укупан број резултата	Вредност М	Укупан број бодова	Коригован број бодова*
Рад у међународном часопису	2	М 23=3	6	6
Рад у националном часопису међународног значаја	1	М24=3	3	2,5
Рад саопштен на скупу међународног значаја штампан у целини	14	М 33=1	14	13,83
Рад саопштен на скупу међународног значаја штампан у изводу	29	М 34=0,5	14,5	14,5
Рад у врхунском часопису националног значаја	1	М51=2	2	2
Саопштење са скупа националног значаја штампано у целини	1	М63=0,5	0,5	0,5
Саопштење са скупа националног значаја штампано у изводу	2	М64= 0,2	0,4	0,4
УКУПНО				39,73

* Корекција броја бодова према броју коаутора на раду одређена је према формули К/(1+0,2(н-7)), н>7 за експерименталне радове, где је К вредност резултата, а н број аутора.

Кандидаткиња др Николина Живковић испунила је све диференцијалне услове и неопходан укупан број бодова за техничко-технолошке и биотехничке науке прописане Правилником о стицању истраживачких и научних звања („Службени гласник РС“, бр 159/2020, Прилог 4) за избор у научно звање научни сарадник (Табела 2). Комисија сматра да су испуњени сви квантитативни захтеви да кандидаткиња стекне научно звање научни сарадник.

Табела 2. Минимални квантитативни резултати за стицање научног звања научни сарадник (Област науке: Техничко технолошке и биотехничке науке)

Диференцијални услов	Категорије	Минимално потребно	Остварено
Научни сарадник	Укупно	16	38,83
Обавезни (1)	М10+М20+М31+М32+М33+М41 +М42+М51+М80+М90+М100	9	32,83
Обавезни (2)	М21+М22+М23	5	6

9. ЗАКЉУЧАК СА ПРЕДЛОГОМ

На основу прегледа приложене документације, анализе и оцене научно-истраживачког рада, доприноса и остварених резултата кандидаткиње др Николине Живковић Комисија закључује да се ради о посвећеном, свестраном, амбициозном и перспективном младом истраживачу који је оспособљен за самостални научно-истраживачки рад.

Комисија је сагласна у оцени и закључку да кандидаткиња др Николина Живковић испуњава све услове прописане Законом о науци и истраживању и Правилником о стицању истраживачких и научних звања за избор у научно звање научни сарадник за област: Биотехничке науке, грану: Прехрамбено инжењерство, научну дисциплину: Прехрамбена биотехнологија и ужу научну дисциплину: Технологија вина.

Мишљење Комисије је засновано на оцени квалитативних и квантитативних показатеља научно-истраживачке делатности кандидаткиње. На основу изложеног Комисија са задовољством предлаже Изборном већу Пољопривредног факултета Универзитета у Београду да усвоји предлог за избор др Николине Живковић у научно звање научни сарадник и такав предлог достави одговарајућем Матичном одбору на коначно усвајање.

Београд,
17.05.2023. године

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ПРИЛОЗИ
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Original scientific paper

EXTRACTION KINETIC OF SOME PHENOLIC COMPOUNDS DURING CABERNET SAUVIGNON ALCOHOLIC FERMENTATION AND ANTIOXIDANT PROPERTIES OF DERIVED WINES

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In this study, we estimated the usage of Cabernet Sauvignon in microvinifications, obtaining wines with increased phenolic compound content. Kinetic extraction of phenolic compounds during alcoholic fermentation was affected by maceration time (3, 5, 7, 14 and 21 days) and the addition and kinetics of enzyme preparations (EP). The highest extraction rates were observed for catechin (EXV EP – EXV enzyme preparation and CP EP – Color plus enzyme preparation) and *p*-hydroxybenzoic acid (Car EP - Caractere enzyme preparation). According to extraction time of the analyzed phenolic compounds, maximal values (ellagic acid, ferulic acid, chlorogenic acid, caffeic acid, naringenin, *p*-hydroxybenzoic acid, *p*-coumaric acid, protocatechuic acid, *trans*-resveratrol, syringic acid, vanillin, and vanillic acid) were obtained on day 15 of maceration with addition of CP EP, with exceptions of gallic acid, catechin, and myricetin. Prolonged maceration times, up to 21 days, showed the most potent DPPH free radical scavenging activity with Car EP and the highest Ferric Reducing Ability of Plasma (FRAP) values with CP EP.

Keywords: Cabernet Sauvignon; enzyme preparations; kinetic extraction; maceration time; Ultra Performance Liquid Chromatography

ЕКСТРАКЦИОНА КИНЕТИКА НА НЕКОИ ФЕНОЛНИ СОЕДИНЕНИЈА ВО ТЕКОТ НА АЛКОХОЛНАТА ФЕРМЕНТАЦИЈА НА ГРОЗЈЕ ОД СОРТАТА КАБЕРНЕ СОВИЊОН И АНТИОКСИДАНТНИ СВОЈСТВА НА ДОБИЕНИТЕ ВИНА

Во ова истражување беше применета микровинификација на грозје од сортата каберне совињон и беа добиени вина со зголемена содржина на фенолни соединенија. Беше забележано дека кинетичката екстракција на фенолните соединенија во текот на алкохолната ферментација зависи од времето на мацерација (3, 5, 7, 14 и 21 ден) и од додавањето и кинетиката на ензимските препарати (EP). Најголема екстракција беше забележана за катехин (EXV EP – комерцијален ензимски препарат и CP EP – ензимски препарат) и *p*-хидроксибензоева киселина (Car EP – ензимски препарат Caractere). Во однос на влијанието на времето на екстракција врз анализираните фенолни соединенија (елагова киселина, ферулна киселина, хлорогенска киселина, кофеинска киселина, наринген, *p*-хидроксибензоева киселина, *p*-кумарна киселина, протокатехинска киселина, *trans*-ресвератрол, сирингинска киселина, ванилин и ванилна киселина), максимални вредности се добиени петнаесеттиот ден од мацерација со додавање на CP

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CHARACTERISTICS OF NEWLY CREATED GRAPEVINE VARIETIES VOŽD AND VLADUN

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Nikolić D., Z. Ranković-Vasić, A. Petrović, S. Matijašević, N. Lisov, I. Plavšić (2022). *Characteristics of newly created grapevine varieties Vožd and Vladun*. - Genetika, Vol 54, No.3, 991-1004.

This paper presents the most important morphological and production-technological characteristics of newly created grapevine varieties Vožd and Vladun, intended for the production of red wines. The newly created varieties were compared with the standard variety Cabernet Sauvignon during the three-year period of testing (2015-2017) in the relation studied properties. The variety Vožd obtained from the crossing combination Začinak × Prokupac, and the variety Vladun from the crossing combination Merlot × Župski Bojadiser. The investigated varieties differed considerably in terms of some morphological traits and represents unique genotypes. The newly recognized varieties have a hermaphrodite type of flower, dense bunch, globose berry shape and blue black color of berry skin. The yield, bunch weight, bunch length and bunch width were higher at both varieties than for the standard variety. The Vožd variety had a yield of 1.29 kg/m^2 and a bunch weight of 174.3 g, and the Vladun variety had a yield of 0.87 kg/m^2 and a bunch weight of 153.7 g. For the standard variety the grape yield was 0.78 kg/m^2 and the bunch weight was 134.0 g. The content of sugar and total acids in the must of the Vožd variety was 20.5% and 6.5 g/l, while for the Vladun variety it was 21.8% and 6.0 g/l respectively. Wine of both varieties was drinkable, harmonious, with a specific varietal of smell and taste and contained 12.1 vol. % of alcohol (Vožd variety), or 12.6 vol. % of alcohol (Vladun variety). Due to the many positive features of the grapes and wines from the Vožd and Vladun varieties, their spread to the production vineyards of Serbia is expected.

Key words: Vitis vinifera, hybridization, new variety, morphological traits, yield, quality

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Original research paper

THE EFFECTS OF *PROKUPAC* VARIETY CLONES AND VINIFICATION METHOD ON THE QUANTITY OF RESVERATROL IN WINE

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ABSTRACT: The focus of this study was to investigate the effects of clones (subvarieties) of autochthonous Serbian grape variety *Prokupac*, along with the influence of vinification method on the content of *trans*- and *cis*-resveratrol as well as on total phenolic content (TPC) in wines. Wines were made from four clones of *Prokupac* variety (PR1, 40/1, PR6 and PR7) by application of different periods of maceration duration (1, 5 and 10 days). The effects of different species of selected wine yeasts and glucosidase enzymes on the quantity of resveratrol and TPC in wine made from PR6 variety were also investigated. The content of *trans*-resveratrol varied from 0.27 mg/L to 1.46 mg/L. The highest content of resveratrol was determined in *Prokupac* clone PR6, and the lowest in PR7 clone. An increase in resveratrol and TPC content was observed in all clones when the duration of maceration was prolonged. Wine produced by application of β enzyme preparation and 299 yeast had the highest concentration of total resveratrol (4.23 mg/L). The TPC was the highest in the wine made by combined application of yeast 299 and OE enzyme. The obtained results showed that by adequate selection of varieties, prolonged duration of maceration, application of appropriate species of yeast and enzyme preparations, it is possible to increase the content of resveratrol and other phenolic compounds in wine.

Key words: *antioxidants, polyphenols, yeast, enzymes, maceration, HPLC*

INTRODUCTION

Resveratrol (3,5,4'-trihydroxystilbene) is a polyphenol which appears as a *cis*- and a *trans*- isomer, free or in a glucosidase bound form as a 3-mono-D-glucoside called piceid or polydatin (3,5,4'-trihydroxystilbene-3-β-mono-D-glucoside).

Resveratrol is a phenolic phytoalexin with antifungal properties. It belongs to the class of antibiotics synthetized by certain parts of plants as a response to an attack of illness, in cases of abiotic stress (in the presence of heavy metal ions) (Vitrac et

Original scientific paper

The quality of grape and wine of Merlot and Blatina varieties in the agroecological conditions of the Trebinje vineyard

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Abstract

The aim of this paper is to present the quality of grape and wine of Merlot and Blatina varieties in the agro ecological conditions of the Trebinje vineyard, during the vintages of 2016 and 2017. The vineyards were established in 2004 (Merlot) and in 2013 (Blatina), at an altitude of 269 m, with the planting distance of 2.8 x 1 m for Blatina and 2.8 x 0.9 m for Merlot. The Merlot and Blatina grape varieties were grafted on *Berlandieri* × *Riparia* Kober 5BB rootstock. The research included analysis of the sugar, total acid content and pH as parameters of grape quality. The following parameters of wine quality were analyzed: alcohol content, total acid, total ash, content of extract and total phenols. The quality of the grapes, grown in the conditions of Trebinje vineyard is suitable to produce quality red wines.

Key words: sugar content, alcohol content, total acid, ash and phenols.

Introduction

The biological characteristics of the variety together with the ecological characteristics of the region and the applied agro-technical measures are the most important factors for successful viticultural production, Sivčev et al. (2012). Considering the ecological conditions, almost every country has its own autochthonous grapevine varieties formed over a long time. In

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Banja Luka

2019

Original scientific paper

Properties of grapevine hybrid '14362' obtained from crossing combination Red Traminer × Early Muscat

Zorica Ranković-Vasić, Aleksandar Petrović, Nikolina Lisov, Saša Marjanović, Mirjam Vujadinović Mandić, Ana Vuković, Sara Muhtalo, Dragan Nikolić

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Abstract

The most important method for creating new grapevine varieties is hybridization. Work on the creation of new grape varieties by hybridization has been in progress for a long time on the Faculty of Agriculture University in Belgrade. This paper presents the results obtained from two years research (2017-2018) of important properties of perspective hybrid intended for table and wine production. The properties of studied hybrid were compared to the parental partners Red Traminer and Early Muscat. Data analysis was performed using the statistical software package Statistica, Version 8 (StatSoft, Inc., Tulsa, Oklahoma, USA). The results of the study showed that the hybrid 14362 had a higher grape yield (2.25 kg per vine) than the Red Traminer (1.80 kg per vine), while the Early Muscat had a grape yield of 3.44 kg per vine. The hybrid 14362 had a higher bunch weight (258.0 g) than the Red Traminer (118.6 g), and a smaller bunch weight compared to the Early Muscat (302.0 g). Hybrid 14362 and Red Traminer had approximately the same sugar content (22.6; 22.9%) and total acid content in the must (7.1; 7.2 g/l). Sugar and total acid content were lower in Early Muscat (18.1%; 6.9 g/l). The investigated hybrid 14362 due to its specificity and diversity in relation to parental partners should be further monitored and studied in order to obtain a more detailed analysis of the most important traits.

Key words: grapevine, hybridization, yield, quality

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PROIZVODNA I TEHNOLOŠKA VREDNOST NOVOSTVORENE SORTE VINOVE LOZE - VLADUN

Zorica Ranković-Vasić[1], Branislava Sivčev, Aleksandar Petrović, Nataša Lisov, Dragan Nikolić

Sažetak

U ovom radu prikazane su najvažnije proizvodno-tehnološke karakteristike novostvorene sorte vinove loze Vladun koja je u Srbiji priznata i stavljena na sortnu listu 2017. godine. Sorta Vladun je dobijena iz kombinacije ukrštanja Merlo x Župski bojadiser i namenjena je za proizvodnju crvenih vina. Istraživanja kod ove sorte su obavljena u toku dve proizvodne godine (2015-2016) na Oglednom dobru "Radmilovac" Poljoprivrednog fakulteta u Beogradu. Najvažnije osobine kod sorte Vladun su upoređivane sa sortom Merlo koja je bila jedan od roditelja i sortom Kaberne sovinjon koja je sličnog perioda sazrevanja. Rezultati analize varijanse su pokazali značajne razlike između ispitivanih sorti za: prinos, masu grozda, širinu grozda, broj bobica u grozdu, sadržaj šećera i ukupnih kiselina u širi. Efekat godine se ispoljio samo kod prinosa grožđa. Sorta Vladun je imala prinos od 0,89 kg/m², dok su sorte Merlo i Kaberne sovinjon imale prinos od 0,80 i 0,78 kg/m². Masa grozda (168,7 g) i sadržaj šećera u širi (22,3%) bili su značajno veći kod sorte Vladun u odnosu na obe standardne sorte. Proizvedeno vino od sorte Vladun sa 12,7 vol. % alkohola bilo je pitko, harmonično, sa specifičnim sortnim karakteristikama. Novostvorena sorta Vladun je pokazala dobre rezultate za veći broj ispitivanih osobina u agroekološkim uslovima Beogradskog rejona (Grocansko vinogorje) pa se može preporučiti za gajenje u ovom i u drugim sličnim rejonima.

Ključne reči: *vinova loza, nova sorta, kvalitet, grožđe, vino*

UVOD

Vinova loza (*Vitis vinifera* L.) ima veliki privredni značaj u svetu. Značaj gajenja loze leži u činjenici da je ona jedna od najrasprostranjenijih biljnih vrsta jer uspeva u vrlo različitim ekološkim uslovima. Conde et al. (2007) navode da se približno 71% od ukupne svetske proizvodnje grožđa koristi za vino, 27% za svežu potrošnju i 2% kao sušeno grožđe. Vinogradarstvo u Republici Srbiji predstavlja veoma važnu poljoprivrednu granu. Ono datira od davnih vremena. Fosilni ostaci semenki vinove loze i posuđe za vino na arheološkim nalazištima na obali Dunava kod Grocke, u Vinči i drugim mestima ukazuju da je vinova loza na prostorima današnje Srbije bila

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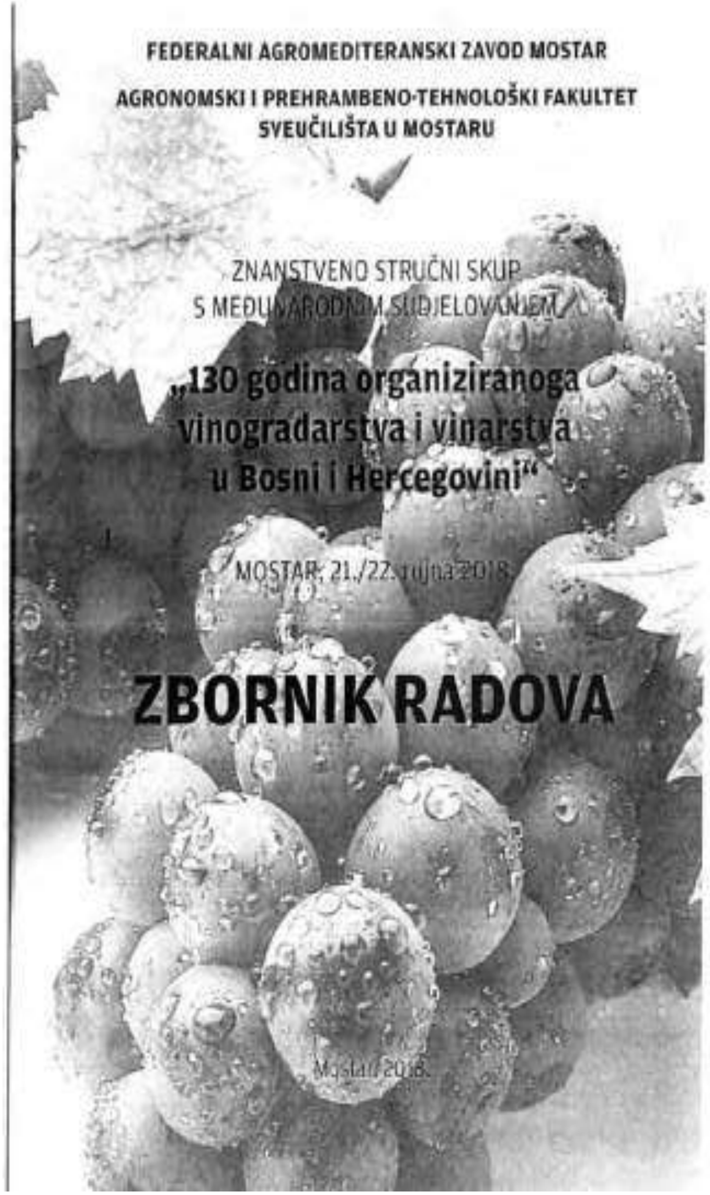

P A2

EXTRACTION KINETICS OF SOME PHENOLIC COMPOUNDS DURING VINIFICATION OF GRAPE VARIETY CABERNET SAUVIGNON AND ITS ANTIOXIDANT PROPERTIES

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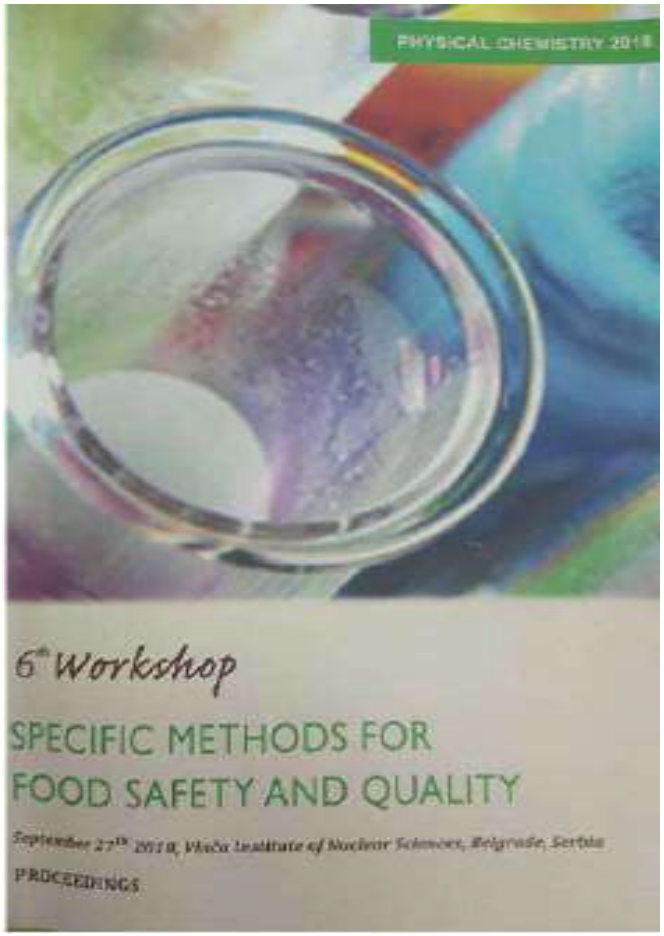
ABSTRACT

The effects of five different pomace maceration times (3, 5, 7, 14 and 21 days) on phenolic compounds and antioxidant capacity of Cabernet Sauvignon wines were studied. Wines with longer maceration times promoted a greater extraction of phenolic compounds (total and individual) and a greater antioxidant capacity.

INTRODUCTION

Red wine quality and its stability are associated with the concentration of phenolic compounds in the grapes and the resulting musts. Phenolic compounds accumulate primarily in the skins and seeds of grape berries, and are extracted into the must and wine during pomace contact period. These compounds have beneficial effects on human health (antiinflamatory, antioxidant and anticancer activity). The concentration of phenolic compounds in wine can be strongly influenced by many variables. The cultivar is one of them but viticultural and environmental factors such as maturity stage, seasonal conditions, enological factors, maceration and ageing can be highlighted too. The length of maceration is the first factor that affects extraction of phenolic compound to the must, although maceration affects not only the extraction of phenolic compounds but also of other compounds that may participate in condensation, oxidation and polymerization reactions. The first objective of this study was to determine



Original scientific paper

Influence of some enological treatments on *trans*-resveratrol and total phenolic content in wine

Petrović Aleksandar, Lisov Nikolina, Plavšić Ivana, Madžgalj Valerija,
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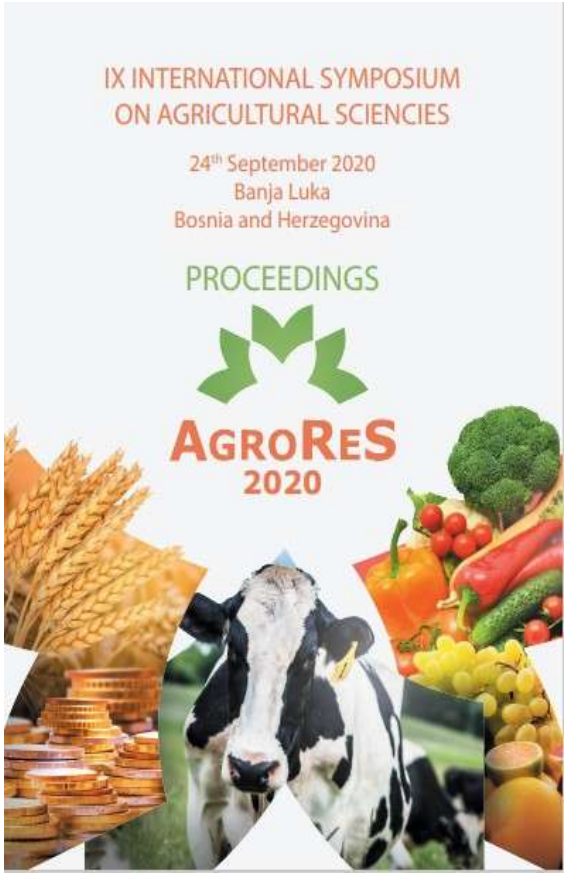
Abstract

In this study, the influence of winemaking techniques and grape cultivars on *trans*-resveratrol and total phenolic content in wines was studied. The *trans*-isomer occurs in the berry skins of most grape cultivars, and its synthesis is stimulated by UV radiation, injury, and fungal infection. The *trans*-resveratrol content in wine depends of many different factors including variety, vintage, climatic conditions, UV radiation, storage conditions and winemaking process. Some wine making techniques were applied in order to investigate its impact to *trans*-resveratrol and total phenolic content. Addition of different combination of enzymes and wine yeasts, resulted in different content of these compounds. Yeast Uvaferm 299 (Lallemand, Canada) with the enzyme Lallzyme OE (Lallemand, Canada) indicated the best extraction of *trans*-resveratrol (1.56±0,04 mg/l) and total phenolic content (1774.20 mg GAE/l) in Prokupac wine samples. Also, biological deacidification, pasteurization and use of some clarifying agents (bentonite and gelatine) had no influence on *trans*-resveratrol and total phenolic content.

Keywords: Trans-resveratrol, Total phenolic content, Wine yeasts, enzymes

Introduction

Resveratrol (3,5,4'-trihydroxystilbene) is a phytoalexin synthesized by grapevine leaf tissue following fungal infection (*Botritys cinerea*) and UV light irradiation (Pezet et al., 2003). It is a phenolic phytoalexin that is biosynthesized in the grapevine in response to fungal infection, exposure to ozone or heavy metal ions and stress conditions, or when the environmental factors are unfavorable to their development (Téguo et al., 2001; Caruso et al., 2004; Baptista et al., 2001). *Trans*-resveratrol mostly synthesized in the skin cells, while its concentracion in flesh



DYNAMIC OF TOTAL PHENOLIC CONTENT *cv* CABERNET SAUVIGNON DURING RIPENING AND IMPACT ON ANTIOXIDANT CAPACITY OF WINE

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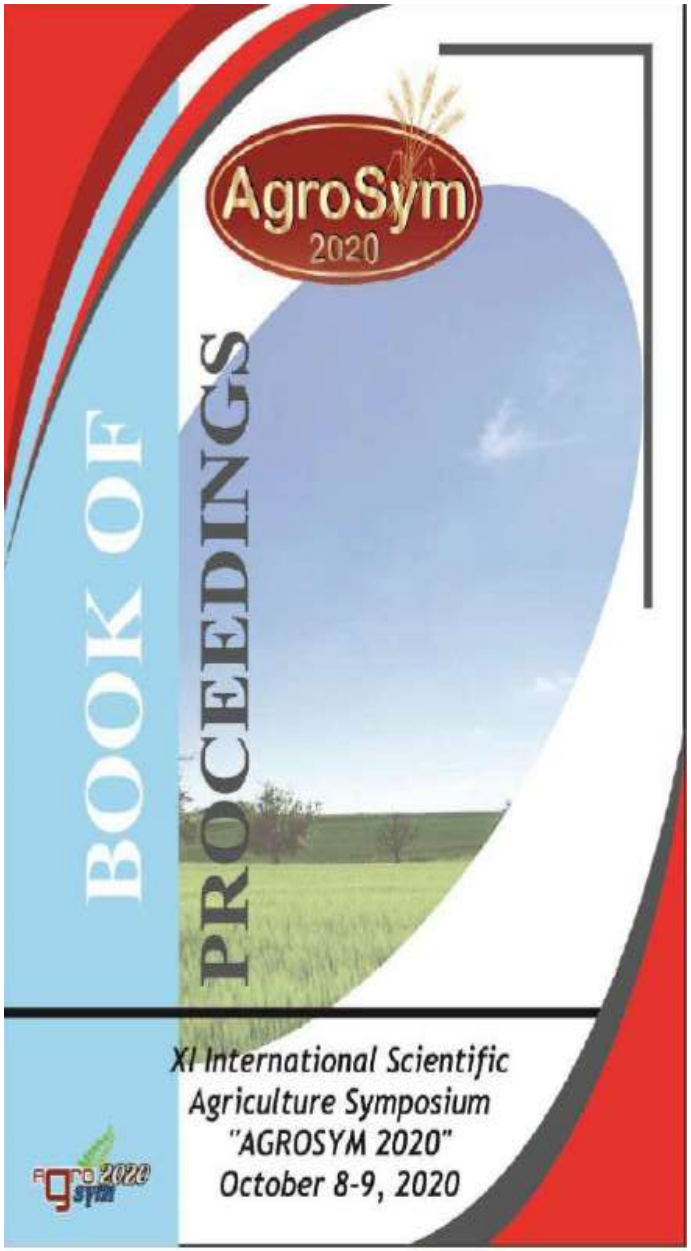
Abstract

In this study, the impact of ripening phenophases on the total phenolic content in wines and their antioxidant capacity was studied. Grapes were harvested in three different stages of maturity: véraison, optimal enological maturity and overripeness, which originated from vineyards belonging to experimental field "RADMILOVAC" of the Faculty of Agriculture in Zemun, University of Belgrade (Serbia). After grapes crushing and destemming, the samples of crushed grapes sulfited with 10 g of $K_2S_2O_5$ per 100 kg and yeast strain *Saccharomyces cerevisiae* in the amount of 20 g/hl (BDX, Lallemand, Canada) was inoculated. Alcohol fermentation with maceration lasted 21 day at temperature of 25±3□C using the "pigeage"system (mechanically punching down). After that pomace was separated and obtained wine samples were bottled and stored until analyses. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard. According to this method, the highest phenolic content was for véraison sample (1385.0 mg GAE/l), then for optimal enological maturity sample (1325.0 mg GAE/l), and the lowest content was for overripeness sample (1070.0 mg GAE/l). Also, anti-DPPH radical activity and antioxidant capacity were analysed using FRAP and TEAC methods. The results of these antioxidant methods showed that higher total phenolic content led to better antioxidant capacity of wine samples. A véraison wine sample showed the highest antioxidant capacity which was positively correlated with their total phenolic content.

Keywords: *Total phenolic content, grape maturation, antioxidant capacity, wine.*

Introduction

Many compounds of enological interest (phenolic compounds, aroma precursors) are known to be accumulated in that tissue throughout ripening (Vicens *et al.*, 2009). As the berries are growing, the sugar content rises, while the concentration of the acids decreases. Furthermore, during véraison the grapes accumulate color (anthocyanins for red grapes), aroma compounds, tannins and minerals. The moment when the grape is fully ripe, called physiological ripeness, is characterized by maximum sugar content, and it is also the moment when the sugar, acidity and pH levels are in a good balance for harvesting (Ivanova *et al.*, 2011; Milosavljevic, 1998). Accumulation of anthocyanins in the red grape varieties starts at véraison (Kennedy *et al.*, 2002) while proanthocyanidins are mainly accumulated before véraison (Cadot *et al.*, 2006). Véraison is the period when grape berries go through several changes i.e. the green color is changing into yellow-green for the white grapes or into red and different blue nuances for the red grapes due to accumulation of anthocyanins in the skins (Milosavljevic, 1998). The softening mechanism during véraison may be associated with the changes in polysaccharide composition and structure of the mesocarp cell walls (Yakushiji *et al.*, 2001). Proanthocyanidins are primarily responsible for the astringent properties of red wine (Des Gachons and Kennedy, 2003). It is generally accepted that tannins are not chemically broken



INFLUENCE OF SULFUR DIOXIDE AND ASCORBIC ACID ON PHENOLIC ACIDS IN CABERNET SAUVIGNON WINE

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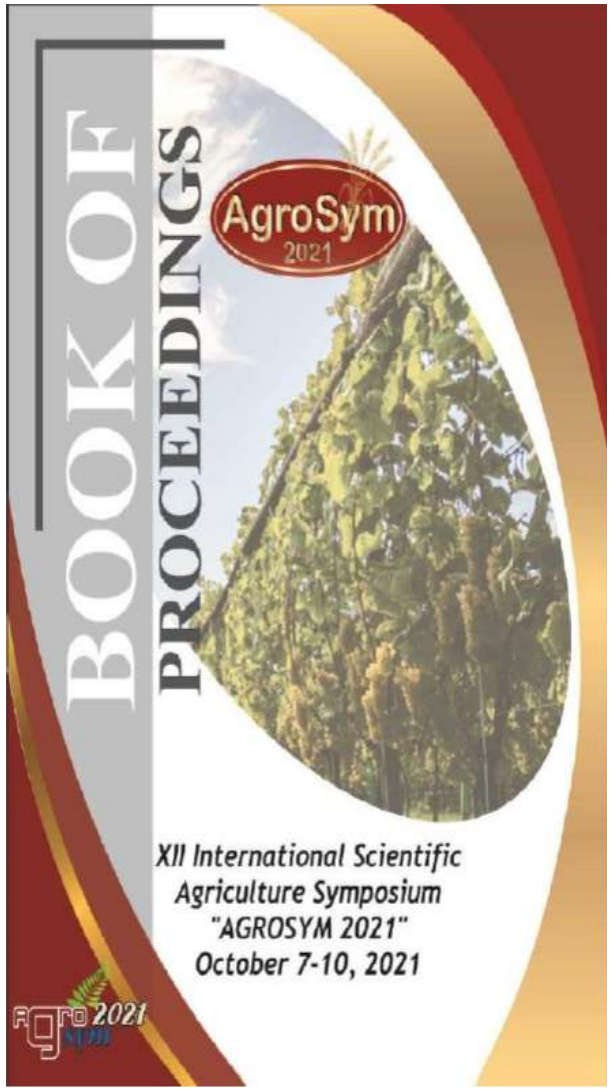
Abstract

Many reactions between O_2 and phenolic compounds or ascorbic acid in the wine induce an rapidly rate of consumption of O_2. If concentration of sulfur dioxide is sufficiently high in wine, the reaction products of O_2 and the wine components are mostly avoided. The impact of addition $K_2S_2O_5$ and ascorbic acid to phenolic composition in wine was investigated. Analysis of Cabernet Sauvignon wine was made by classical vinification and maceration (21 days) inoculated with pure yeast strain *Saccharomyces cerevisiae* (BDX, Lallemand, Canada). After six months of storage, in different samples of experimental wine increasing contents of $K_2S_2O_5$ (3g/hl, 5g/hl and 7g/hl) and ascorbic acid in concentration 200mg/lwere added. Control sample without any addition was the same for both of experiments. Phenolic acids in wines wereanalyzed by UPLC H-Class System.Thestatistically significant difference between control and wine samples added by 5 and 7g/hl of $K_2S_2O_5$for derivates of benzoic acidwas observed. Addition of $K_2S_2O_5$in all of added concentrations did not significantly changed content of derivates of cinnamic acids. SO_2 has an excellent abilitystabilise hydroxycinnamic acid polyphenols such as caffeic acid when exposed to conditions of oxidation. Influence of ascorbic acid wasnot statistically significant for content of benzoic and cinnamic acidsderivatesin wine. Among phenolic acids the most susceptible to oxidation are those containing an ortho-diphenol functional group, including caffeic acid and its derivatives and compounds with a triphenol group such as gallic acid.

Keywords: *Sulfur dioxide, Ascorbic acid, Phenolic compounds, Red wine.*

Introduction

Sulfur dioxide (SO_2) has been used for centuries by winemakers as a preservative due to its antimicrobial and antioxidant properties (Waterhouse, 2016). The central role of oxygen in the process of wine maturation has been long known. In recent years, a number of studies have described the influence of oxygen exposure on wine chemical and sensory characteristics, including changes of wine aroma, color and mouthfeel (Ferreira et al., 2015). Even in wines without SO_2 additions, low amounts of total SO_2 (typically 10–20 mg/L) are present at the end of alcoholic fermentation as a result of SO_2 formation during amino acid biosynthesis. However, in most wines, the majority of SO_2 is added exogenously either before or after fermentation, often in the form of potassium metabisulfite ($K_2S_2O_5$) or as SO_2 gas. Free bisulfite can be lost following wine oxidation, either by reaction with H_2O_2 or by forming adducts with acetaldehyde or other electrophiles. SO_2 adduct formation is reversible and thus formation and dissociation reactions are happening continuously (Waterhouse, 2016). The mechanisms of wine antioxidant



Original scientific paper

Effects of thermovinification and carbonic maceration on polyphenols extraction of cv. Cabernet Sauvignon

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Abstract

In this study, the impact of winemaking technique: classical vinification with different maceration time (7 (CC7) and 14 (CT14) days); thermovinification (60°C (T60) and 80°C (T80) and carbonic maceration (CM) on the total phenolic content and phenolic acids in wines was studied. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard and phenolic acids in wines were performed by UPLC H-Class System. It was conducted that the application of thermovinification (T60°C, 2800mg GAE/l; T80°C, 3130 mg GAE/l) leds to higher total phenolic content then in wines CT14 (1395 mg GAE/l). On the other hand, total phenolic content of CM wines were a lower than those in the wines made by CC7, which lasted 7 days. All phenolic acids have had higher content in samples CT14, except caffeic acid which was the highest for T60 sample (7,5819 mg/l).

Key words: thermovinification, carbonic maceration, total phenolic content and phenolic acids.

Introduction

There are many winemaking techniques (maceration time, heat and cold treatman, yeast and enzyme used, SO_2 dose, fining agents, ageing of red grape processing) used to produce different styles of wines with different content of phenolic compounds. Phenolic compounds depend of the grape variety, ripening stage, cultivation, agrotecnique conditions, location (Ševcech et al., 2015; Boranzan & Boran, 2013). The quantity of phenolic compounds that are transferred from grapes into wine during maceration varies according to the conditions of the process (González-

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Preliminary report

Extraction kinetics of phenolic acids during prolonged maceration time and vinification of Cabernet Sauvignon grape variety

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Abstract

Effects of maceration time on the phenolic acids content in red wine grape variety Cabernet Sauvignon (*Vitis vinifera L.*) was investigated in this study. In focus of this study were four derivates of hydroxybenzoic and hydroxycinnamic acids: gallic, syringic, caffeic and *p*-coumaric acids extracted into wine during five different maceration periods and using two different yeasts (FX10 and Qa23). The control wine was made according to technology of white wine, exactly separated must and solids immediately after crushing and destemming. Concentrations of these compounds were measured using UPLC-MS system (Agilent LCTQ 6495C Triple Quadrupole). The most abundant phenolic acid in wines fermented with yeast FX10, was *p*- coumaric acid and its maximal value was on 12th day of maceration. The highest extracted values during fermentation with Qa23 were obtained for syringic acid with maximal value at 12th day of maceration. Gallic and caffeic acids values also showed exponential increase during maceration but its extracted values were lower. A statistically significant difference was found comparing content of tested phenolic compounds in control wine and wines obtained after maceration for 3, 5, 7, 14 and 21 days using FX10 yeast strain ($p < 0,05$). Maceration which lasted 5, 7 and 21 days using Qa23 yeast strain also showed a statistically significant difference than control wine in term of phenolic acids concentrations ($p < 0,05$).

Key words: extraction, maceration time, phenolic acids, yeast strain.

Introduction

Phenolic compounds have been studied due to their beneficial effect on human health and

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COMPARISON OF DIFFERENT EXTRACTION METHODS FOR QUANTIFICATION OF INDIVIDUAL PHENOLIC COMPOUNDS IN WINE BY LIQUID CHROMATOGRAPHY

Ivana PLAVŠIĆ, Nikolina LISOV, Sandra GAJEVIĆ, Ivana SREDOVIĆ IGNJATOVIĆ, Aleksandar PETROVIĆ*

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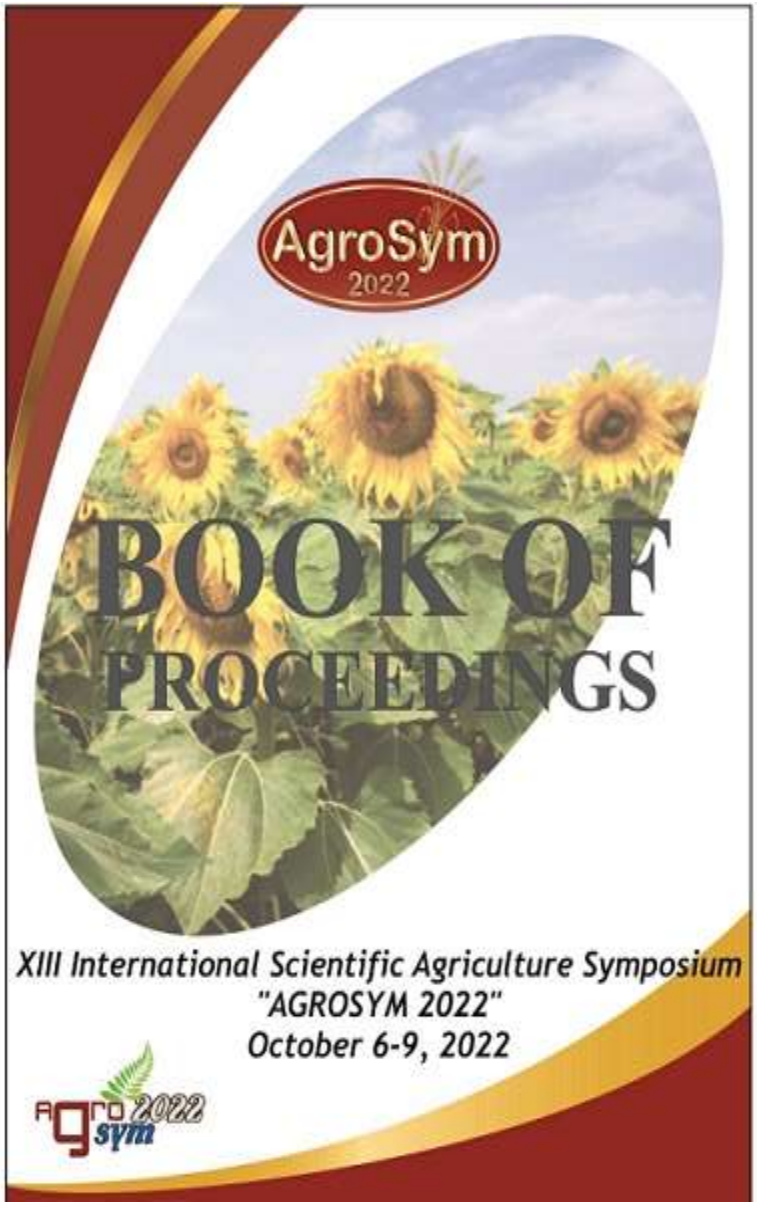
Abstract

Two different methods for sample preparation as a preliminary phase for the quantification of individual phenolic compounds were compared with the aim to establish the best conditions for the determination of these compounds in wine samples by ultra-high performance liquid chromatography (UHPLC). Wine of the variety Vozd (newly acquired variety from Faculty of Agriculture in Zemun) was the subject of this study. Grapes were harvested in optimal enological maturity which originated from vineyards belonging to winery "Draskovic" in Vrsac (Serbia). Three different vinification techniques were applied (cold maceration, thermomaceration and carbonic maceration). Cold maceration (C) was conducted at temperature of 4°C (four days) and thermomaceration (T) at temperature of 60°C (heated one hour). For carbonic maceration (CM) it was necessary to use dry ice and that maceration lasted four days. After maceration, pomace was separated and obtained wine samples were bottled and stored until analyses. The analysis of individual phenolic compounds (caffeic acid, *p*- coumaric acid, *p*- hydroxybenzoic acid, rutin and quercetin) in wines was performed by using a coupled with a diode array detector and a triple quadruple mass spectrometer (UHPLC DAD–MS/MS). Quantification of investigated phenolic compounds after solid phase extraction have showed higher concentrations of these compounds in wine, than in samples in analysed without any pretreatment (direct injection).

Keywords: *Phenolic compounds, Wine, Solid phase extraction, Liquid chromatography.*

Introduction

Chromatographic analysis of wine and other complex matrices presents an analytical challenge in terms of effective analyte resolution, compound identification and quantification. The quantification of phenolic compounds in wine is very important because of their biologically properties and also due to this group of substances being responsible for colour, astringency, flavour and hardness of wine. The determination of this group of compounds is important since variations in wine types and styles are largely due to the concentration and composition of wine phenols. Different variables, such as type of organic solvent, time of extraction, pH of the extraction, solvent for the extract have different impact to obtaining chromatograms of phenols that could be easy interpreted (Malovana et al., 2001). Many reported methods lean toward simplicity in sample manipulation and suggest direct injection. Other methods illustrate the advantages of sample fractionation via solid-phase extraction (Manns and Mansfield, 2012). SPE is capable of reducing interference from the high molecular weight phenolics eluting as a broad hump, while at the same time retaining most of the information on the low molecular weight compounds (de Villiers et al., 2004). While some authors favor direct injection of wine samples



OP C2

PHENOLIC PROFILE OF PLUM WINES AND THEIR ACTIVITY IN THE PROTECTION AGAINST FREE RADICALS

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ABSTRACT

The cell damage is expected when the balance is broken in favor of reactive oxygen species (ROS). Antioxidants are responsible for the prevention of this problem. In this study, a protective effect of plum wines against hydrogen peroxide-induced oxidative stress was evaluated in rat synaptosomes. The wines were produced from plums according to an innovative microvinification procedure. The phenolic profile of plum wines highlighted phenolic acids and flavonoids. Oxidative stress parameters, malondialdehyde (MDA), superoxide dismutase (SOD), glutathione peroxidase (GPx), and catalase (CAT) were monitored. All fruit wines used in this study showed good abilities to protect synaptosomes against the induced oxidative stress. Such properties of plum wine result from the synergistic effect of all natural antioxidant compounds present in the wine.

INTRODUCTION

Fruits and vegetables, along with their derived products, represent a rich source of bioactive compounds [1]. Among them, it is possible to highlight phenolic acids and flavonoids. Those compounds can scavenge reactive oxygen species (ROS), which are products of normal cellular physiology [2]. The ROS involve superoxide anion radical ($O_2^{\cdot-}$), hydrogen peroxide (H_2O_2), and hydroxyl radical ($^{\cdot}OH$), chemically reactive byproducts of cellular metabolism, which are essential in cell growth, differentiation, and gene expression. Under normal physiological conditions, the balance between antioxidants and ROS in the organism is important since a moderate amount of ROS protects cells by activating redox-sensitive signaling pathways. The imbalance in favor of ROS in the human body activates protective mechanisms [3]. The first line of antioxidant defense system includes superoxide dismutase (SOD), catalase

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P C5

COMPARISON OF EXTRACTION KINETICS OF PHENOLIC COMPOUNDS DURING SPONTANEOUS AND INOCULATED FERMENTATION CV. CABERNET SAUVIGNON

N. Lisov[1], I. Plavšić[1], U. Čakar[2], A. Petrović[1] and Lj. Gojković-Bukarica[3]

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ABSTRACT

The influence of applying spontaneous and inoculated fermentation with pure yeast strain (FX 10, Laffort, France) on phenolic compounds (total phenolic compounds, catechin, epicatechin, quercetin and *trans*- resveratrol) were studied. In this study spontaneous fermentation has promoted higher content of anlysed phenolic compounds (*trans*-resveratrol, quercetin, catechin and epicatechin) as well as total phenolic compounds.

INTRODUCTION

Wine composition depends on variety, climatic conditions, soil, cultivation techniques, and time of vintage during the berry ripening and winemaking process. Improving the extraction of phenolic compounds from grape during winemaking is an important step in optimizing the enological process [1]. The length of skin maceration is the first factor that affects the extraction of phenolic compounds [2]. The extraction of flavan-3-ols and tannins is better when increasing the length of skin contact and percentage of produced ethanol during alcoholic fermentation, and they continue to be extracted after the anthocyanin extraction has reached maximum [3]. The interaction between tannins and mannoproteins, released from different yeast has been examined, and it has been found that addition of mannoproteins from particular yeast led to more condensation reactions and decreased astringency in wine [4]. In this study, the influence of different time of maceration, with and without addition of pure yeast strain, on the extraction of skin and seed phenolics was investigated.

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PROCEEDINGS

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THE INFLUENCE OF THE ENOLOGICAL TANNINS APPLICATION ON THE PHENOLIC COMPOSITION OF WINE

Aleksandar Petrovic[1], Nikolina Lisov[1], Ivana Plavsic-Janjatovic[1], Ivana Sredovic-Ignjatovic[1], Danka Mitrovic[1]

Abstract: The chemical composition of wine depends on the degree of maturity and quality of the grapes, as well as the agroecological conditions under which the grapes are grown. Tannins are of particular importance for wines, they are the source of the characteristic astringency of red wines. The main aim of this study was to investigate the influence of addition of enological tannins (0.05 g/L; 0.15 g/L; 0.3 g/L) on the phenolic composition of wine. The effect of the addition of differenttannins on the certain phenolic compounds (gallic acid, caffeic acid, ellagic acid and quercetin) was measured by HPLC analysis.Only forcontent of gallic and caffeic acid, there was a statistically significant difference between the control sample and all other samples with added tannins.

Keywords: enological tannins, phenolic compounds, wine, HPLC analyse

Introduction

The grape harvest is done when technological and phenolic maturity is reached. These two maturities coincide in good years, but in bad years the difference between full technological and phenolic maturity can be as much as 15 days.

Different oenological supplies, such as chips, staves and commercial enological tannins, are widely used to add phenolic compounds to wine (Vazallo-Valleumbrocio et al., 2017). With the development of tannin products, newoenological tannins are developed with many specific functions, such as modifying antioxidanteffect, colour stabilization and aroma modifications (Chen et al., 2016). According to their structure, tannins can be broadly divided into two classes of macromolecules, termedhydrolysable tannins and condensed tannins (Fig. 1) (Herderich and Smith, 2005). The action mechanism is different depending onthe nature of the tannin. Condensed tannins(procyanidins) can combine with anthocyanins(directly or by means of acetaldehyde mediatedreactions) and stabilize wine colour. Hydrolysabletannins cannot participate in condensation reactions with anthocyanins, but they can participatein copigmentation reactions, as well as protectwine anthocyanins from oxidation since they mayregulate

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ČAČAK

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- PROCEEDINGS -

SB XXVIII Čačak 2023.

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ANTIOXIDANT PROPERTIES AND BIOLOGICAL ACTIVITY OF FRUIT WINES

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Abstract: The fruit wines from blueberry were made by microvinification procedure. Wines were produced in the absence or presence of sugar and/or enzymatic preparation glycosidase (EPG). Selected phenolic acids were quantified using UPLC/MS-MS analysis. Total phenolic content (TPC) was determined by the Folin-Ciocalteu method. Also, 2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing ability of plasma (FRAP) methods were applied. The α-glucosidase inhibitory activity of blueberry wines was also investigated. Wines made with addition of sugar and EPG showed the best results. Phenolic profile and biological activity of blueberry wine depended from microvinification procedure which was used in the production.

Keywords: blueberry wine, phenolic compound, antioxidant activity, anti radical activity, α-glucosidase inhibitory activity

Introduction

Fruits and vegetables are essence part of balanced diet and their regular consumption (400 g every day), as fresh or processed may positively affect human health (Joshipura et al., 2001). Antioxidant compounds are responsible for health promoting effects of food, since they prevent development of chronic non-communicable diseases such as heart disease and diabetes mellitus (WHO, 2016). Fruits and their derived products are rich source of numerous naturally occurring compounds such as phenolic acids (hydroxybenzoic and hydroxycinnamic acid derivatives), flavonoids and anthocyanins (Robards et al., 1999;. Wang, 2003). The fruit wine is one of the products which is possible to make from various types of fruit. It is important to emphasize that during fruit processing active principles retain in the final product (Czyzowska and Pogorzelski, 2002). Berry fruit wines are

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SB XXVIII Čačak 2023.

Title: ANTIOXIDANT, ANTIRADICAL AND IN VITRO INVESTIGATION OF HEALTH PROPERTIES OF SOUR CHERRY WINE
In: on Wednesday, 25 September 2019, -
Type: Poster
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade, Serbia)
Co-author(s): Uroš Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Nada Grozdanić: Institute for Oncology and Radiology of Serbia, Experimental Oncology, Belgrade, Serbia
Aleksandar Petrović: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Nikolina Lisov: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Vlatka Vajs: Institute for Chemistry, Technology and Metallurgy, University of Belgrade , Belgrade, Serbia
Branislav Nastasijević: Vinča Institute of Nuclar Sciences, University of Belgrade, Belgrade, Serbia
Brižita Đorđrvic: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia, ()

Abstract:
BackgroundCherry fruit and it derived products are significant in nutrition since they exhibit beneficial health effects on human organism. Wine from fruits showed interesting antioxidant, antiradical and health properties.MethodsWines were produced with addition of sugar and enzyme before fermentation and without addition. Two different yeasts were used and in study was investigated 8 samples. Antioxidant activity determined by FRAP while antiradical by DPPH method. Alpha glucosidase inhibitory activity was measured by using alpha-glucosidase and substrate solution, p-nitrophenyl alpha-D-glucopyranoside. Quantification of some natural compounds conducted by using UPLC TQ-MS/MS while total phenolic by Folin-Ciocalteu method.ResultsThe antioxidant activity was in range 43.55-57.75 mmol L-1Fe2+ , while antiradical 1.85-2.19%. Alpha glucosidase inhibitory activity indicated that all samples showed inhibition and results were in range 55.47-75.21 μg/mL but some results can be highlighted. Cherry wines are good source of chlorogenic, vanillic, protocatehuic acids while epicatehin and catehin were determined too. Total phenolic content was in range 1521-1770 mg GAE L-1. Wines with the sugar and enzyme showed better extraction of phenolic compounds, antioxidant properties, antiradical properties and alpha glucosidase inhibitory activity.
ConclusionCherry wines showed as a good source of phenolic compounds, which synergistically and antagonistically contribute to the beneficial health effects of analysed wines.

Title: INFLUENCE OF TECHNOLOGICAL PROCESS ON ANTIOXIDANT CAPACITY OF WINES FROM CABERNET SAUVIGNON VARIETY
In: on Wednesday, 25 September 2019, -
Type: Poster
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade, Serbia)
Co-author(s): Uroš Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Nikolina Lisov: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Aleksandar Petrović: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Valerija Madžgalj: 13 jul Plantaže a.d. , Podgorica , Montenegro
Ljiljana Bukarica: Institute of Clinical pharmacology, Pharmacology and Toxicology, Faculty of Medicine, Belgrade, Serbia, ()

Abstract:
BackgroundPhenolic compounds exhibit beneficial helth effect on human organizam and conditions for increasing their content in some products such as wine can be considered as important.
MethodsAlcohol fermentation with maceration was carried out in microvinification by using Saccharomyces cerevisiae yeast during the 3, 5, 7, 14 and 21 days , Antioxidant capacity was measured by radical cation decolourisation (ABTS) expressed as mmol/L Trolox eqv. and antiradical activity was evaluated by using DPPH radical expressed in %. ResultsAntioxidant capacities of all wine samples increased linearly. Antioxidant properties are in correlation with phenolic content of wine samples. It wac obeerved that wine on 21st day of maceration have the highest antiradical activity 7,33% while antioxidnt activity was 17,20 mmol/L Trolox eqv. in samples with EXV enzymes. Using enzyme Color plus, the highest antiradical activity was also on 21st day 6,48 % while antioxidant activity was 14,23 mmol/L Trolox eqv. . The antioxidant properties of analyzed wine samples are result of synergistic activity of all phenolic and non phenolic natural active principles in wine.
ConclusionAntioxidant activity of wine samples with different enzyme preparations addition showed statistically significant difference. Addition of enzymes and longer maceration leads to better extraction of phenolic compounds which posses beneficial health effect on human organizam and higher antioxidant capacity of produced wines.

DYNAMICS OF SOME POLYPHENOLIC COMPOUNDS DURING VINIFICATION OF GRAPE VARIETIES CABERNET SAUVIGNON

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Introduction: Phenolic compounds have beneficial effects on human health (anti-inflammatory, antioxidative and anticancer activity). The aim of this study was to determine the moment during alcoholic fermentation when the maximum amount of certain phenolic compounds was extracted. In focus were gallic acid, catechin, and myricetin.

Materials and methods: Grape variety Cabernet Sauvignon have been harvested in the state of technological maturity. Phytosanitary state: 100% health, sugar and must 23% and total acid in must 6,8 g/l. Alcohol fermentation with maceration carried out by micro vinification method at temperatures of 25°C using peggeage. Free sulfur dioxide (5 g/hl) was added to grape pomace. *Saccharomyces cerevisiae* was used (BDX, Lallemand, Canada) in the amount of 20 g/hl and pectolytic Enzyme Color Plus (Enartis, Italy) in the amount of 2 g/hl. Liquid parts were separated after 3, 5, 7, 14, 21 day, respectively and fermented without contact with the solid phase (seeds and skin). Determination of the amount of catechin, gallic acid, and myricetin was performed using Waters Acquity UPLC H-Class with the mass detector (Waters TQ -Tandem Quadrupole, WAT-176001263).

Results: It was found that the dynamics of extraction during alcohol fermentation all three phenolic compounds take place exponentially. [1] Maximum of extraction for gallic acid was at fourteen day of maceration (0.0014 mg/l), and for myricetin (0,0288 mg/l) and catechin (0,1770 mg/l) fifth day of maceration. After these maxims, there is an exponential decrease in the number of phenolic compounds detected, which can be explained by their mutual interactions (oxidation, polymerization, condensation). [2]

Conclusions: These results indicate that optimal time for the maximal value of extraction of catechin and myricetin was at the beginning of fermentation (fifth day) and for some phenolic acid, as gallic acid was close to ending of fermentation.

Literature:

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Exhibitors

EXTRACTION KINETIC OF RESVERATROL AND TOTAL PHENOLIC COMPOUNDS DURING VINIFICATION OF GRAPE VARIETIES MERLOT AND SMEDEREVKA

Petrović A. (1)*, Lisov N. (1), Madrgalj V.(2), Čakar U. (3), Despotović S.(1), Gojković-Bukarica Lj. (4)
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Introduction: Resveratrol (*trans*-3,5,40-trihydroxystilbene) is a phenolic phytoalexin produced by grapevines in response to fungal infection. It exists as *trans*- and *cis*-isomeric forms. Numerous studies supported a role of dietary resveratrol in the prevention of cardiovascular diseases.
Materials and methods: Wines were made at the oenological station Radmilovac of Faculty of Agriculture, Zemun, Belgrade from grapes Merlot and Smederevka. After destemming, the grapes were crushed and free sulfur dioxide was added 5 g/hl. Alcoholic fermentation with maceration is carried out by micro vinification method. The grapes of Smederevka variety were processed according to the procedure for obtaining red wines. Alcoholic fermentation was conducted with BDX yeast (Lallemand, Canada) added to a concentration of 20 g/hl. The determination of *trans*-resveratrol is performed using reverse phase HPLC with UV detection. (Hitachi 655A-11, column Bishoff Hypersheome Hypersil 25cm x 4.6mm). The total phenols were determined using the Folin-Ciocalte method.
Results: The maximal value of extraction of resveratrol from the grape skin is achieved after the ninth day of maceration (2.30 mg/l) in the Merlot variety, while in the Smederevka variety max peak was after eight days (1.20 mg/l) from the beginning of fermentation. Maximum extraction of phenolic compounds in the Merlot variety was achieved after 14 days (2090 mg/l), and in Smederevka after 10 days (500 mg/l). [1][2]
Conclusions: Extraction of resveratrol follows the kinetics of extraction of other phenolic compounds. Also, when the white grapes (Smederevka) are processed according to the technology of red wines, eight times more resveratrol is obtained compared to control.

Literature:
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ABSTRACT BOOK

Exhibitors

EFFECTS OF MACERATION DURATION OF GRAPES VARIETY CABERNET SAUVIGNON ON KINETICS EXTRACTION OF SOME POLYPHENOLS AND ANTIOXIDANT PROPERTIES OF WINE

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Extraction of phenolic compounds during maceration depends on vinification conditions, while the maceration duration has the greatest influence. The aim of this research was to determine the influence of different maceration periods of grapes variety Cabernet Sauvignon (3, 5, 7, 14 and 21 days of maceration) on extraction kinetics of ellagic acid, myricetin, catechin, total phenols and antioxidant capacity of wine. Grape variety Cabernet Sauvignon was harvested in state of technological maturity. Grape pomace was added free sulphur dioxide 5 g/hl, yeast *Saccharomyces cerevisiae* (BDX, Lallemand, Canada) in the amount of 20 g/hl and Enzyme Colour Plus (pectolytic activity) (Enartis, Italy) in the amount of 2g/hl. Wine samples were collected on days 3, 5, 7, 14 and 21 from the beginning of maceration. Determination of the amount of ellagic acid, myricetin and catechin was performed using UPLC TQ-MS/MS. The content of total phenols was determined by the Folin–Ciocalteu's method and antioxidant capacity with FRAP assay. It was found that the dynamics of extraction during alcohol fermentation all three phenolic compounds and total phenols take place exponentially. Maximum extraction of total phenols was 5th day of maceration (606.20 mg/l GAE). Maximum of extraction for ellagic acid was at 14th day of maceration (0.4158 mg/l), for myricetin (0.2765 mg/l) and catechin (4.6271 mg/l) 5th day of maceration. Antioxidant capacity measured with FRAP test increase with the increase in total phenols, and it ranged from 19 mmol/l (3rd day) to 36 mmol/l (21st day).

Keywords: *maceration, myricetin, ellagic acid, catechin, frap assay*

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INFLUENCE OF MACERATION TIME OF GRAPE POMACE CABERNET SAUVIGNON ON EXTRACTION KINETICS OF SOME POLYPHENOLS AND ANTI-DPPH RADICAL ACTIVITY OF WINES

Nikolina LISOV[1], Uroš ČAKAR[2], Aleksandar PETROVIĆ[1*], Ljiljana GOJKOVIĆ-BUKARICA[1]

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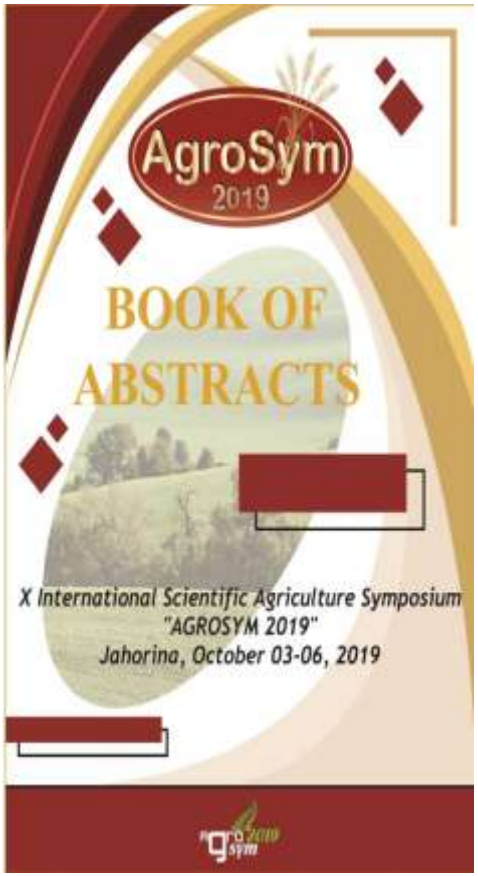
Abstract

The influence of five different maceration times on extraction of some polyphenols and anti-DPPH radical activity of wine samples were investigated. In focus were: caffeic acid, syringic acid and *p*-coumaric acid. Grape variety Cabernet Sauvignon was harvested in the state of technological maturity. Phytosanitary state: 100% health, sugar in must 23% and total acid in must 6.8 g/l. Alcohol fermentation and maceration was carried out by microvinification method using the pigeagé system. Sulphur dioxide was added as $K_2S_2O_5$ (10g/100 kg crushed grapes), enzymatic preparation Caractére (Car) (Enartis, Italy) with pectolytic, hemicellulase and *β*-glycosidase activity and wine yeast *Saccharomyces cerevisiae* (BDX, Lallemand, Canada) in the amount of 20g/hl. Liquid parts were separated from the start of fermentation (3, 5, 7, 14, 21 day, respectively), and fermented without contact with pomace (seeds and skin). Control sample obtained first day, without maceration. Determination of the amount of caffeic, syringic and *p*-coumaric acids was performed using Waters Acquity UPLC H-Class with mass detector. It was found that the dynamics of extraction during alcohol fermentation all three phenolic compounds take place exponentially. Maximal amount of extraction for caffeic acid was at 13th day (2.851 mg/l), for syringic acid was at 11th day (1.096 mg/l) and for *p*-coumaric acid at 12th (1.335 mg/l) day of maceration. For anti-DPPH radical activity, the highest potential (5.8%) was found for wine macerated 21day, and lowest (40.66%) was found for wine macerated 3 days. Addition of enzymes and longer maceration leads to better extraction of phenolic compounds and to higher antiradical activity.

Keywords: *Maceration time, Phenolic compounds, Extraction, Antiradical activity.*



AN INSIGHT INTO QUALITY OF APRICOT AND SWEET CHERRY FRUIT WINES

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ABSTRACT

This study was conducted to evaluate phenolic profile and antioxidant properties of sweet cherry and apricot wine. The wines were produced by innovative microvinification procedure. Musts were obtained by fruit crushing in two ways: the pits were removed or left (without cracking). Furthermore, in part of the samples sugar was added before start of fermentation, due to the increasing of alcohol content. While total phenolic content (TPC) was determined by Folin-Ciocalteu method, polyphenolic profile was identified using UPLC TQ-MS/MS. Additionally, anti-DPPH radical activity and FRAP values were spectrophotometrically estimated. Microvinification procedure significantly affected both polyphenolic profile and antioxidant potential. Herein, the addition of sugar before fermentation resulted in higher content of the selected polyphenolic compounds followed by enhanced antioxidativity. TPC and FRAP values were in the ranges 521.21–1787.57 mg GAE/L and 38.51–65.77 mmol/L Fe^{2+} respectively, while anti-DPPH radical activity (expressed as an IC_{50} value) ranged from 1.97 to 77.34%. Taken all together, sweet cherry wine was found to be a richer source of naturally occurring polyphenolics compared to the apricot one.

Keywords: *apricot, sweet cherry, fruit wine, antioxidant properties, polyphenolic profile*

INTRODUCTION

Drupe fruit are very popular part of diet during the spring and summer. This fruit are mainly consumed fresh during the season, but it is possible to consume them processed in different forms during the whole year. Among drupe fruit it is possible to highlight apricots and sweet cherries as a good source of natural active compounds which exhibit antioxidant properties (Usenik et al., 2008; Carbone et al., 2018). From the phenolic antioxidants in the sweet cherries and apricots is possible to point out phenolic acids which are represented in both fruits and their derived products. Phenolic acids are presented as a derivatives of hydroxycinnamic and hydroxybenzoic acids (Melgarejo et al., 2014; Kim et al., 2005). Phenolic antioxidants have been reported to have various positive effects on the human health like anti-inflammatory, anti carcinogenic effects and protective effects on neuronal cells. These compounds possess strong ability to scavenge free radicals, donate hydrogen, chelate metals, break radical chain reactions, and quench singlet oxygen in vitro and in vivo (Moriarti-Matsuda et al., 2006; Dai and Mumper, 2010). Beside phenolic acids there are also other phenolic and non-phenolic active principles in this fruit which all together contribute to the health beneficial effects (Xiang and Ning, 2008).
During the processing of sweet cherries and apricots into the wine, all those natural active compounds pass into the final product. The aim of this study was to evaluate antioxidant properties and phenolic profile of fruit wines produced by innovative microvinification procedure from the sweet cherries and apricots cultivated in Serbia.

GLOBAL WARMING - CHALLENGE TO THE MODERN ENOLOGY

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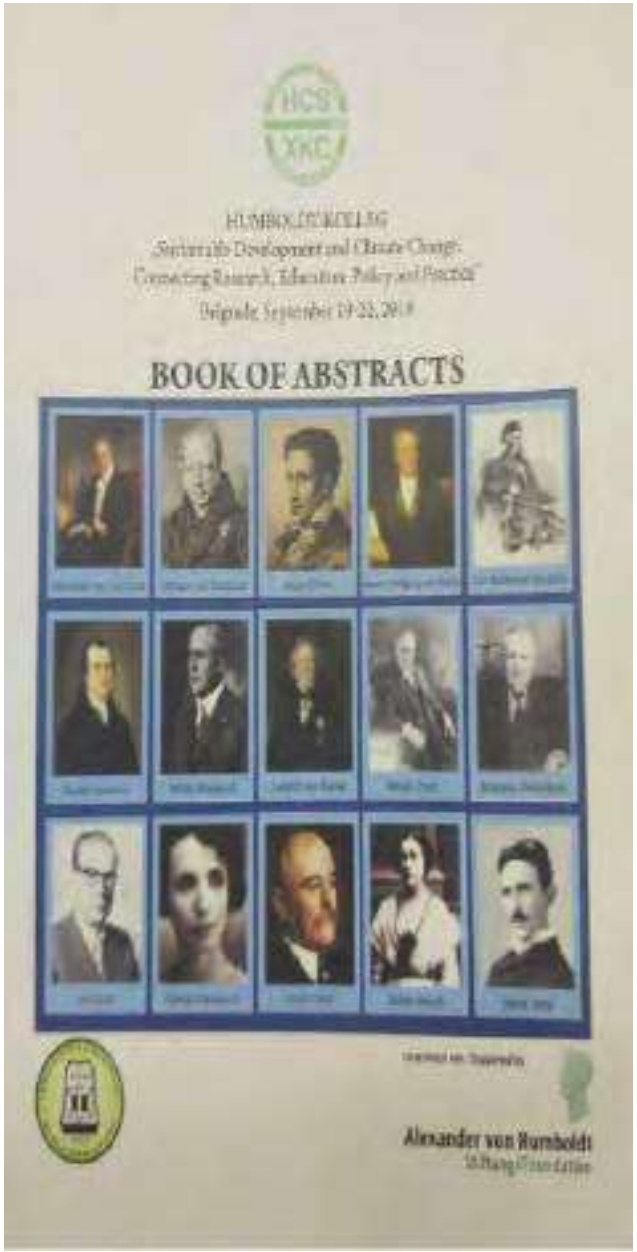
A numerous papers have been published dealing with the influence of global warming on the chemical composition and sensory characteristics of grapes and wines. High temperature values shorten the time needed for grape harvest. The all parts of the berries could not reach the full maturity and the concentration of sugar in the grapes is on the rise. The acidity of grapes often decreasing along with an undesired increase in pH. All of this affect grape harvesting before the berry achieves full technological maturity, which is primarily related to the skin and seeds. The insufficient maturity of grape influences the chemical composition and quality of the wine. The wine have not the required intensity of color. In the case of long maceration, there is a risk of increasing extraction of bitter tannins. In this situation, the oenologists have to use the technological process that is applied under conditions of incompletely mature grapes or they have to wait for the full maturity of grapes and then apply technological procedures to reduce alcohol content and pH. Thus, the variability of the climate from year to year influences the quality of grapes, and therefore the quality of the wine.

Keywords: global warming, wine, phenolic maturity



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BKHP56 / FQSP56

Uticaj načina prerade grožđa i vinifikacije na sadržaj resveratrola u vinu

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U ovom radu ispitivan je uticaj enoloških zahvata i sorti grožđa na količinu resveratrola i ukupnih fenolnih jedinjenja u vinu. Resveratrol (3,5,4'-trihidroksistilben) se javlja u dva izomerna oblika. *Trans*-izomer se nalazi u pokožici bobice većine sorti grožđa, a njegova sinteza je stimulisana UV zračenjem, povredama tkiva i gljivičnim infekcijama. *Cis*-izomer nastaje pod uticajem UV zračenja iz *trans*-izomera. Sadržaj resveratrola u vinu zavisi od mnogo različitih faktora, uključujući sortu grožđa, godinu berbe, klimatske uslove, prisutno UV zračenje, uslove čuvanja vina i tehnologiju proizvodnje. Viši sadržaji su obično prisutni u crvenim vinima koja su imala duži kontakt između šire i pokožice, dok su niže koncentracije u belim i roze vinima. Druge tehnološke mogućnosti za povećanje sadržaja *trans*-resveratrola u vinu su ceđenje, presovanje kljuka. Vina dobijena od grožđa zahvaćenog plesni *Botrytis cinerea* u meri od 80% imaju najniži nivo resveratrola, dok vina proizvedena od zdravog grožđa ili grožđa koje je zahvaćeno plesnima od 10 do 40% sadrže višu količinu resveratrola. Pored toga, koncentracija slobodnog *trans*- i *cis*-resveratrola u širi i vinu, veoma zavisi od primene različitih zahvata kao što je upotreba enzima β-glukozidaza. Pokazalo se da resveratrol poseduje raznovrsne biološke efekte kao što su prevencija kardiovaskularnih oboljenja, antiinflamatorna i antikancerogena dejstva. Za određivanje količine resveratrola u vinu korišćena je visokoefikasna tečna hromatografija u kombinaciji sa detektorom sa diodnim nizom i RP-C_{18} kolona sa gradient eluacijom [solvent A: acetonitril - sirćetna kiselina - voda (20 : 2: 78 v/v), solvent B: acetonitril - sirćetna kiselina - voda (90 : 2 : 8 v/v)]. Detekcija *trans*- i *cis*-resveratrola izvršena je na talasnim dužinama 306 i 286 nm.

Influence the processing of grapes and vinification of resveratrol content in wine

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In this work the influence of winemaking techniques and cultivars on the resveratrol content and total phenolic content of wines was studied. Resveratrol (3,5,4'-trihydroxystilbene) exists in two isomeric forms. The *trans*-isomer occurs in the berry skins of most grape cultivars, and its synthesis is stimulated by UV light, injury, and fungal infection. *Cis*-isomer is produced by UV irradiation of the *trans*-isomer. The resveratrol content in wine depends on many different factors including variety, harvest year, climatic conditions, UV light, storage conditions and winemaking technology. Higer contens are usually present in red wines that have had prolonged contact between the must and skins, whereas lower concentrations are usally present in white and rose wines. Other winemaking conditions that influence *trans*-resveratrol content such as free- and press-run after dejuicing. Wines obtained from grapes affected 80% by *Botrytis cinerea* have the lowest resveratrol levels, while wines prepared from healthy grapes or grapes affected 10 or 40% by *Botrytis* have higher resveratrol contents. In addition, the concentrations of free *trans*- and *cis*- resveratrol in must and wines are profoundly influenced by some practices, such as the use β-glucosidases. Resveratrol has been shown that it possess various biological effects such as prevention of cardiovascular disease and anti-inflammatory and anticancerogenic properties. Analyses were performed after solid-phase extraction by high-performance liquid chromatography with a diode array detection system using an RP-C_{18} with gradient elution [solvent A: acetonitrile - aceticacid - water (20 : 2 : 78 v/v), solvent B: acetonitrile - acetic acid - water 90 : 2 : 8 v/v)]. Detection of *trans*- and *cis*-resveratrol was performed on 306 and 286 nm.

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Karakteristike grožđa i vina pet klonova sorte merlo u beogradskom rejonu, Srbija

Branislava Sivčev[1]*, Zorica Ranković-Vasić[1], Aleksandar Petrović[1], Nikolina Lisov[1], Vladimir Radovanović[2], Kristina Milišić[1]

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Klonska selekcija vinove loze je doprinela većoj raznolikosti i prilagodljivosti poboljšanih kvantitativnih i kvalitativnih karakteristika sorti. Tipičan primer je sorta Merlo. U Bordou postoji oko 300 potencijalnih klonova, 13 je priznato i široko je rasprostranjeno u svetu. I u drugim zemljama vršena je klonska selekcija sorte Merlo. U našem eksperimentu uključili smo klonove R12, R3 i I-ISV-F-V4 iz Italije, i dva klona 181 i 348 koji potiču iz Bordoa. Pored prinosa, zanimali su nas kvalitet, pokazatelji sastava grozda i bobice, kao i kvalitet vina. U toku tri godine ispitivanja najveći prinos postignut je kod klona R3, po jedinici površine od jednog hektara i iznosio je 5700 kg. U isto vreme ovaj klon je pokazao najmanju varijabilnost u ispitivanom periodu. Klon 348 imao je izuzetno mali broj grozdova, samo 9,73 po čokotu. Prosečan broj grozdova po čokotu bio je ujednačen kod klonova R12, R3, I-ISV-F4 i 181 i iznosio je 19. Veći grozd sa manje semenki u bobici i niski sadržaj ukupnih kiselina je karakterističan za klon I-ISV-F-V4, dok je sadržaj šećera u širi kod klona R12 bio najveći (22,2%). Razlike u kvalitetu vina između klonova bile su najizraženije u sadržaju ukupnih polifenola, alkohola i ukupnog ekstrakta. Vremenski uslovi u periodu ispitivanja (2013-2015) bili su značajno različiti i uticali su na kvalitet grožđa i vina ispitanih klonova.

Fruit and wines characteristics of the five merlot clones in Belgrade winegrowing region, Serbia

Branislava Sivčev[1]*, Zorica Ranković-Vasić[1], Aleksandar Petrović[1], Nikolina Lisov[1], Vladimir Radovanović[2], Kristina Milišić[1]

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Clonal selection has contributed more variety and adaptability improved quantitative and qualitative characteristics of the grapevine. The Merlot variety is a typical example. In Bordeaux keeps about 300 potential clones, 13 were approved and widely diversity in the world. In other countries was conducted clonal selection of the Merlo variety. In our experiment we included clones R12, R3 and I-ISV-F-V4 from Italy, and two clones 181 and 348, which are originating from Bordeaux. In addition to the yield, we showed quality, and the structure of the bunches and berries, and quality of wines. In three years the highest yield achieved the clone R3, per unit area of one hectare was 5700 kg. At the same time this clone showed the least variability in the examined period. The clone 348 had an extremely low number of bunches, only 9.73 per vine. The average number of bunches per vine was uniform at clones R12, R3 I-ISV-F4 and 181, about 19 bunches per vine. Bigger bunch with low seeds in berry and low total acid in the must is characteristic of the clone I-ISV-F-V4, while the sugar content in the must in clone R-12 is the highest (22.2%). The differences in the quality of the wines between clones were most pronounced in the content of total polyphenols, alcohol and total extracts. The weather conditions in the investigation period (2013-2015) were significantly different and affected the quality of grapes and wine of the investigated clones.

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Belgrade, Octobre 5-6, 2018

Title: Comparison of antioxidant profile of sour cherry wine and raspberry wine

In: on Wednesday, 5 September 2018, 12:00-14:30
Type: Poster
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade)
co-author(s): Uros Cakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Milon Jankovic: Faculty of Chemistry, University of Belgrade, Belgrade, Serbia
Aleksandar Petrovic: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Nikolina Lisov: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Mira Cakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Vlatka Vajs: Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia
Brizita Djordjevic: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia, ()

Abstract:
BackgroundSour cherry and raspberry are fruits which are rich source of many natural active principles. Among them it is possible to emphasize those which exhibit antioxidant properties. Fruit wine is also derived product which is rich with those compoundsMethodsFruit wines were produced in microvinification which was conducted with pure selected yeast culture. Determinations of total polyphenol content (TPC) were conducted using Folin-Ciocalteu method. Antiradical activity estimated by DPPH method, while FRAP method was also applied. Selected phenolic compounds were quantified by UPLC TQ-MS/MS.ResultsThe TPC for the sweet cherry wine was in interval 1957-2125 mg GAE/L while FRAP was 55.1- 64.2 mmol/L Fe2+. The IC50 anti DPPH radical activity was from 1.8 to 2.5% . For the raspberry wine samples TPC was in interval from 1390-1478 mg GAE/L while FRAP was 25.3 to 36.4 mmol/L Fe2+ . The IC50 anti DPPH radical activity was from 1.5-1.9%. Also were quantified compounds which exhibit antioxidant properties which are hydroxybenzoic acid derivatives, such as vanillic, gallic, protocatehuic and parahydroxybenzoic acid. ConclusionThe obtain results indicate that sweet cherry and raspberry wine are promising source of antioxidant compounds. Antioxidant properties and quantity of phenolic compounds depends from type of fruit from which wine is made. Sweet cherry, raspberry and their derived products have beneficial health effect for overall health.

Antioxidant properties of phenolic compounds as residues in fermented grape pomace of cv. Cabernet Sauvignon

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In recent 20 years, it was discovered that there are many compounds in wine that have positive healthy effects. The most powerful compounds for humans health are phenolic compounds. Their extraction depends on winemaking technique, and it was investigated how much phenolic compounds stay in its by-product (pomace) as residue. These compounds possess various biological effects such as prevention of cardiovascular diseases and anti-inflammatory and anti-cancerogenic properties. The polyphenolic molecules have a functional role, in that they behave as antioxidants against the free radical species and show a physiologic role as well. In fact, they increase the antioxidant capacity and beneficial health effect wine consumption. Grape variety Cabernet Sauvignon was harvested in the state of technological maturity. Phytosanitary state was: 100% health, sugar in the must 23% and total acid in the must 6.8 g/l. Alcohol fermentation with maceration was carried out by microvinification method at temperature of 25°C using the "pigeage" system. Free sulfur dioxide 5 g/hl was added to the grape pomace. Yeast *Saccharomyces cerevisiae* (BDX, Lallemand, Canada) in the amount of 20 g/hl and Enzyme EXV (pectolytic) (Lallemand, Canada) in the amount of 2 g/hl were used. Liquid parts were separated from the start of fermentation (3, 5, 7, 14, 21 day, respectively), and fermented without contact with the solid phase (seeds and skin). Control sample was pomace separated immediately after crushing. Samples of pomace for each day, were frozen (-80°C) and after that lyophilized. Their extracts (extraction-methanol: water) were used for determination of total phenol compounds and anti-DPPH radical activity. Extraction of phenolic compounds depends on increasing of alcohol content, temperature and other yeasts nutritients (NH_4^+, pH, etc.). It was evaluated increasement until 10th day from start of maceration (236.7 g/kg fresh pomace), and after that their content decreased until 21st day (155.5 g/kg fresh pomace). Also, it was found that anti-DPPH radical activity of pomace extracts descrease with prolonged maceration time and at 21st day was 1.8 %. Except for the amount of phenolic compounds in grapes (seeds and skin), their extractability during the vinification process is also important.

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Phenotypic variation of ampelographic and technological traits of newly created grapevine genotypes

Glišić Milica, Matijašević Saša, Ranković-Vasić Zorica, Lisov Nikolina, Plavšić Ivana, Petrović Aleksandar, Nikolić Dragan
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The identification of grapevine varieties can be done by several complementary methods. Ampelographic methods are based on morphological, i.e. phenotypic characteristics and rely on descriptors to express the results uniformly. Production-technological characteristics describe the yield characteristics, the elements of the structure of the bunch and berry, as well as the characteristics of the wine. The aim of this study was to investigate some of the ampelographic and most important technological characteristics of perspective grapevine genotypes: H2 (Merlot x Župski Bojadiser), H12 (Prokupac x Župski Bojadiser) and OCB (Alicante Henri Bouschet x Vranac) intended for the production of red wines. The listed genotypes with these codes are on the *Vitis* International Variety Catalog (VIVC). It was necessary to determine similarities and differences with their parental partners in the studied genotypes. The experimental vineyard where the plant material was tested and collected, during the three years (2016–2018), belongs to the Faculty of Agriculture, University of Belgrade. The ampelographic description included 21 characteristics in the tested genotypes and parental partners, recommended by the International Plant Genetic Resources Institute (IPGRI, 1997) for the Gene Bank. The examined genotypes showed many similarities among themselves, as well as in comparison with their parental partners, but for some traits, differences were found, and as such, they represent unique genotypes. The H12 genotype differed by 5 characters, while the H2 and OCB genotypes differed by 6 characters from both of their parental partners. The technological characteristics of the examined genotypes were at the same level or better than their parental partners. The OCB genotype showed the highest yield, the highest bunch weight and the largest berry size, while the H2 genotype showed the highest average sugar and total acid content in the must. The wine of the tested genotypes was drinkable, harmonious with specific aroma and taste. Alcohol content varied from 13.5% v/v (OCB genotype) to 14.2% v/v (H2 genotype). The tested genotypes also differed from each other in total phenol content ranging from 0.95 g/l (OCB genotype) to 1.2 g/l (H12 genotype). Since the ampelographic description has determined that each of the examined genotypes represents a unique genotype, their application has been submitted to the Commission for the recognition of new grapevine varieties in Serbia.

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P2_22

Morphological and production-technological characteristics newly created grapevine variety Vožd

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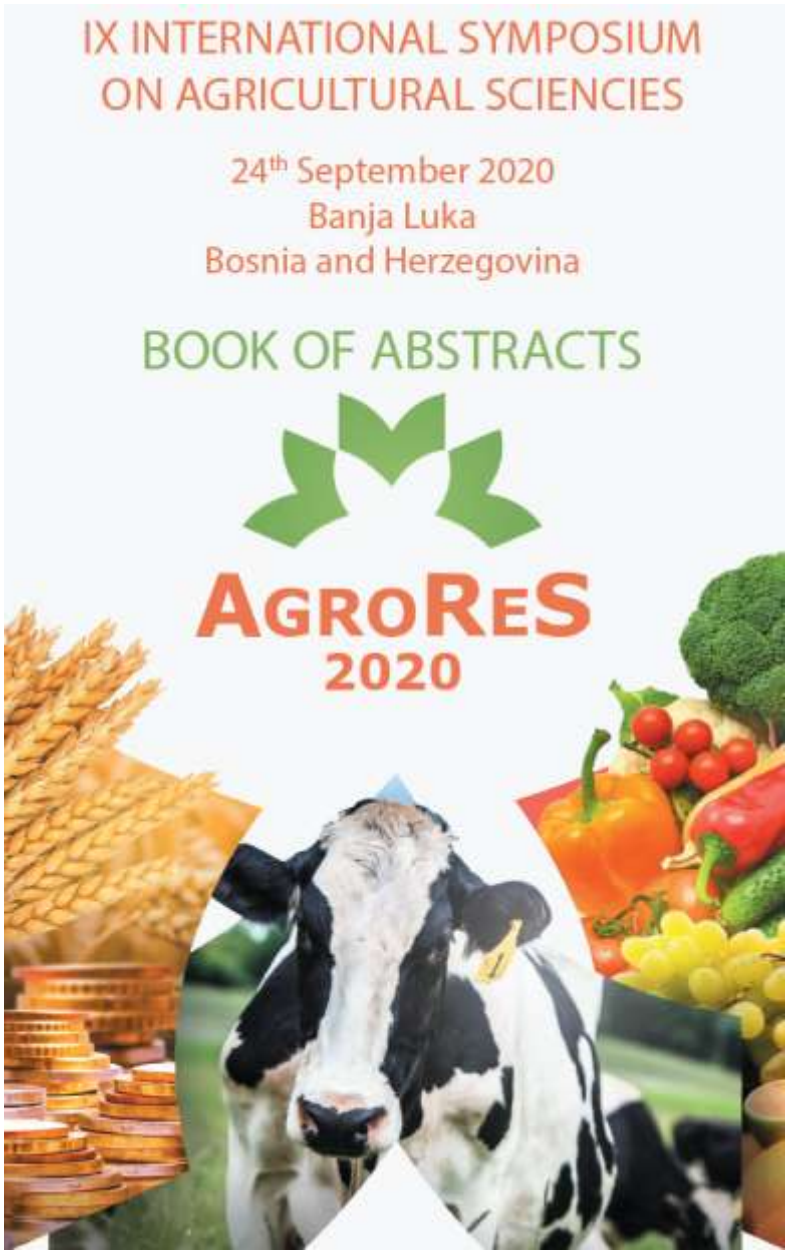
Abstract

By the method of planned hybridization up to now, 32 new grapevine varieties (10 wine and 22 table) have been created and recognized at the Faculty of Agriculture, University of Belgrade. Newer wine varieties include the Vožd variety, which was recognized in 2017. It is intended for the production of red wines and was obtained from the crossing combination of the Začinak × Prokupac. This paper presents the most important morphological and production-technological characteristics of this variety, which were compared with the standard Merlot and Pinot Noir varieties over a three-year testing period (2017-2019). The investigated varieties varied significantly in terms of individual morphological characteristics and represented unique genotypes. Grape yield per vine, grape and berry weight of the Vožd variety were significantly higher than in the standard varieties. Structural indicators of the berry indicate that the Vožd variety had a smaller content of the skin in the berry (3%) compared to the varieties Merlot (6%) and Pinot Noir (8%). The sugar content in the must of Vožd variety (20.3%) was lower than the standard varieties (Merlot - 22.5%; Pinot Noir - 22.9%). The produced wines of the tested Vožd variety and standard varieties were drinkable, harmonious, with specific varietal characteristics and differences in individual parameters. Total phenolic content of the newly created Vožd variety was 800 mg GAE/l while it was 975 mg GAE/l for Merlot and 1025 mg GAE/l for Pinot Noir. Anti-DPPH radical activity of the tested wines was positively correlated with the total phenolic content. With the application of appropriate agro and ampelotechnical measures, the Vožd variety can be recommended for cultivation in production vineyards.

Keywords: *Vitis vinifera*, hybridization, Vožd, yield components, wine quality



ANALYSIS OF THE IMPACT OF DIFFERENT FINING AGENTS ON THE PHENOLIC COMPOUNDS OF CABERNET SAUVIGNON WINES

Nikolina, M. Lisov[1], *Ivana, V. Plavšić*[3], *Uroš, D. Čakar*[2], *Aleksandar, V. Petrović*[2*], *Ljiljana, C. Gojković-Bukarica*[3]

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In this study impact of different fining agents (gelatine and albumin) on the catechin, epicatechin and *trans*-resveratrol content were investigated. Grape variety Cabernet Sauvignon was harvested in a state of technological maturity. Phytosanitary state: 100% health, sugar in the must 23% and total acid in the must 6.8 g/l. Alcohol fermentation with maceration was carried out by microvinification method at a temperature of 25°C using the pigeage system (punch-down twice a day). Free sulfur dioxide 5g / hl was added to the grape must. Yeast *Saccharomyces cerevisiae* (BDX, Lallemand, Canada) in the amount of 20g/ hl and enzyme preparation EXV (Lallemand, Canada) were used. Maceration has lasted 14 days and after that pomace was separated from the must and racket in pilot tanks to finish fermentation. The second operation was bottling and storage until the addition of fining agents. A control sample was wine without fining. In other four samples increasing concentration of gelatine and albumin (5 and 10 g/hl) was added. After two months all samples were analysed by Waters Acquity UHPLC H-Class with mass detector (Waters TQ (Tandem Quadrupole, WAT-176001263)). It was not observed a statistically significant difference between the control sample and wine with different doses of fining agents ($p \geq 0.05$). Content of catechin was decreased about 14% with a lower concentration and 28% with a higher concentration of gelatine. Albumin has affected the content of catechin about 14% reduction with both doses. Addition of gelatine and albumin had higher impact to epicatechin content and it was observed its reduction of about 30% for both doses of gelatine, and 24% for both concentrations of albumin. *Trans*-resveratrol was decreased up to 17% for all fining experiments.

Keywords: phenolic compounds, Cabernet Sauvignon, fining agents, gelatine, albumin

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Belgrade, September 24-25, 2021

BLACK CHOKEBERRY-FRUIT FOR WINE PRODUCTION

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Black chokeberry (Aronia melanocarpa L.) possesses broad range of different compounds which show beneficial health effects on humans. It can be differently processed and one of final products include wine.

The analysed wine samples were produced by microvinification procedure. The control fermentation of black chokeberry must was conducted using selected yeast cultures. Enzyme and sucrose were added in part of the samples before fermentation, due to the increasing of phenolic compounds content of the final product. Total phenolic content (TPC) was spectrophotometrically determined by Folin-Ciocalteu method, while single polyphenolics were quantified using UPLC TQ-MS/MS. In addition, antioxidant properties were also estimated with Ferric Reducing Antioxidant Power (FRAP) assay and anti-DPPH radical activity.

The applied microvinification procedure significantly affected both polyphenol profiles and antioxidant potentials of the examined samples. Indeed, the wine enriched with phenolic compounds and with highest antioxidant activity was produced with addition of enzyme and sugar before start of fermentation. However, an opposite trend was observed for a control sample, produced without addition of enzyme and sugar. Among quantified phenolic compounds especially stood out following phenolic acids: chlorogenic (655.23-717.35), protocatechuic (375.77-645.27) and caffeic (77.72-97.21). The TPC and FRAP values were in ranges 2247.55-2457.23 mg GAE/L and 67.55-78.41 mmol/L Fe2+, respectively. On the other hand, anti-DPPH radical activity (expressed as an IC50 value) ranged from 1.41 to 1.67%.

In summary, black chokeberry wine may be considered as a rich natural source of phenolic acid derivatives that are, jointly with other active principles – both phenolic and non-phenolic, responsible for its high antioxidant potential.

Keywords: black chokeberry wine, microvinification procedure, phenolic compounds, antioxidant activity

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exist is not verb in this sentence it is noun

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Belgrade, September 24-25, 2021

INFLUENCE OF SULFUR DIOXIDE AND ASCORBIC ACID ON PHENOLIC ACIDS IN CABERNET SAUVIGNON WINE

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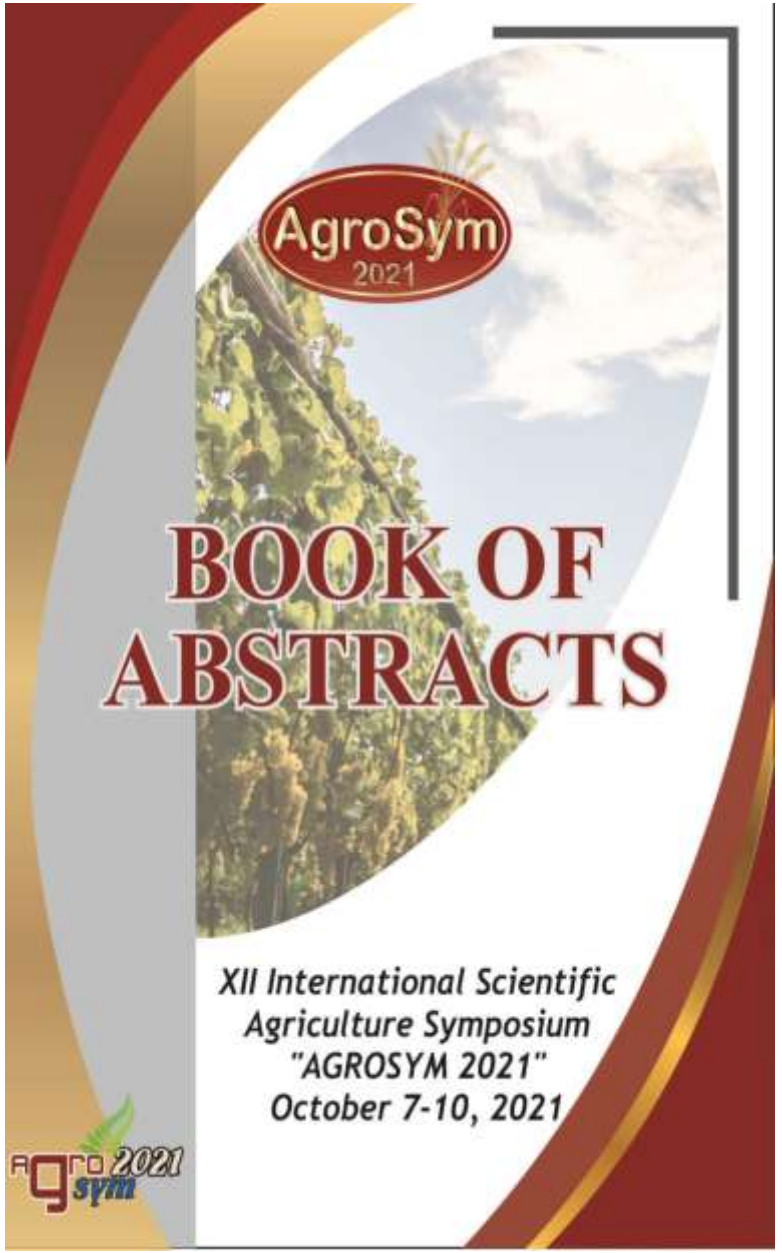
Abstract

Many reactions between O_2 and phenolic compounds or ascorbic acid in the wine induce an rapidly rate of consumption of O_2. If concentration of sulfur dioxide is sufficiently high in wine, the reaction products of O_2 and the wine components are mostly avoided. The impact of addition $K_2S_2O_5$ and ascorbic acid to phenolic composition in wine was investigated. Analysis of Cabernet Sauvignon wine was made by classical vinification and maceration (21 days) inoculated with pure yeast strain *Saccharomyces cerevisiae* (BDX, Lallemand, Canada). After six months of storage, in different samples of experimental wine increasing contents of $K_2S_2O_5$ (3g/hl, 5g/hl and 7g/hl) and ascorbic acid in concentration 200mg/lwere added. Control sample without any addition was the same for both of experiments. Phenolic acids in wines wereanalyzed by UPLC H-Class System.Thestatistically significant difference between control and wine samples added by 5 and 7g/hl of $K_2S_2O_5$for derivates of benzoic acidwas observed. Addition of $K_2S_2O_5$in all of added concentrations did not significantly changed content of derivates of cinnamic acids. SO_2 has an excellent abilitystabilise hydroxycinnamic acid polyphenols such as caffeic acid when exposed to conditions of oxidation. Influence of ascorbic acid wasnot statistically significant for content of benzoic and cinnamic acidsderivatesin wine. Among phenolic acids the most susceptible to oxidation are those containing an ortho-diphenol functional group, including caffeic acid and its derivatives and compounds with a triphenol group such as gallic acid.

Keywords: *Sulfur dioxide, Ascorbic acid, Phenolic compounds, Red wine.*



P2_13

Effects of thermovinification and carbonic maceration on polyphenols extraction cv. Cabernet sauvignon

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Abstract

In this study, the impact of winemaking technique: classical vinification with different maceration time (7 (CC7) and 14 (CT14) days); thermovinification (60°C (T60) and 80°C (T80) and carbonic maceration (CM) on the total phenolic content and phenolic acids in wines was studied. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard and phenolic acids in wines were performed by UPLC H-Class System. It was conducted that the application of thermovinification (T60°C, 2800mg GAE/l; T80°C, 3130 mg GAE/l) leds to higher total phenolic content then in wines CT14 (1395 mg GAE/l). On the other hand, total phenolic content of CM wines were a lower than those in the wines made by CC7, which lasted 7 days. All phenolic acids have had higher content in samples CT14, except caffeic acid which was the highest for T60 sample (7.5819 mg/l).

Key words: thermovinification, carbonic maceration, total phenolic content and phenolic acids

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DYNAMIC OF TOTAL PHENOLIC CONTENT OF CABERNET SAUVIGNON DURING RIPENING AND IMPACT ON ANTIOXIDANT CAPACITY OF WINE

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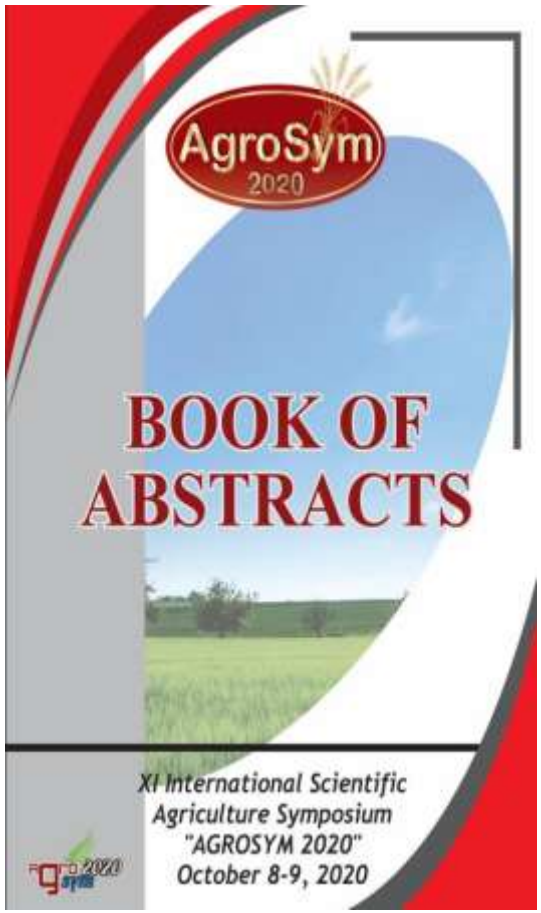
Abstract

In this study, the impact of ripening phenophases on the total phenolic content in wines and their antioxidant capacity was studied. Grapes were harvested in three different stages of maturity: véraison, optimal enological maturity and overripeness, which originated from vineyards belonging to experimental field "RADMILOVAC" of the Faculty of Agriculture in Zemun, University of Belgrade (Serbia). After grapes crashing and destemming, the samples of crushed grapes sulfited with 10 g of $K_2S_2O_5$ per 100 kg and yeast strain *Saccharomyces cerevisiae* in the amount of 20 g/hl (BDX, Lallemand, Canada) was inoculated. Alcohol fermentation with maceration lasted 21 day at temperature of 25±3°C using the "pigeage" system (mechanically punching down). After that pomace was separated and obtained wine samples were bottled and stored until analyses. Total phenolic content in wine samples was determined by the Folin–Ciocalteu's (FC) method using gallic acid as a standard. According to this method, the highest phenolic content was for véraison sample (1385.0 mg GAE/l), then for optimal enological maturity sample (1325.0 mg GAE/l), and the lowest content was for overripeness sample (1070.0 mg GAE/l). Also, anti-DPPH radical activity and antioxidant capacity were analysed using FRAP and TEAC methods. The results of these antioxidant methods showed that higher total phenolic content led to better antioxidant capacity of wine samples. A véraison wine sample showed the highest antioxidant capacity which was positively correlated with their total phenolic content.

Keywords: *Total phenolic content, grape maturation, antioxidant capacity, wine.*



02_25

Influence of some enological treatments on *trans*-resveratrol and total phenolic content in wine

Petrović Aleksandar, Lisov Nikolina, Plavšić Ivana, Madžgalj Valerija, Ranković-Vasić Zorica, Nikolić Dragan

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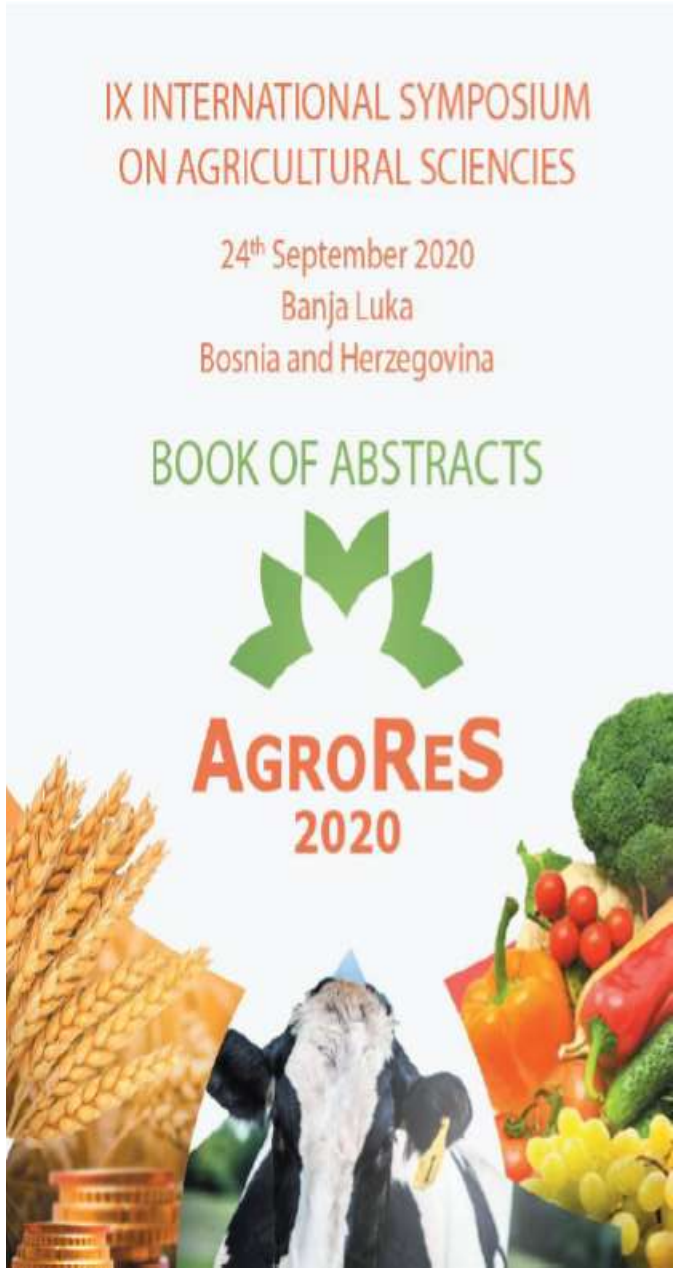
Abstract

In this study, the influence of winemaking techniques and grape cultivars on *trans*-resveratrol and total phenolic content in wines was studied. The *trans*-isomer occurs in the berry skins of most grape cultivars, and its synthesis is stimulated by UV radiation, injury, and fungal infection. The *trans*-resveratrol content in wine depends of many different factors including variety, vintage, climatic conditions, UV radiation, storage conditions and winemaking process. Some wine making techniques were applied in order to investigate its impact to *trans*-resveratrol and total phenolic content. Addition of different combination of enzymes and wine yeasts, resulted in different content of these compounds. Yeast Uvaferm 299 (Lallemand, Canada) with the enzyme Lallzyme OE (Lallemand, Canada) indicated the best extraction of *trans*-resveratrol (1.56±0,04 mg/l) and total phenolic content (1774.20 mg GAE/l) in Prokupac wine samples. Also, biological deacidification, pasteurization and use of some clarifying agents (bentonite and gelatine) had no influence on *trans*-resveratrol and total phenolic content.

Key words: Trans-resveratrol, Total phenolic content, Wine yeasts, enzymes



Title: Red wine as a source of antioxidant properties and its phenolic profile in function of maceration time

In: on Friday, 25 September 2020, -
Type:
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade, Serbia)
Co-author(s): Uroš Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia;, Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Nikolina Lisov: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Ivana Plavšić: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Aleksandar Petrović: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Ljiljana Bukarica-Gojković: Faculty of Medicine, University of Belgrade, Belgrade, Serbia, ()

Abstract:

BackgroundIt is well-known that grapes and wine contain large amounts of phenolic compounds, which have multiple positive effects on human health. Among the variables inherent to the maceration process in red winemaking is possible to highlight following. The first is contact period that is allowed between the solids (seeds and skin) and the fermenting must. It is arguably the most critical factor for defining phenolic profile and antioxidant properties of resulting wine.
PurposeThe purpose of this study was evaluation of antioxidant properties and phenolic profile of red wine.
MethodsThe effect of five different skin maceration times (3, 5, 7, 14 and 21 days), addition of pectolytic enzyme (Cuveé Blanc, Lallemand) on total phenolic compounds and antioxidant properties of Cabernet Sauvignon wines were studied. Total phenolic content was measured by Folin-Ciocalteu method and antioxidant capacity by radical cation decolourisation (ABTS) expressed as mmol/L Trolox eqv.
ResultsTotal phenolic content increased exponentially and the highest content was observed at 19th day of maceration (1432 mg GAE/L). The highest antioxidant capacity was measured at 21st day of maceration (15.21 mmol/L). Antioxidant properties are in positive correlation with total phenolic content of wine samples.
ConclusionLonger skin maceration period produce wines with higher total phenolic content and better antioxidant properties which have a variety beneficial effect for human health.

Title: Phenolic profile and antioxidant properties of Serbian fruit wines

In: on Friday, 25 September 2020, -
Type:
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade, Serbia)
Co-author(s): Uroš Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Nikolina Lisov: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Aleksandar Petrović: Faculty of Agriculture, University of Belgrade, Belgrade, Serbia
Vlatka Vajs: Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Belgrade, Serbia
Brižita Đorđević: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia, ()

Abstract:

BackgroundSerbia is producer of high quality sweet cherry and apple. Beside its nutritional value those fruits are rich source of many natural active principles. It is possible to highlight those which exhibit antioxidant properties. During the fruit processing those compounds pass into the final product. One of such kind product is fruit wine where natural active principles pass.
Purpose The aim of this study was evaluation of phenolic profile and antioxidant properties of fruit wines.
MethodsProduction of fruit wine was conducted in microvinifcation in which was used pure selected yeast culture. Phenolic profile was investigated by UPLC TQ-MS/MS. Total phenolic content (TPC) evaluation was conducted by using Folin-Ciocalteu method. Antiradical activity estimated by DPPH method, while FRAP method was also applied.
ResultsPhenolic compounds which were quantified exhibit antioxidant properties. Among them were quantified hydroxycinnamic acid derivatives such as chlorogenic, caffeic, p-coumaric and sinapinic acids. The TPC for sweet cherry wine was in interval 1845 - 2276 mg GAE/L while FRAP was 47.7 - 57.5 mmol/L Fe2+. Anti DPPH radical activity (IC50) was from 2.1 - 2.7%. The TPC for apple wine was in interval 527 - 823 mg GAE/L while FRAP was 35.7 - 42.3 mmol/L Fe2+. Apple wine anti DPPH radical activity was in interval from 57.7 - 72.3%.
ConclusionSweet cherry and apple showed as a good fruits for the wine production. Phenolic profile and antioxidant properties of wines depend from the fruit which was used in microvinification. Both fruit wines showed as a good source of natural compounds which have beneficial health effects.

Title: Stone fruit wine-potential functional food

In: on Friday, 25 September 2020, -
Type:
By: ČAKAR, Uroš (Faculty of Pharmacy, University of Belgrade, Serbia)
Co-author(s): Uroš Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
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Mira Čakar: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia
Vlatka Vajs: Institute for Chemistry, Technology and Metallurgy, University of Belgrade , Belgrade, Serbia
Brižita Đorđević: Faculty of Pharmacy, University of Belgrade, Belgrade, Serbia, ()

Abstract:

BackgroundPeach is fruit which is possible to find in different foods due to it nutritional value and nice fresh flavor. Derived products from peach are also important. One of such derived product is wine which possess possible beneficial health properties.
Purpose-
MethodsMicrovinification in which was produced wines was conducted with the addition of sugar, and enzyme before fermentation. Also were produced wines without addition. Antioxidant activity determined by FRAP while antiradical by DPPH method. Alpha-glucosidase and substrate solution, p-nitrophenyl alpha-D-glucopyranoside were used for determination of alpha glucosidase inhibitory activity. Quantification of some natural compounds conducted by using UPLC TQ-MS/MS while total phenolic content by Folin-Ciocalteu method.
ResultsThe antioxidant activity obtained by FRAP was in range 34.7 - 43.3 mmol/L Fe2+ while antiradical expresed as IC50 57.3 - 65.7 %. Alpha glucosidase inhibitory activity indicate that all analyzed samples showed inhibition and results were in range 67.5 - 85.7 microg/mL, while some samples is possible to highlight regarding inhibitory activity. Peach wines are good source of chlorogenic, protocatehuic acids and epicatechin. Total phenolic content was in range 472.3 - 587.5 mg GAE/L. Microvinifications in which was added sugar and enzyme before fermentation showed better antioxidant and antiradical properties, higher content of phenolic compounds and better alpha glucosidase inhibitory activity. Better extraction of phenolic compounds is responsible for it.
ConclusionPeach wine produced in different microvinifications showed as a good and promising source of phenolic compounds which exhibit beneficial health effects.

II_PP2_ Total phenolic content and antioxidant properties of fermented grape pomace of Cabernet Sauvignon grape variety

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Phenolic compounds are secondary plant metabolites with potential beneficial effects on human health because of their antioxidant activity and antimicrobial, antiviral, and anti-inflammatory properties. Grape pomace has high content of phenolics due to an incomplete extraction during the winemaking process. It has been shown that approximately 60-65% of phenolic compounds remain in the grape pomace after red wine production [1,2]. In this study, pomaces from Cabernet Sauvignon grape variety were analyzed in order to determine total phenolic content and antioxidant capacity. Alcohol fermentation with maceration was carried out by microvinification method at temperature of 25°C using the "pigeage" system. Free sulfur dioxide 5 g/hL was added to the grape pomace. Yeast *Saccharomyces cerevisiae* (FX10, Laffort, France) in the amount of 20 g/hL were used. Maceration lasted 3, 5, 7, 14, 21 day, respectively and after that liquid parts were separated. On the other hand, remaining samples of pomace were frozen (-80°C) and after that lyophilized. Total phenolic compound content and antioxidant capacity were analyzed in extracts obtained after extraction of pomace with water/methanol solution (50:50, v/v). Total phenolic content was evaluated by Folin-Ciocalteu method [3] and antioxidant capacity by FRAP method [4]. The highest content of total phenolic compounds was determined in sample which maceration lasted three days and it was 2822.19 mg/kg GAE of fermented pomace. For the same sample antioxidant capacity was 26.35 mmol Fe^{2+}/kg of fermented pomace. Total phenolic content and antioxidant capacity were well correlated. The coefficient of correlation was 0.8276. Accordingly, grape pomace represents an important source of phenolic compounds, which can be useful from technological, pharmacological and environmental points of view.

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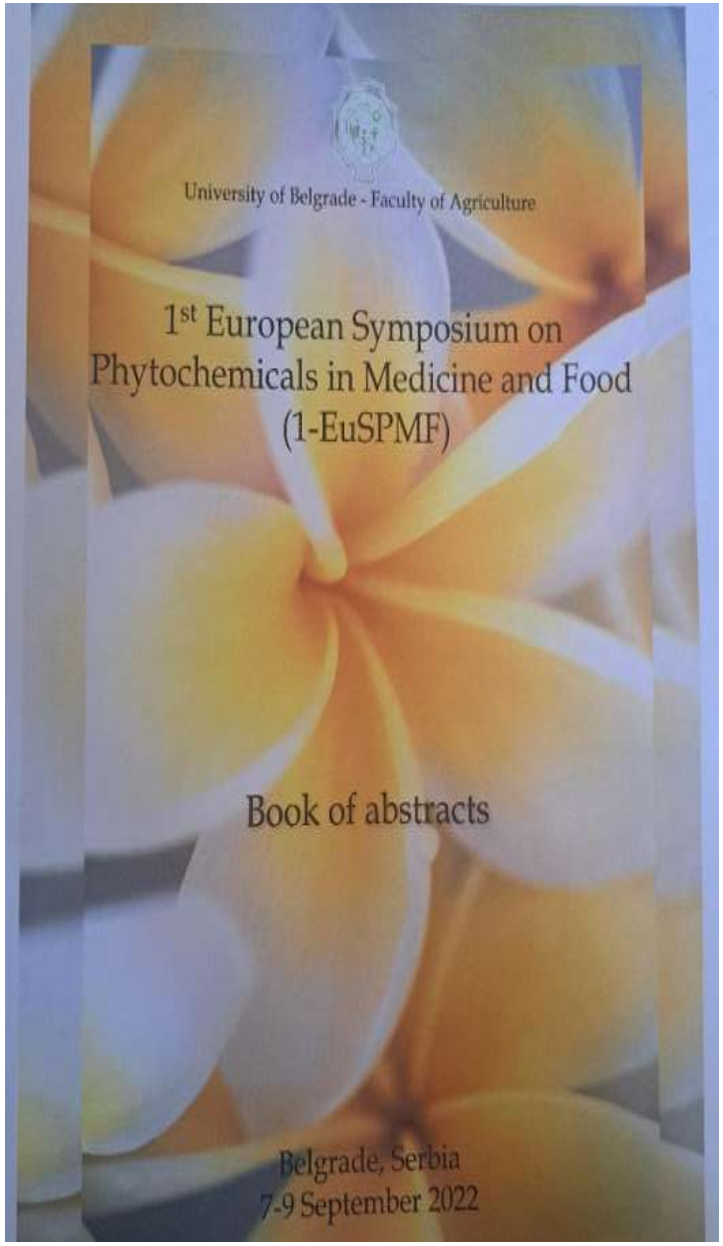

COMPARISON OF DIFFERENT EXTRACTION METHODS FOR QUANTIFICATION OF INDIVIDUAL PHENOLIC COMPOUNDS IN WINE BY LIQUID CHROMATOGRAPHY

Ivana PLAVŠIĆ, Nikolina LISOV, Sandra GAJEVIĆ, Ivana SREDOVIĆ IGNJATOVIĆ, Aleksandar PETROVIĆ*

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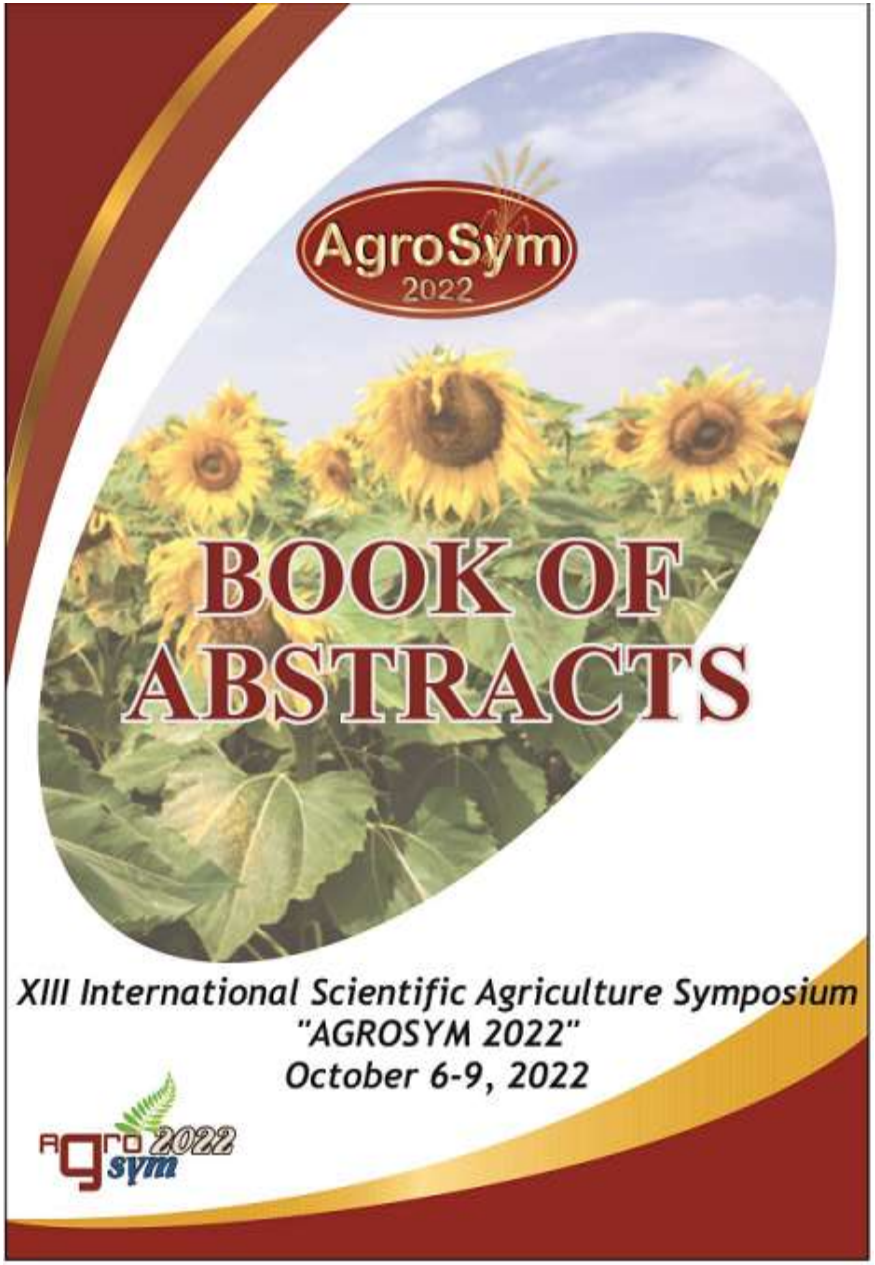
Abstract

Two different methods for sample preparation as a preliminary phase for the quantification of individual phenolic compounds were compared with the aim to establish the best conditions for the determination of these compounds in wine samples by ultra-high performance liquid chromatography (UHPLC). Wine of the variety Vozd (newly acquired variety from Faculty of Agriculture in Zemun) was the subject of this study. Grapes were harvested in optimal enological maturity which originated from vineyards belonging to winery "Draskovic" in Vrsac (Serbia). Three different vinification techniques were applied (cold maceration, thermomaceration and carbonic maceration). Cold maceration (C) was conducted at temperature of 4°C (four days) and thermomaceration (T) at temperature of 60°C (heated one hour). For carbonic maceration (CM) it was necessary to use dry ice and that maceration lasted four days. After maceration, pomace was separated and obtained wine samples were bottled and stored until analyses. The analysis of individual phenolic compounds (caffeic acid, *p*- coumaric acid, *p*- hydroxybenzoic acid, rutin and quercetin) in wines was performed by using a coupled with a diode array detector and a triple quadruple mass spectrometer (UHPLC DAD–MS/MS). Quantification of investigated phenolic compounds after solid phase extraction have showed higher concentrations of these compounds in wine, than in samples in analysed without any pretreatment (direct injection).

Keywords: *Phenolic compounds, Wine, Solid phase extraction, Liquid chromatography.*



Title: In vitro activity and antioxidant investigation of fruit wines
In: on Monday, 19 September 2022, -
Type: Poster
By: ČAKAR, Uroš ()
Co-author(s): Mr. Uroš Čakar
Nikolina Lisov
Ivana Plavšić
Aleksandar Petrović
Brižita Đorđević, ()

Abstract:
Background: Fruit is rich source of biologically active compounds which are essential for human organism. It is also important to highlight fruit products which can be considered as an important constituents of nutrition. Among those products it is possible to highlight fruit wines.

Purpose: The aim of this study was to determinate phenolic profile, antioxidant and in vitro activity of analyzed fruit wine.

Methods: Fruit wines were produced from black chokeberry in different controlled conditions of microvinification. Wines were produced with addition of sugar and enzymatic preparation and without addition. Two different yeasts were used in separate fermentations. Identification and quantification of phenolic compounds was conducted by UPLC TQ-MS/MS, while antioxidant activity was detected by FRAP method. Alpha glucosidase inhibitory activity was measured by using alpha-glucosidase and substrate solution, p-nitrophenyl alpha-D-glucopyranoside.

Results: In the black chokeberry wine were quantified phenolic acids and flavonoids. From phenolic acids it is possible to highlight content of chlorogenic, caffeic, p-coumaric acids. From flavonoids considerable amount of quercetin and rutin was observed. Antioxidant activity measured by FRAP method showed that values for chokeberry wine was in range from 70.77 to 88.57 mmol/L Fe2+ . Alpha glucosidase inhibitory activity showed that black chokeberry wine have ability to inhibit enzymatic activity of above mentioned enzyme. The values were in range from 25.75 to 52.37 µg/ml. The control was acarbose which inhibitory activity was 73.7µg/ml. Higher content of selected phenolic compounds and better antioxidant activity was observed in wines produced with sugar and enzymatic preparation addition. Also better inhibitory activity against alpha glucosidase was observed for the same wines.

Conclusion: Beside quantified phenolic compounds synergistic and antagonistic effect of many other biologically active compounds in analyzed black chokeberry wines are responsible for antioxidant and in vitro inhibitory activity against alpha glucosidase.

Title: Total phenolic content and antioxidant capacity of pomace from Cabernet Sauvignon

In: on Wednesday, 21 September 2022, -
Type: Poster

By: ČAKAR, Uroš (, Serbia)
Co-author(s): Nikolina Lisov, Serbia
Ivana Plavšić, Serbia
Aleksandar Petrović, Serbia
Ljiljana Gojković-Bukarica, Serbia , ()

Abstract:
BackgroundGrape pomace is an industrial waste from the wine production and consists basically of grape seed, skin and stems. A high usability of grape pomace is obtained by the extraction of pharmacological usable substances from these by-products, like antioxidant components. Grape pomace is characterized by high contents of phenolic compounds due to insufficient extraction during the winemaking process.
PurposeThe aim of this study was to evaluate total phenolic content in different samples of grape pomace and their antioxidant properties.
MethodsSamples of grape pomace were obtained after following five maceration periods (3, 5, 7, 14 and 21 days). After these periods must was separated from wine. Maceration and alcoholic fermentation of grape variety Cabernet Sauvignon were conducted using Cuvee Blanc enzymatic preparation and BDX yeast (Lallemand, Canada). It was followed by lyophilization of grape pomace and optimized extraction with methanol and deionized water. Total phenolic content was measured by Folin-Ciocalteu method (mg GAE/kg of grape pomace) and antioxidant capacity by ferric reducing antioxidant power (FRAP) expressed as mmol Fe2+/kg of grape pomace.
ResultsIn addition, the highest total phenolic content was obtained for sample whose maceration lasted 3 days (3278.50 mg GAE/kg of grape pomace) and the lowest measured value was 1900.35 mg GAE/kg of grape pomace (21 days). Antioxidant capacity was well correlated with total phenolic content. The highest FRAP value have been measured in three days macerated grape pomace (43.60 mmol Fe2+/kg of grape pomace) and then a decline was found.
ConclusionAs shorter maceration lasted as higher total phenolic content and antioxidant capacity measured in that grape pomace samples.

Title: Influence of different treatment of Vožd cultivar on total phenolic content and antioxidant capacity of wine

In: on Monday, 19 September 2022, -
Type: Poster
By: ČAKAR, Uroš ()
Co-author(s): Mr. Uroš Čakar
Nikolina Lisov
Ivana Plavšić
Aleksandar Petrović
Ljiljana Gojković-Bukarica, ()

Abstract:
"Background
The red grape skins and stalk are particularly rich in extractable polyphenols responsible of the major sensorial characteristics of wine such as color, astringency and ageing ability. During vinification, colorless phenolic increase during alcoholic fermentation, reaching maximum values at pressing, and remain stable during malolactic fermentation and subsequent storage. Profile of wine polyphenols depends on grape variety and other factors affecting berry development, such as climat conditions or geographical location.

Purpose
The aim of this paper was to investigate the influence of treatment preparations (adding grape stalk) on the total phenol content and antioxidant capacity of Vožd wine.

Methods
The grape variety Vožd (vintage 2020) was harvested in optimal enological maturity which originated from vineyards around town of Vršac (Serbia). Grapes were prepared with crashing and destemming, and with treatment preparations by adding a grape stalk in 30 and 50 percent. For all sample maceration time is the same (14 days). Total phenolic content in wine samples was determined by the Folin-Ciocalteu's (FC) method using gallic acid as a standard. Antioxidant capacity of wine was analyzed with anti-DPPH radical
activity.

Results
The minimal amount of total phenolic content was detected in wine obtained without adding a grape stalk (2380 mg GAE/l), while wine with treatment preparations (50% grape stalk) gave the maximum amount of total phenolic content in wine (2640 mg GAE/l). While wine prepared with the addition of 30% grape stalk showed the most potent DPPH free radical-scavenging activity.

Conclusion
The total phenol content was higher when the crashing grapes were added to the grape stalk, but the antioxidant capacity of the wine was not accompanied by an increase in the TPI value.
"

P2_07

Extraction kinetics of phenolic acids during prolonged maceration time and vinification of Cabernet Sauvignon grape variety

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Abstract

Effects of maceration time on the phenolic acids content in red wine grape variety Cabernet Sauvignon (*Vitis vinifera L.*) was investigated in this study. In focus of this study were four derivates of hydroxybenzoic and hydroxycinnamic acids: gallic, syringic, caffeic and *p*-coumaric acids extracted into wine during five different maceration periods and using two different yeasts (FX10 and Qa23). The control wine was made according to technology of white wine, exactly separated must and solids immediately after crushing and destemming. Concentrations of these compounds were measured using UPLC-MS system (Agilent LCTQ 6495C Triple Quadrupole). The most abundant phenolic acid in wines fermented with yeast FX10, was *p*- coumaric acid and its maximal value was on 12th day of maceration. The highest extracted values during fermentation with Qa23 were obtained for syringic acid with maximal value at 12th day of maceration. Gallic and caffeic acids values also showed exponential increase during maceration but its extracted values were lower. A statistically significant difference was found comparing content of tested phenolic compounds in control wine and wines obtained after maceration for 3, 5, 7, 14 and 21 days using FX10 yeast strain ($p < 0,05$). Maceration which lasted 5, 7 and 21 days using Qa23 yeast strain also showed a statistically significant difference than control wine in term of phenolic acids concentrations ($p < 0,05$).

Key words: extraction, maceration time, phenolic acids, yeast strain

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BOOK OF ABSTRACTS

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26-28, May, 2022
Trebinje
Bosnia and Herzegovina

САВРЕМЕНА ЕНОЛОШКА ПРАКСА У ДУХУ КЛИМАТСКИХ ПРОМЕНА

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Када се говори о климатским променама поред проблема који се огледају у бржем сазревању грожђа, високом садржају алкохола у будућем вину, сниженом садржају киселина и порасту pH вредности, у нашим условима, запажене су и следеће промене: пораст садржаја протеина у грожђу и шири, понекад поремећај у механичком саставу грожђа, појава ожеготина на грожђу белих сорти у случају дефолијације и поремећаја у фотосинтези у грожђу неких сорти у условима дуготрајне суше. Када грожђе није потпуно зрело пред винарима је велико искушење, јер уколико се спроводи кратка мацерација вино неће имати потребан интензитет боје, а у случају дуге мацерације постоји ризик од повећање екстракције адстрингентних танина. Тада су на располагању само две могућности: да се обави берба грожђа које садржи коректну концентрацију шећера и оптималну pH вредност и прилагоди технолошки поступак прераде, или да се чека пуна зрелост грожђа и берба обави када се грожђе налази у стању пуне зрелости и потом примене технолошки поступци за снижење садржаја алкохола и pH вредности. У условима високих температура, долази до презревања грожђа, чак и благог просушивања бобица што нарушава нормалан механички састав грожђа. Када је грожђе презрело, примењују се одређени поступци и технике као што су селекција сорти и клонова винове лозе са позним временом сазревања, селекција винских квасаца који стварају мање алкохола током алкохолне ферментације, снижавање концентрације алкохола и снижавање pH вредности вина применом катјонског измењивача. У нашим условима, високе температуре последњих година праћене су и веома дугим сушним периодима који трају често од појаве шарка па све до бербе грожђа.

Кључне речи: *грожђе, степен зрелости, шарак, презрелост, климатске промене*

UNIVERZITET U BEOGRADU

POLJOPRIVREDNI FAKULTET

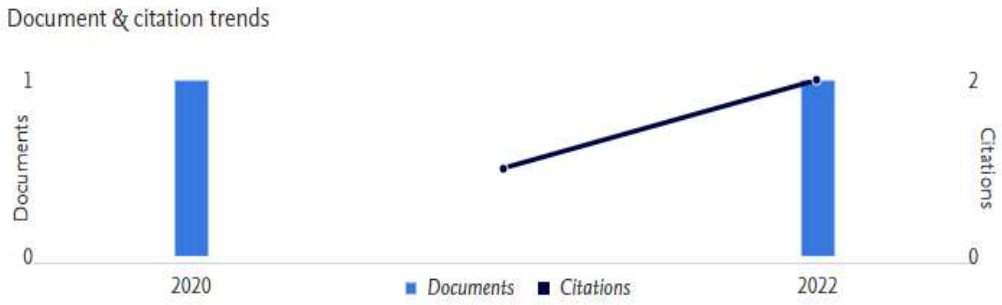
Lisov M. Nikolina

DINAMIKA SADRŽAJA BIOLOŠKI AKTIVNIH FENOLNIH JEDINJENJA GROŽĐA SORTE CABERNET SAUVIGNON TOKOM FENOFAZA SAZREVANJA, PRIMARNE PRERADE, VINIFIKACIJE I UTICAJ NA ANTIOKSIDATIVNI KAPACITET VINA

doktorska disertacija

Beograd, 2022.

Прилог 2. Цитираност радова



	Document title	Authors	Year	Source	Cited by
1	The influence of different enzymatic preparations and skin contact time on aromatic profile of wines produced from autochthonous grape varieties Krstač and Žižak | [УТИЦАЈ РАЗЛИЧИТИХ ЕНЗИМСКИХ ТРЕТМАНА И ВРЕМЕНА КОНТАКТА ПОКОЖИЦЕ НА АРОМАТСКЕ ПРОФИЛЕ ВИНА ПРОИЗВЕДЕНИХ ОД АУТОХТОНИХ СОРТИ ГРОЖЂА КРСТАЧ И ЖИЖАК] *Open Access* View abstract ∨ Related documents	Madžgalj, V., Petrović, A., Čakar, U., (...), Sofrenić, I., Tešević, V.	2022	Journal of the Serbian Chemical Society	0
2	OPTIMIZATION OF THE EXTRACTION OF ANTIOXIDANTS FROM STINGING NETTLE LEAF USING RESPONSE SURFACE MET HODOLOGY | [ОПТИМИЗАЦИЈА НА ЕКСТРАКЦИЈАТА НА АНТИОКСИДАНСИ ОД ЛИСТОТ НА КОПРИВА СО ПРИМЕНА НА МЕТОДОЛОГИЈАТА НА ПОВРШИНА НА ОДГОВОР] *Open Access* View abstract ∨ Related documents	Vajić, U.-J., Živković, J., Ivanov, M., (...), Bugarski, B., Mihailović-Stanojević, N.	2022	Macedonian Journal of Chemistry and Chemical Engineering	0
3	A fast, low-cost, sensitive, selective, and non-laborious method based on functionalized magnetic nanoparticles, magnetic solid-phase extraction, and fluorescent carbon dots for the fluorimetric determination of copper in wines without prior sample treatment View abstract ∨ Related documents	Costa, M.H., Ferreira, D.T.S., Pádua, J.E.S., (...), Cunha, F.A.S., Araujo, M.C.U.	2021	Food Chemistry	4

Прилог 3. Потврда о учешћу на пројектима

На основу члана 29. став 1. Закона о општем управном поступку ("Службени гласник РС", бр. 18/2016), Универзитет у Београду – ПОЉОПРИВРЕДНИ ФАКУЛТЕТ, издаје

ПОТВРДУ

Да је наставник / сарадник Никодина Лилић, учесник на пројекту-има *(Назив пројекта - број пројекта; циклус истраживања: година – година.)*:

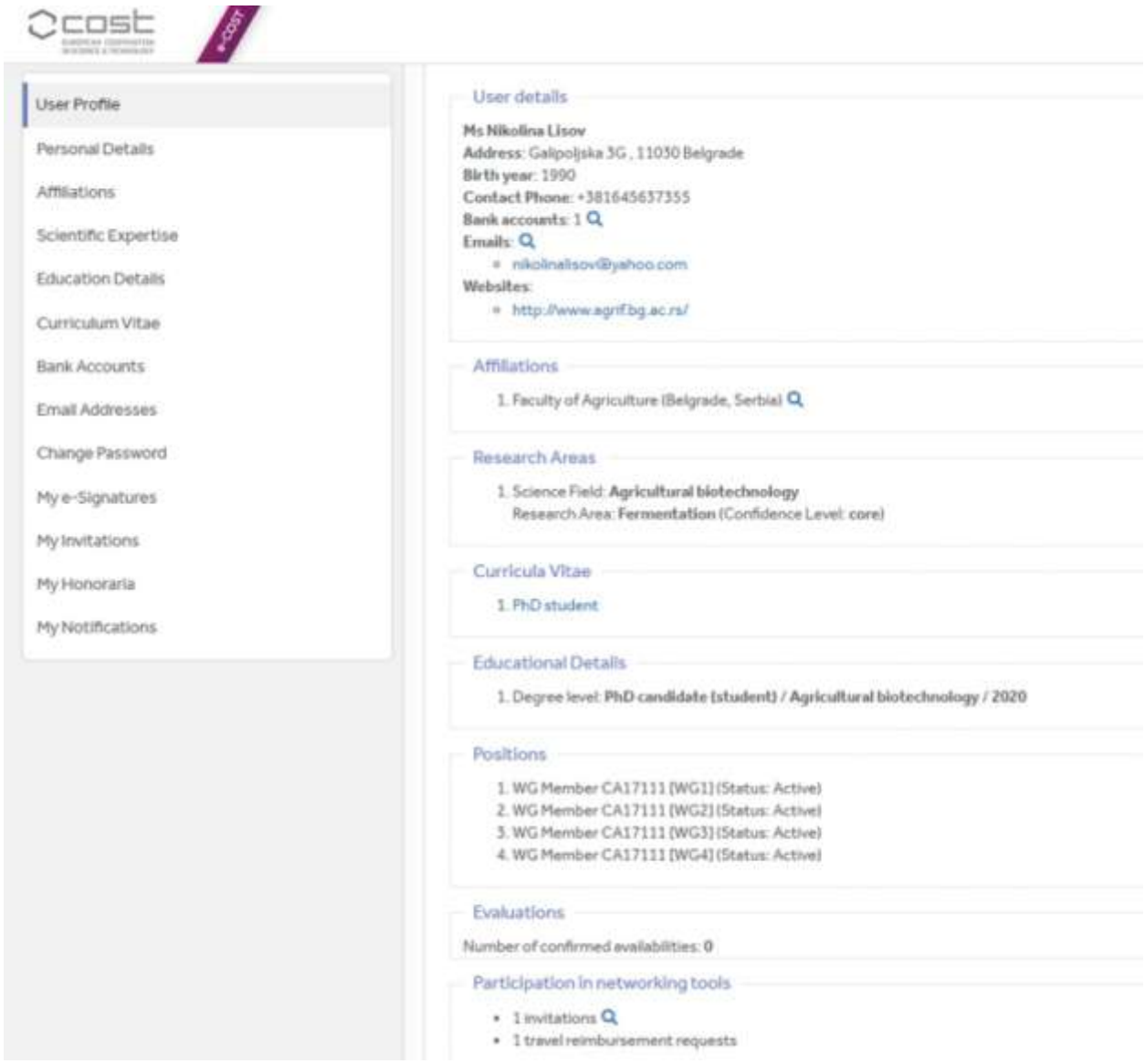
ТР 31020 "Развој технолошких поступака производње здравствено безбедних и функционалних производа из вина богатих биолошки активним полифенолима са кардиопротективним дејством", 2017. –

Потврда се издаје на лични захтев, у сврху остваривања права везаних за поступак избора у звање, а основу података у одговарајућој евиденцији Универзитета у Београду – Пољопривредног факултета.

Београд-Земун
Датум: 27.03.2023.

Шеф Службе за финансијске и рачуноводствене послове

Милена Досковић


User Profile
Personal Details
Affiliations
Scientific Expertise
Education Details
Curriculum Vitae
Bank Accounts
Email Addresses
Change Password
My e-Signatures
My Invitations
My Honoraria
My Notifications
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1. Faculty of Agriculture (Belgrade, Serbia)
Research Areas
1. Science Field: Agricultural biotechnology
Research Area: Fermentation (Confidence Level: core)
Curricula Vitae
1. PhD student
Educational Details
1. Degree level: PhD candidate (student) / Agricultural biotechnology / 2020
Positions
1. WG Member CA17111 [WG1] (Status: Active)
2. WG Member CA17111 [WG2] (Status: Active)
3. WG Member CA17111 [WG3] (Status: Active)
4. WG Member CA17111 [WG4] (Status: Active)
Evaluations
Number of confirmed availabilities: 0
Participation in networking tools
1 invitations
1 travel reimbursement requests