



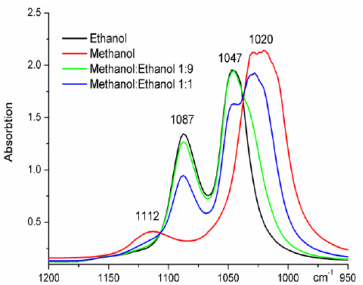
PHYSICOCHEMICAL CHARACTERIZATION OF VRANEC WINES USING FOURNIER TRANSFORM INFRARED (FT-IR) SPECTROSCOPY

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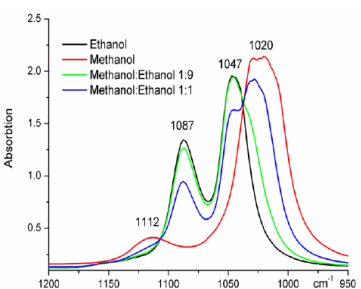
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Vranec wines from **Tikveš** wine region were produced (vintage 2022) and analyzed with fournier transform infrared (FT-IR) spectroscopy.



Basic parameters	Vranec - 1	Vranec -2	Vranec - 3	Vranec - 4	Vranec - 5	Avarege	Min	Max
Ethanol (%)	13.06	13.14	15.50	12.49	15.97	14.04	12.50	15.98
Density (g/mL)	0.99369	0.99416	0.99481	0.99859	0.99811	0.995872	0.99369	0.99859
Reducing sugars (g/L)	1.94	2.91	4.32	3.22	7.11	3.90	1.94	7.11
Glucose (g/L)	0.00	0.25	0.00	0.00	1.32	0.31	0.00	1.32
Fructose (g/L)	2.25	3.02	3.07	1.85	5.40	3.12	1.85	5.40
pH	3.73	3.74	3.58	3.53	3.72	3.66	3.53	3.74
Total acidity (g/L)	4.63	4.80	7.74	7.40	7.73	6.46	4.63	7.74
Volatile acidity (g/L)	0.34	0.42	0.57	0.36	0.78	0.49	0.34	0.78
Free SO₂ (mg/L)	11.34	11.82	8.26	9.21	5.79	9.28	5.79	11.82
Total SO₂ (mg/L)	24.31	34.36	24.47	20.82	21.38	21.07	21.38	34.36
CO₂ (g/L)	480	663	1277	431	610	692	431	1277
Glycerol (g/L)	9.58	9.83	14.17	15.01	17.91	13.30	9.58	17.91



Organic acids	Vranec - 1	Vranec - 2	Vranec - 3	Vranec - 4	Vranec - 5	Avarege	Min	Max
Gluconic acid (g/L)	0.86	0.90	1.33	2.46	3.80	1.87	0.86	3.80
Tartaric acid (g/L)	2.37	2.05	3.46	3.15	3.57	2.92	2.05	3.57
Malic acid (g/L)	0.00	0.00	0.85	1.26	1.36	0.69	0.00	1.36
Lactic Acid (g/L)	0.97	1.22	0.00	0.22	0.22	0.52	0.00	1.22
Citric acid (g/L)	0.14	0.14	0.39	0.46	0.41	0.31	0.14	0.46
Sorbic acid (g/L)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Color parameters								
Folin index	68.61	68.42	87.33	53.19	75.79	70.67	53.19	87.33
CI (colour intensity)	3.87	3.63	6.20	4.34	5.10	4.63	3.63	6.20
Hue (Hue)	0.66	0.66	0.62	0.60	0.63	0.64	0.60	0.66
Yellow (%)	34.06	34.01	32.96	33.03	33.41	33.49	32.96	34.06
Red (%)	51.44	51.49	52.74	55.17	52.74	52.72	51.44	55.17
Blue (%)	14.51	14.50	14.30	11.80	13.85	13.79	11.80	14.51
dA (Brilliance) (%)	52.79	52.89	55.20	59.38	55.20	55.09	52.79	59.38

- **Tartaric** acid was the dominant compound, followed by **malic** acid, **lactic** acid and **citric** acid.
- **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.
- All wines presented relatively **high FC index**, as expected, since Vranec variety is rich in polyphenols.

Conclusion: Vranec wines presented very good physical, chemical and microbiological stability, characteristic for high quality red wines.