

COMPONENT ANALYSIS FOR THE INFLUENCE OF YEASTS ON MULTI-ELEMENT COMPOSITION OF VRANEC WINES

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INTRODUCTION

The presence of metals (i.e. Al, Zn, Cu, Fe, Pb) in wine is important for efficient alcoholic fermentation and for its sensorial characteristics (flavor, aroma, freshness). Certain metal ions, such as Fe, Cu and Mn participate in destabilization of wine and in their oxidative evolution, whereas Cu, Fe, Al, Zn and Ni contribute to haze formation and undesirable changes of aroma and taste. The element composition of the wines may be influenced by many factors such as elemental levels in the soil, fertilization practices, wine processing equipment and vinification [1].

✓The aim of the work was to assess the influence of different yeast preparations, Vinalco (Macedonian autochthonous yeast) and yeasts from Lallemand, on the element composition of Vranec wines.

MATERIALS AND METHODS

Wine samples

Vranec wines (10 samples) from Tikveš region.

Grapes (ripeness: 23-24°Brix), processed with crusher/destemmer, SO₂ (ca. 65 mg/L total concen). Inoculation with *Saccharomyces cerevisiae* yeast strains:

Clos, RC212, D254, BDX (Lallemand, Bordeaux, France) (4 wines)

Vinalco yeast (Bitola, Republic of Macedonia) (6 wines)

Abbreviation of wines: V-Vranec; Abbreviation of *Saccharomyces cerevisiae* yeasts: Vi-Vinalco; L-Lallemand yeasts

ICP-MS analysis

The element contents were determined with application of mass spectrometry with inductively coupled plasma (ICP-MS, Model Agilent 7500cx, USA).

For pre-treatment of wine samples microwave digestion system (Model MARS, CEM Corporation, USA) was applied using 5 mL of concentric HNO₃ (trace pure).

The concentration of 41 isotopes (Table 1) were measured in *No-gas* and *Helium* mode. The quality assurance of the method was approved with the standard addition method. The recoveries for the analyzed elements were in range 81-112 %.

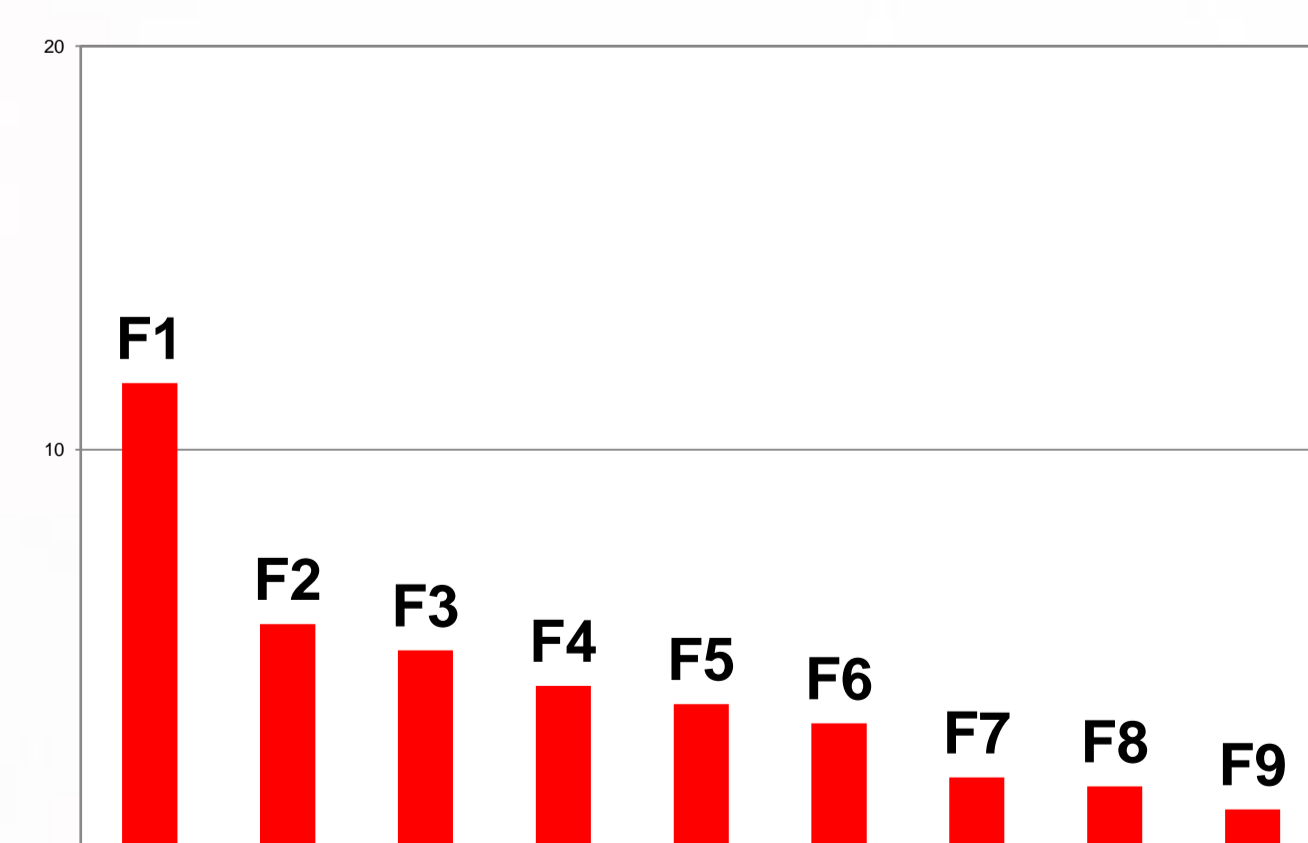
RESULTS AND DISCUSSION

Table 1. Multi-element composition of Vranec wines fermented with different yeast strains

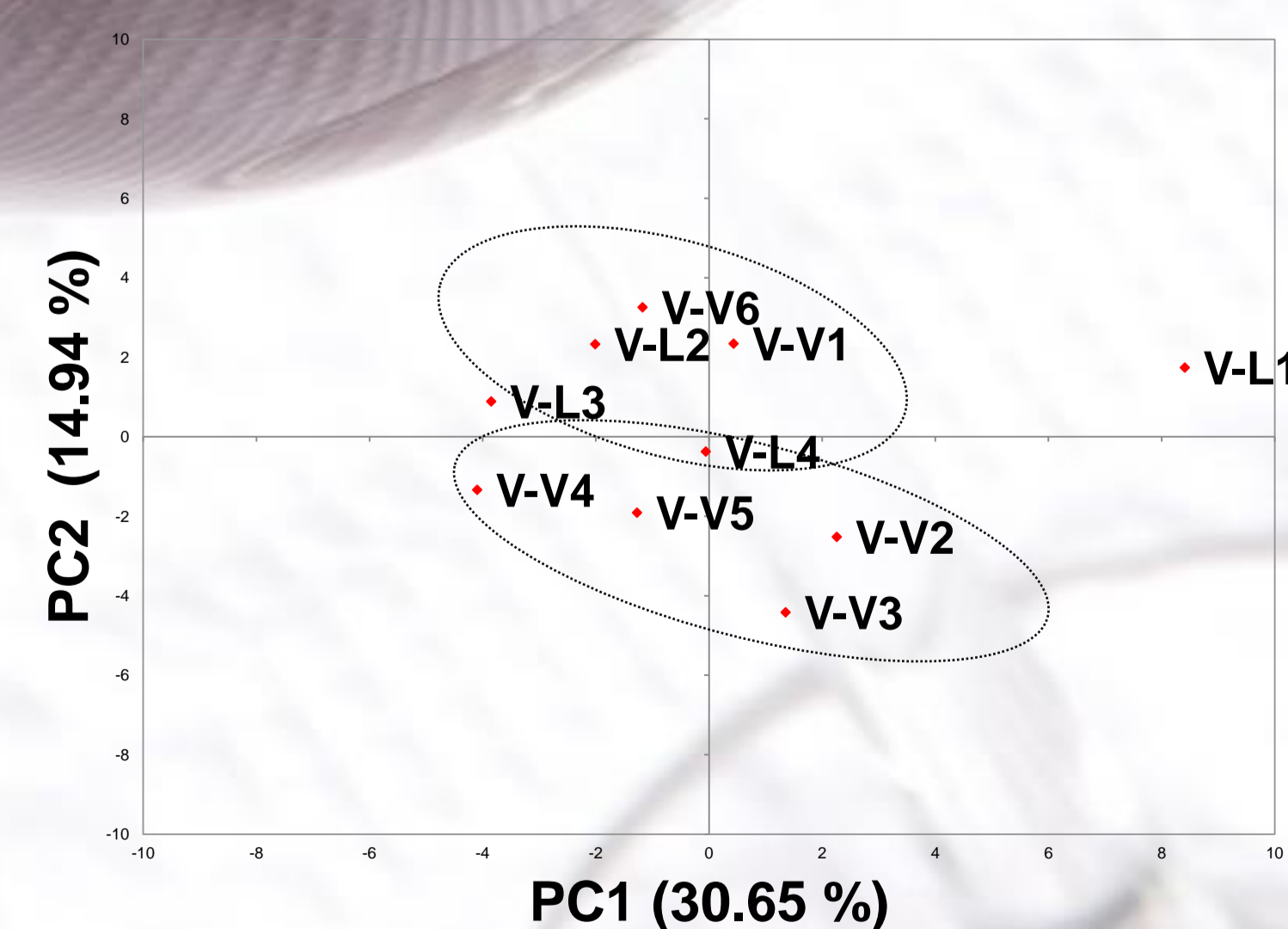
Element/Wines	Isotope	Unit	V-1	V-2	V-3	V-4	V-5	V-6	V-7	V-8	V-9	V-10
Li	7	µg/L	54.7	9.94	8.20	1.43	2.95	3.75	10.0	3.72	6.78	8.3
Be	9	µg/L	0.15	0.12	0.12	0.11	0.87	0.14	0.10	0.13	0.10	0.074
B	11	mg/L	5.70	4.68	3.59	2.94	4.85	3.39	4.21	2.65	3.67	4.16
Na	23	mg/L	31.85	6.93	8.60	4.92	5.39	5.87	7.00	1.89	4.62	6.43
Mg	24	mg/L	209	122	100	85.2	85.4	95.8	111	72.7	98.3	127
Al	27	mg/L	0.20	0.14	0.13	0.10	0.16	0.24	0.24	0.14	0.18	0.10
Si	28	mg/L	18.8	16.3	13.2	9.5	19.0	15.9	14.4	9.2	12.9	16.0
P	31	mg/L	172	211	119	164	117	135	151	96	135	124
S	34	mg/L	113	190	134	315	112	79.2	95.8	85.8	101	171
Ca	42	mg/L	56.2	74.9	67.1	92.1	67.7	81.7	69.2	76.4	73.1	72.6
Ti	48	µg/L	2.81	3.83	3.28	4.69	3.37	3.89	3.33	3.60	3.59	3.50
V	51	µg/L	0.83	0.75	0.42	0.45	0.64	0.44	0.96	0.58	0.74	0.46
Cr	53	mg/L	0.017	0.011	0.010	0.011	0.011	0.016	0.014	0.010	0.012	0.011
Mn	55	mg/L	1.63	0.67	0.69	0.46	1.17	0.94	0.92	0.54	0.84	0.90
Fe	56/57	mg/L	0.72	1.36	0.70	1.43	1.66	0.62	1.67	0.56	2.73	0.74
Co	59	µg/L	2.42	2.06	1.39	1.78	2.11	2.20	0.96	0.54	0.80	1.52
Ni	60	mg/L	0.022	0.015	0.013	0.010	0.015	0.020	0.045	0.017	0.026	0.013
Cu	63	mg/L	0.041	0.182	0.120	0.039	0.026	0.027	0.016	0.015	0.015	0.125
Zn	66	mg/L	0.44	0.37	0.13	0.17	0.35	0.09	0.07	0.05	0.07	0.14
Ga	69	µg/L	13.74	6.31	6.27	2.00	1.57	11.5	5.18	2.65	3.94	4.42
Ge	72	µg/L	0.12	0.22	0.13	0.39	0.18	0.06	0.14	0.09	0.24	20.2
As	75	µg/L	0.94	0.93	0.60	0.57	0.70	1.22	0.96	0.86	0.83	1.23
Se	77	µg/L	1.39	1.67	1.27	1.37	1.76	1.97	1.53	1.61	1.15	1.19
Rb	85	mg/L	3.10	2.17	1.88	2.78	1.89	3.91	2.87	1.90	2.53	2.65
Sr	88	mg/L	1.30	0.92	0.69	0.12	0.21	0.61	0.68	0.13	0.53	0.78
Mo	95	µg/L	1.13	6.78	0.91	1.07	5.74	1.73	32.9	11.2	9.24	14.0
Pd	106	µg/L	1.08	1.11	41.4	0.87	6.98	0.69	13.2	24.6	0.74	0.53
Ag	107	µg/L	0.15	0.26	0.24	0.31	0.14	0.23	0.15	5.50	0.45	0.23
Cd	111	µg/L	0.29	0.39	0.32	0.26	0.22	0.23	0.20	0.23	1.22	0.28
In	115	µg/L	6.67	0.43	0.65	0.73	<0.1	<0.1	2.69	7.91	0.32	<0.1
Sn	120	µg/L	1.02	1.19	5.48	1.33	1.19	1.02	1.15	12.1	1.10	20.8
Sb	121	µg/L	0.08	0.14	0.10	0.24	2.73	0.30	0.11	0.44	0.11	0.15
Te	125	µg/L	0.58	0.24	0.18	0.27	0.19	0.18	0.27	0.26	0.21	0.14
Cs	133	µg/L	6.80	11.01	6.61	4.87	14.4	42.5	7.31	3.55	5.67	5.95
Ba	137	mg/L	0.35	0.10	0.10	0.04	0.03	0.37	0.09	0.05	0.08	0.09
Tl	205	µg/L	0.77	0.48	0.52	0.50	0.83	0.99	0.70	0.46	0.60	0.57
Pb	206/207/208	µg/L	5.21	8.97	13.4	4.41	6.26	4.16	3.06	5.32	4.26	13.6
Bi	209	µg/L	<1	<1	<1	<1	<1	<1	5.95	<1	<1	<1

Principal Component analysis

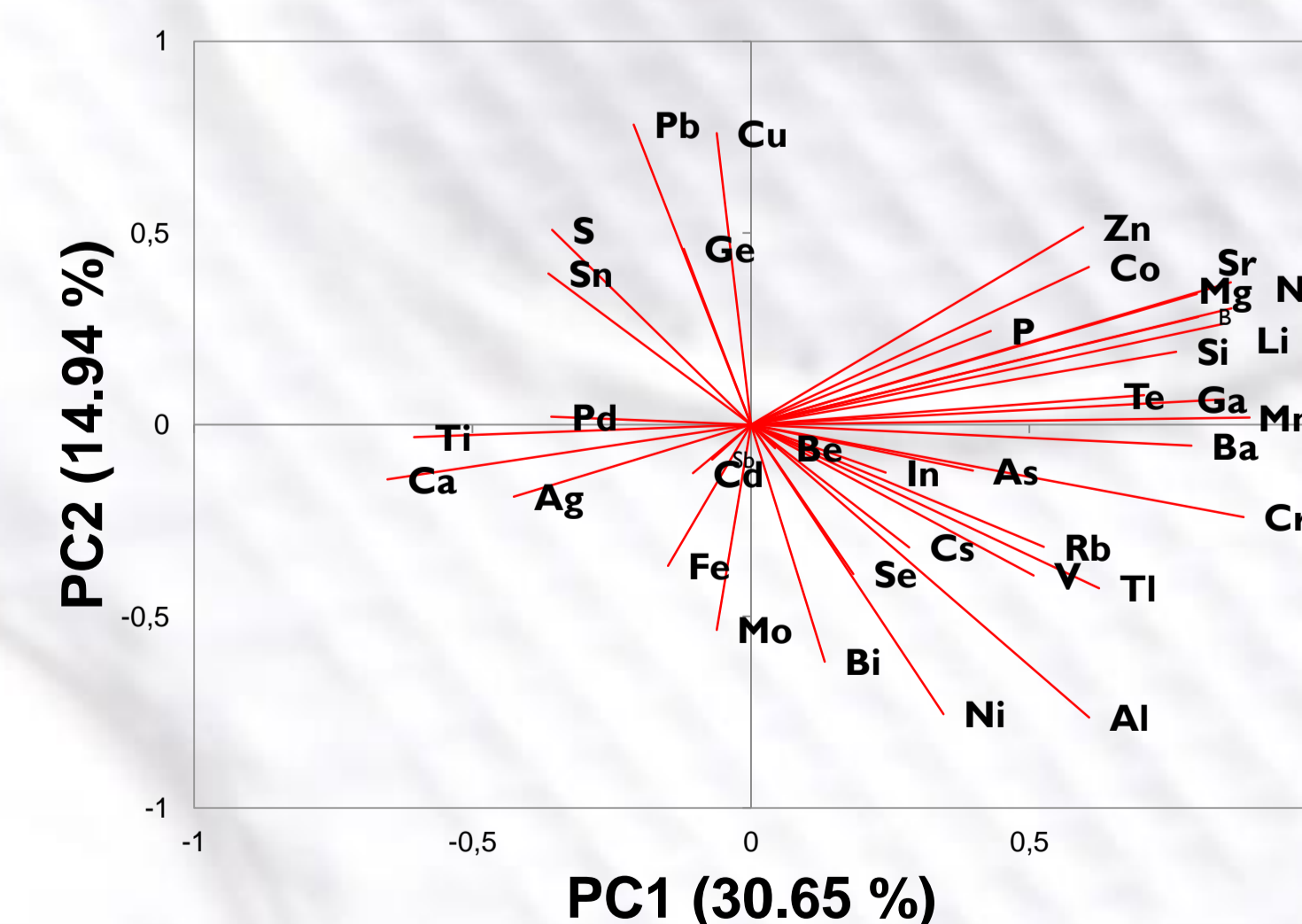
Eigenvalues



PC1 vs. PC 2: 45.59 %



PC1 vs. PC2: 45.59 %



CONCLUSION

The content of total elements in wines ranged between 348 to 678 mg/L, whereas wine fermented with D254 commercial Lalemand yeast presented highest concentration. The content of harmful elements, such as Pb and Cu was below the maximal allowed concentration in wines (200 and 100 µg/L, respectively). Statistical treatments, including descriptive, factor, cluster and principal component analysis were performed in order to discriminate wines. The main discriminant elements were P, S, Mg, Ca, Si, Na and B.

REFERENCES

[1] Ivanova-Petropulos, V., Wiltsche, H., Stafilov, T., Stefova, M., Motter, H., Lankmayr, E., *Maced. J. Chem. Chem. En.* 32(2) (2013) 265-281.

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