BIOLOGICALLY ACTIVE SUBSTANCES IN RED DESSERT WINE PREPARED VIA INNOVATIVE TECHNOLOGY

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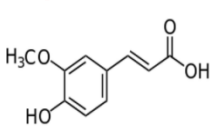
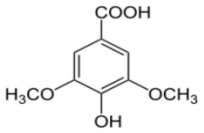
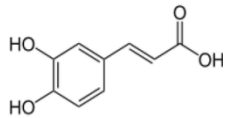
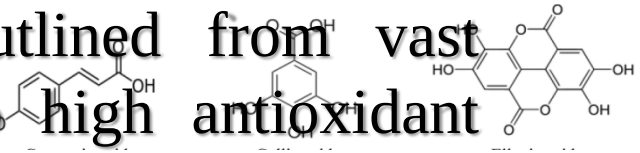
Literature Review

- Phenolic components of wine are outlined from vast spectrum of bioactive substances due to high antioxidant effect



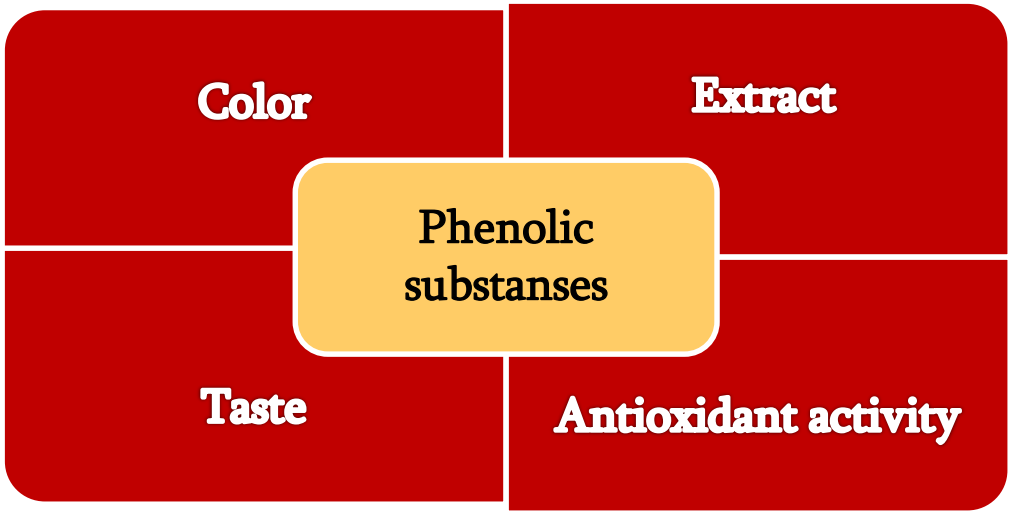
- Phenolics lessen risk of numerous diseases development

- Intensive investigation of red wines started from 1991 year – after it became known about "French paradox"

- **Those who regularly and moderately consume Red wine are by 20-30% less predisposed to cardiovascular disease** (German & Walzem, 2000)

Literature Review

- Bioactive Substances - Phenolic compounds play an important role for the Red Wine's Color, Extract, Taste & Antioxidant activity.



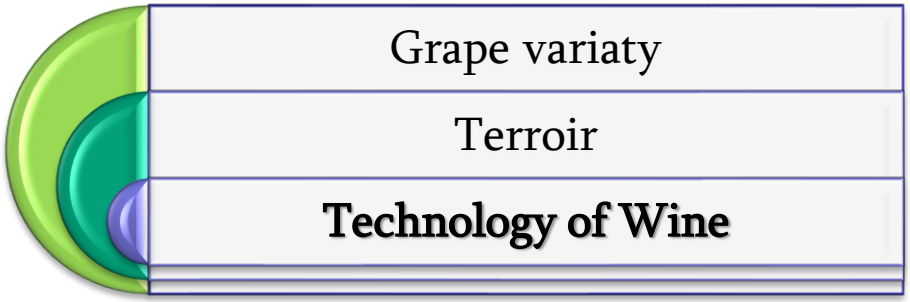
Literature Review

- Growing demand on red wines in international market – explained by their antioxidant activity
- Antioxidant activity and Wine phenolics are in positive correlation
- Those Red wines outstand with antioxidant activity, whose phenolic components' content is high

Literature Review

High antioxidant activity have phenolics such as: catechins, phenolic acids, kaempferol, quercetin, myricetin (Waterhouse 2002).

Concentration of phenolic substances in wine depends on several factors:



- According to the phenolic compounds, young wines have higher antioxidant activity than aged ones (Pellegrini et al., 2000).

- Wine enriched with phenolics ⇔ higher in antioxidants even after aging

- **Demand on antioxidant-rich food & drinks (among them Wines) increases worldwide.**

Elaboration of Innovative technology of high antioxidant activity red dessert wine production ⇔ Topical theme in Oenology

We have elaborated innovative technology of red dessert wine enrichment with phenolics.

- During production of Wines with Standard technologies, only 20-40% of grape phenolics transfers into wine, but 80-60% remains in musts (Valuiko 1971, 2001; Kennedy et al., 2006; Joscelyne 2009 & others)

- **Technological Technics for increasing the concentration of phenolic substances in wine are:**

1. **Termovinification**
2. **Removal of part of the Juice**
3. **Postfermentative Maceration**

World wine production estimated at 275.7 million hectoliters

* - Dessert wine producer countries

Unit: 1000 hl	2010	2011	2012	2013	2014 Provisional	2015 Forecast
1. Italy*	48 525	42 772	45 616	54 029	44 229	48 800
2. France*	44 381	50 757	41 548	42 134	46 804	47 373
3. Spain*	35 353	33 397	31 123	45 308	38 211	36 600
4. USA	20 887	19 140	21 650	23 590	22 020	22 140
5. Argentina*	16 250	15 473	11 778	14 984	15 197	13 358
6. Chile	8 844	10 464	12 554	12 820	10 500	12 870
7. Australia	11 420	11 180	12 259	12 310	12 020	12 000
8. South Africa	9 327	9 725	10 569	10 982	11 316	11 310
9. China	13 000	13 200	13 511	11 780	11 178	11 178
10. Germany*	6 906	9 132	9 012	8 409	9 202	8 788
11. Portugal*	7 148	5 622	6 327	6 231	6 195	6 703
12. Russia*	7 640	6 980	6 220	5 290	4 880	4 880
13. Romania	3 287	4 058	3 311	5 113	3 750	4 069
14. Hungary*	1 762	2 750	1 818	2 618	2 555	2 873
15. Brazil	2 459	3 460	2 967	2 710	2 732	2 732
16. Greece	2 950	2 750	3 115	3 343	2 900	2 650
17. Austria	1 737	2 814	2 125	2 392	1 999	2 350
18. New Zealand	1 900	2 350	1 940	2 484	3 204	2 350
19. Serbia	2 382	2 244	2 175	2 306	2 332	2 332
20. Bulgaria*	1 224	1 237	1 442	1 755	747	1 538
21. Moldova*	840	1 520	1 470	2 570	1 630	1 630
22. Georgia	1 034	1 108	830	997	1 134	1 134
OIV World Total	264 188	267 803	258 211	292 218	270 234	275 665

Source: International Organization of Vine and Wine (OIV) http://www.oiv.int/,2015

Why do we study red dessert wine enriched with phenolic substances?

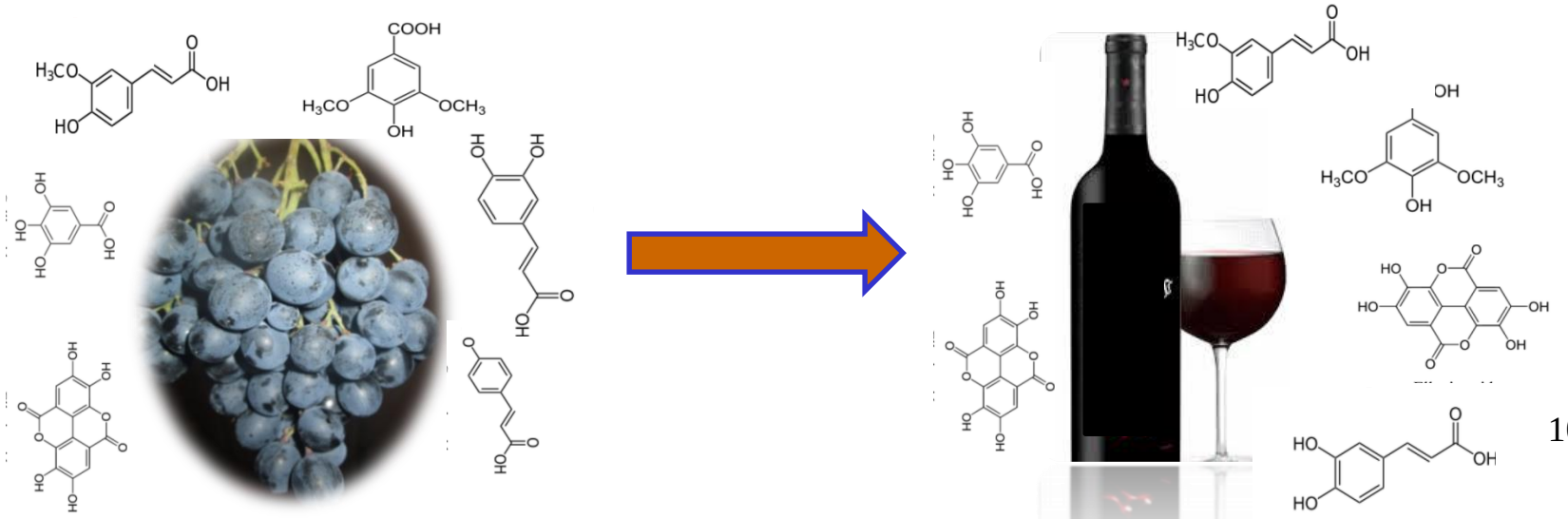
- It is Novelty for Georgia and the World
- Dessert wines – popular Special type of wines, produced in the World, but scientifically not well-studied yet.
- In Soviet Georgia – Dessert wines ("Kvareli №29" & etc.) were produced and on high demand; for now – production is stopped with potential to be restored.
- Bilateral value of the research – Investigation of the non-studied product and improvement of its quality.

The purpose of the study

Elaboration of the Innovative Technology for the production of the enriched with phenolics Georgian Red Dessert Wine

The tasks of the study

1) Preparation of the research objects;
2) Investigation of phenolic substances with HPLC method;



Novelty of the study

For test wines were used separately & in combination ***technological technics:***

- **Removal of the part of the juice before alcoholic fermentation;**
- **Alcoholic fermentation of the must till dryness;**
- **Correction of alcohol till 16% (vol) in fermented pulp and leaving it for a week.**

Objects for study:

Red wine samples from Saperavi Grape

Dessert

Control & 4 Test

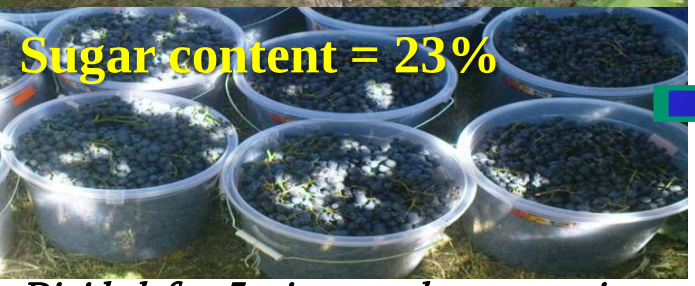
Conditions:

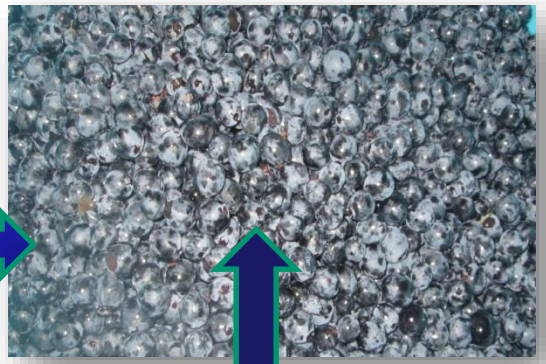
16 ± 0.2 % ⇔ Residual Sugar

16 ± 0.3 % Vol ⇔ Alcohol

Experiment scheme

Harvested grape was processed into wine immediately





Divided for 5 wine samples preparation (1 control & 4 test) & for concentrated juice (80%)

HPLC Chromatography of the Wine Samples

Method for Analysis:
Daniel P.M. Bonerz et al. A New RP-HPLC Method for Analysis of Polyphenols, Anthocyanins, and Indole-3-Acetic Acid in Wine.
Am.J.Enol. Vitic. 59:1 (2008)

Chromatograph: Infinity 1200, Agilent Technologies, USA with UV- detector.

Column: Microsorb 100 5 C18 S250x4.6 Agilent Technologies, Germany.

Mobile Phases used:
A – H_2O (995 ml) + H_3PO_4 (5 ml)
B – CH_3CN (495 ml) + H_2O (500 ml) +H_3PO_4 (5 ml)

Duration of Analysis: 42 min.
Flow rate: 1 ml/min.
Pressure: 120 Bar, Temperature: 30 ˚C

Red Wine Samples Preparation for Analysis

Wine samples right before analysis were:

1) diluted in HPLC grade Methanol (99.9%) 5-times
2) filtered through Analytical Filters (0,45μm)
3) injected automatically (20 microliters)

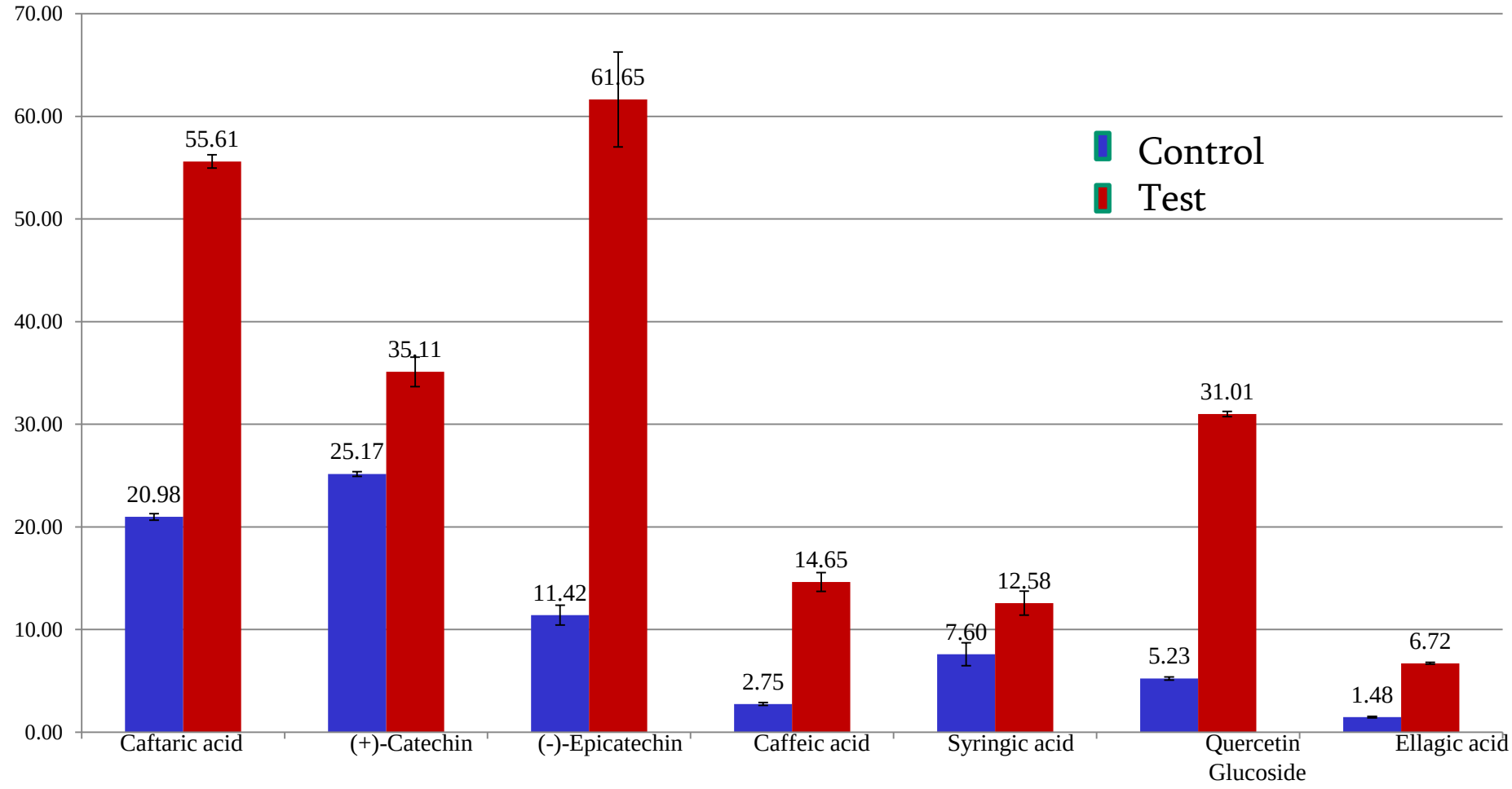
Standards & Solvents for the HPLC were of the Chromatography grade from Sigma Aldrich, Germany.

Each analysis performed in triplicate.

Results of the High Performance Liquid Chromatography Analysis in Red Wine Samples (mg/l)

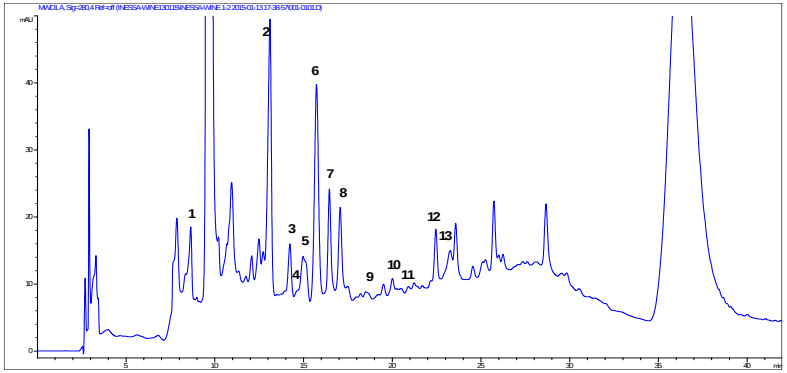
Phenolic compound, mg/l	Control	I Test	II Test	III Test	IV Test
Caftaric acid	20.983±0.325	39.957±2.465	43.833±0.843	55.608±0.643	48.450±0.624
(+)-Catechin	25.167±0.225	35.217±1.581	31.167±0.419	35.108±1.438	36.757±0.449
Caffeic acid	2.753±0.134	8.581±2.672	10.978±0.075	14.648±0.915	12.743±0.090
Syringic acid	7.600±1.126	8.975±1.664	10.867±0.058	12.575±1.170	11.550±0.304
(-)-Epicatechin	11.417±0.967	17.648±2.087	42.800±1.645	61.650±4.621	49.367±1.537
Ellagic acid	1.483±0.076	1.984±0.164	2.533±0.076	6.721±0.085	4.613±0.096
Quercetin Glucoside	5.233±0.161	18.750±0.444	20.050±0.050	31.008±0.251	21.983±0.231

Phenolic Compounds in Red Dessert Wines, mg/l



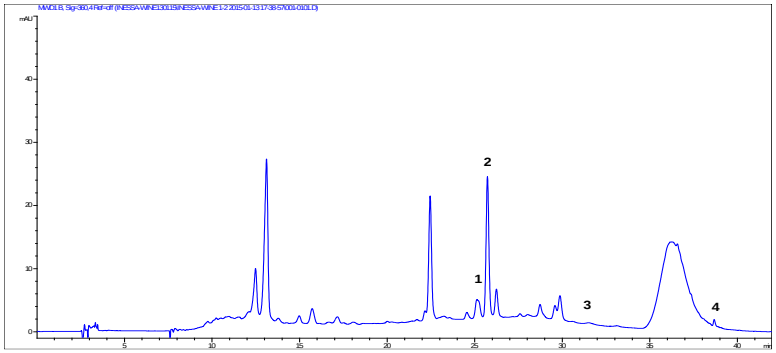
HPLC Analysis Results of the Best Test Wine Sample

In comparison with the Control, Total Identified phenolics higher by 110%;



Chromatogram №1. Detection on wavelength 280 nm.

1 – Gallic acid; 2 – Caftaric acid; 3 - (+)-Catechin; 4 –Chlorogenic acid;
5 - Vanillic acid; 6 – Caffeic acid; 7 - Syringic acid; 8 - (-)-Epicatechin;
9 – Vanillin;10 – Syringic aldehyde; 11 – p-Coumaric acid;12 - Ferulic acid;
13 – Sinapic acid



Chromatogram №2. Detection on wavelength 360 nm.

1 – Ellagic acid; 2 – Quercetin glucoside; 3 – Myricetin; 4 – Kaempferol.

Increase:

Quercetin glucoside - by 5.9 times
(-)-Epicatechin & Caffeic acid – 5-times;
Ellagic acid – 4 times;
Caftaric acid – 2 times;
Syringic acid – by 65 %;
(+)-Catechin – by 39.5 %;
Vanillic aldehyde – by 69 %;
Syringic aldehyde – by 12 %.

Sensory Characteristics higher than of the control.

Conclusions:

- Elaborated by us technology gives **wine with high content of phenolic substances.**

- Received test wine sample is with **high antioxidant effect, improved quality & nutritive value.**

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Thank you for your kind attention!