PHYSICOCHEMICAL CHARACTERIZATION OF VRANEC WINES USING FOURNIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPY

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In this study, Vranec wines from Tikveš wine district were produced (vintage 2022) and analyzed with fournier transform infrared (FT-IR) spectroscopy. The basic physicochemical parameters have been determined: alcohol, density, reducing sugars, pH, total acidity, volatile acidity, free and total SO_2. All wines presented good quality, containing relatively high content of alcohol (range: 12.5 to 15.98%). The pH ranged from 3.53 to 3.74, the total acidity was in range from 4.63 to 7.74 g/L and the volatile acidity ranged from 0.34 to 0.78 g/L, which means that all wines were chemically and microbiologically stable. In addition, all wines were protected from oxidation, containing sufficient free SO_2 (on average: 9.28 mg/L) and total SO_2 (on average: 21.07 mg/L). The content of individual organic acids were also determined, in which tartaric acid was the dominant compound (average value: 2.92 g/L), followed by malic acid (average value: 0.69 g/L), lactic acid (average value: 0.52 g/L) and citric acid (average value: 0.31 g/L). Gluconic acid, which is the most important parameter for the health of grapes since it is considered as indicator of *Botrytis cinerea* disease, was determined for the first time in Macedonian Vranec wines, and the content ranged from 0.86 to 3.80 g/L, which are considered as normal values, confirming the physical and chemical stability of wines. In addition, the Folin-Ciocalteau (FC) Index and colour parameters have been determined. All wines presented relatively high FC index, as expected, since Vranec variety is rich in polyphenols. The red colour dominated (range: 51.44 to 55.17%), followed by yellow colour (range: 32.96 to 34.06%) and blue colour (range: 11.8 to 14.51%). All wines presented satisfactory brilliance, ranged in 52.79 to 59.38%. In general, Vranec wines presented very good physical, chemical and microbiological stability, characteristic for high quality red wines.

Keywords: basic parameters, organic acids, colour parameters, Vranec, FT-IR

FIZIČKO-HEMIJSKA KARAKTERIZACIJA VINA SORTE VRANEC KORIŠĆENJEM INFRACRVENE SPEKTROSKOPSKE FOURIEROVE TRANSFORMACIJE (FT-IR)

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U ovoj studiji proizvedena su vina sorte Vranec iz Tikveškog vinogorja (berba 2022) i analizirana su pomoću infracrvene spektroskopske Fourierove transformacije (FT-IR). Određeni su osnovni fizičko-hemijski parametri: alkohol, specificna tezina, redukujući šećeri, pH, ukupna kiselost, isparljiva kiselost, slobodni i ukupni SO_2. Sva vina su bila dobrog kvaliteta, sa relativno visokim sadržajem alkohola (12,5-15,98%). pH se kretao u rasponu od 3,53 do 3,74, ukupna kiselost u rasponu od 4,63 do 7,74 g/L, a isparljiva kiselost od 0,34 do 0,78 g/L, što znači da su sva vina bila hemijski i mikrobiološki stabilna. Pored toga, sva vina bila su zaštićena od oksidacije, sa dovoljno slobodnog SO_2 (u proseku: 9,28 mg/L) i ukupnog SO_2 (u proseku: 21,07 mg/L). Utvrđen je i sadržaj pojedinih organskih kiselina u kojima je dominantno jedinjenje vinska kiselina (prosečna vrednost: 2.92 g/L), zatim jabučna kiselina (prosečna vrednost: 0,69 g/L), mlečna kiselina (prosečna vrednost: 0,52 g/L) i limunska kiselina (prosečna vrednost: 0,31 g/L). Sorbinska kiselina nije određena u vinima, što znači da sorbinska kiselina nije korišćena kao konzervans. Glukonska kiselina, koja je najvažniji parametar zdravstvenog stanja grožđa jer se smatra indikatorom bolesti *Botrytis cinerea*, prvi put je utvrđena u makedonskim vinima sorte Vranac, a sadržaj se kretao od 0,86 do 3,80 g/L, što se smatra normalnim vrednostima, potvrđujući fizičku i hemijsku stabilnost vina. Pored toga, određen je Folin-Ciocalteau (FC) indeks i parametri boje. Sva vina su pokazala relativno visok FC indeks, kako se i očekivalo, jer je sorta Vranec bogata polifenolima. Dominirala je crvena boja (raspon: 51,44 do 55,17%), zatim žuta boja (raspon: 32,96 do 34,06%) i plava boja (raspon: 11,8 do 14,51%). Sva vina su pokazala zadovoljavajući sjaj, u rasponu od 52,79 do 59,38%. Generalno, vina sorte Vranec su pokazala veoma dobru fizičku, hemijsku i mikrobiološku stabilnost, karakterističnu za visokokvalitetna crvena vina.

Ključne reči: osnovni parametri, organski kiseline, parametri boje, Vranac, FT-IR