Supplementary Material

1 Tables

**Table S1**. Tested polyphenolic standards for HPLC characterization.

|  |  |
| --- | --- |
| **Polyphenolic Standards** | |
| (-)-Epicatechin | Malvidin-3-glucoside |
| (-)-Epicatechin 3-gallate | Malvidin chloride |
| (-)-Epigallocatechin | Myricetin |
| (+)-Catechin hydrate | Naringenin |
| 2-(4-Hydroxyphenyl)ethanol/Tyrosol | Naringin |
| 3,4-Dihydroxybenzoic acid | Neochlorogenic acid |
| Apigenin | *p*-Coumaric acid |
| Caffeic acid | Peonidin chloride |
| Caftaric acid | Piceatannol |
| Chlorogenic acid | Polydatin |
| Cinnamic acid | Procyanidin A2 |
| Cyanidin 3,5-diglucoside | Procyanidin B1 |
| Cyanidin 3-glucoside | Procyanidin B2 |
| Cyanidin chloride | Quercetin |
| Delphinidin 3-glucoside | Quercetin 3-D-galactoside |
| Delphinidin chloride | Quercetin 3-glucoside |
| Ellagic acid | Quercetin-3-O-glucuronide |
| Ferulic acid | Quercetin-3-o-β-D-glucuronide |
| Gallic acid monohydrate | Resveratrol |
| Hydroxytyrosol | Rutin hydrate |
| Isorhamnetin | Syringic acid |
| Kaempferol | Taxifolin |
| Keracyanin | *trans*-Piceid |
| Luteolin-rutinoside | Vanillic acid |
| Malvidin 3,5-diglucoside | Viniferin |

**Table S2.** Composition of the dried grape stems and stem extracts from Mazuelo grape variety (*Vitis vinifera* L. cv. Carignan)

|  |  |  |
| --- | --- | --- |
| **Proximate composition**  (g/100 g dry material) | **Mazuelo stem** | **Mazuelo stem extract** |
| Ash | 1.85 ± 0.14 | 3.14 ± 0.25 |
| Cellulose/Glucan | 31.34 ± 0.10 | 19.68 ± 0.27 |
| Hemicellulose | 16.37 ± 0.24 | n.d. |
| Lignin | 32.84 ± 0.22 | 30.62 ± 0.47 |
| Protein | 5.72 ± 0.16 | 2.67 ± 0.07 |
| Fat | 0.45 ± 0.01 | n.d. |

n.d.: not detected

**Table S3**. Quantification of individual polyphenols in winemaking samples in mg/L

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Standard** | **Stage** | **PC** | **NC** | **ME** | **MM** | **MS** |
| Protocatechuic acid | Must | ND | ND | ND | ND | ND |
| 50%AF | 1.94 ± 0.23 | 1.13 ± 0.06 | 1.99 ± 0.34 | 1.91 ± 0.22 | 1.96 ± 0.08 |
| AF | 2.09 ± 0.29 | 1.09 ± 0.07 | ND | 2.38 ± 0.25 | 1.85 ± 0.31 |
| MLF | 0.83 ± 0.08 | 2.86 ± 0.37 | 2.53 ± 0.36 | 2.96 ± 0.32 | 1.61 ± 0.37 |
| YB | 2.81 ± 0.10 | 2.97 ± 0.16 | ND | 2.27 ± 0.91 | ND |
| Caftaric acid | Must | 38.16 ± 1.83 | 20.87 ± 2.51 | 22.06 ± 2.72 | 22.92 ± 0.81 | 21.82 ± 0.48 |
| 50%AF | 37.94 ± 3.36 | 20.87 ± 1.39 | 23.42 ± 6.57 | 23.16 ± 8.02 | 16.98 ± 1.65 |
| AF | 33.11 ± 1.04 | 19.58 ± 15.25 | 27.85 ± 1.75 | 30.48 ± 1.95 | 29.58 ± 1.85 |
| MLF | 29.94 ± 1.42 | 29.24 ± 3.8 | 30.67 ± 1.58 | 32.09 ± 2.81 | 30.12 ± 3.64 |
| YB | 34.89 ± 3.36 | 26.58 ± 3.03 | 25.07 ± 1.87 | 25.14 ± 2.58 | 26.79 ± 2.70 |
| Chlorogenic acid | Must | 5.57 ± 0.39 | 4.88 ± 0.33 | 4.77 ± 0.15 | 5.18 ± 0.51 | 4.95 ± 0.19 |
| 50%AF | 6.53 ± 0.40 | 5.83 ± 0.26 | 6.90 ± 0.22 | 6.60 ± 0.28 | 6.61 ± 0.31 |
| AF | 8.71 ± 0.18 | 7.72 ± 0.48 | 7.46 ± 1.13 | 8.92 ± 0.65 | 8.04 ± 1.01 |
| MLF | 10.44 ± 0.30 | 11.05 ± 1.10 | 9.93 ± 0.45 | 11.05 ± 0.71 | 9.83 ± 0.39 |
| YB | 9.82 ± 0.35 | 8.94 ± 0.49 | 8.66 ± 0.38 | 9.15 ± 0.73 | 8.61 ± 0.75 |
| Gallic acid | Must | ND | ND | ND | ND | ND |
| 50%AF | 6.69 ± 1.27 | 5.55 ± 0.18 | 7.86 ± 0.54 | 10.84 ± 1.86 | 8.82 ± 1.66 |
| AF | 28.41 ± 0.58 | 19.59 ± 0.72 | 29.99 ± 1.52 | 31.53 ± 2.54 | 28.18 ± 2.95 |
| MLF | 31.31 ± 0.79 | 26.16 ± 3.02 | 37.30 ± 1.58 | 41.28 ± 3.76 | 36.62 ± 2.00 |
| YB | 47.04 ± 0.26 | 38.25 ± 2.16 | 0.26 ± 0.07 | 10.88 ± 10.48 | 21.8 ± 22.65 |
| (+)-Catechin | Must | 9.96 ± 0.12 | 9.70 ± 0.48 | 10.59 ± 0.16 | 11.41 ± 0.64 | 10.08 ± 0.06 |
| 50%AF | 9.05 ± 2.03 | 8.88 ± 1.20 | 9.46 ± 0.76 | 11.1 ± 1.44 | 8.65 ± 0.15 |
| AF | 25.16 ± 1.19 | 22.21 ± 1.59 | 26.22 ± 0.86 | 29.86 ± 1.71 | 25.06 ± 1.11 |
| MLF | 27.69 ± 0.87 | 24.24 ± 0.48 | 28.17 ± 1.73 | 30.38 ± 0.62 | 24.02 ± 0.66 |
| YB | 27.63 ± 0.34 | 21.45 ± 1.51 | 23.03 ± 1.32 | 24.97 ± 0.73 | 20.53 ± 0.62 |
| (-)-Epicatechin | Must | 1.03 ± 0.55 | 0.24 ± 0.03 | 0.22 ± 0.02 | 0.23 ± 0.02 | 0.28 ± 0.05 |
| 50%AF | 5.65 ± 0.13 | 3.82 ± 0.24 | 6.76 ± 1.39 | 7.43 ± 0.35 | 4.97 ± 0.54 |
| AF | 16.63 ± 1.46 | 12.92 ± 1.66 | 19.94 ± 1.30 | 23.58 ± 1.29 | 20.5 ± 5.22 |
| MLF | 20.42 ± 1.32 | 17.07 ± 1.95 | 28.83 ± 0.38 | 31.72 ± 0.99 | 24.86 ± 1.98 |
| YB | 18.58 ± 1.40 | 15.90 ± 0.82 | 21.37 ± 1.35 | 22.76 ± 0.56 | 18.11 ± 1.21 |
| Quercetin | Must | 0.02 ± 0.01 | 0.02 ± 0.01 | 0.03 ± 0.00 | 0.02 ± 0.00 | 0.02 ± 0.00 |
| 50%AF | 0.47 ± 0.09 | 0.42 ± 0.04 | 0.71 ± 0.04 | 0.75 ± 0.08 | 0.65 ± 0.07 |
| AF | 1.2 ± 0.13 | 1.11 ± 0.29 | 1.26 ± 0.09 | 1.69 ± 0.03 | 1.44 ± 0.12 |
| MLF | 1.25 ± 0.31 | 0.96 ± 0.02 | 0.45 ± 0.03 | 0.85 ± 0.02 | 0.64 ± 0.14 |
| YB | 1.25 ± 0.02 | 0.73 ± 0.23 | 0.52 ± 0.02 | 0.74 ± 0.10 | 0.58 ± 0.10 |
| Quercetin-3-glucoside | Must | 0.79 ± 0.12 | 0.78 ± 0.04 | 0.64 ± 0.07 | 0.56 ± 0.04 | 0.61 ± 0.04 |
| 50%AF | 5.71 ± 1.06 | 4.51 ± 0.24 | 4.08 ± 0.24 | 4.07 ± 0.46 | 4.15 ± 0.17 |
| AF | 3.5 ± 0.28 | 2.57 ± 0.66 | 1.15 ± 0.11 | 1.10 ± 0.08 | 1.52 ± 0.17 |
| MLF | 3.28 ± 0.20 | 2.49 ± 0.39 | 0.67 ± 0.15 | 0.69 ± 0.10 | 1.01 ± 0.12 |
| YB | ND | ND | ND | ND | ND |
| Quercetin-3-glucuronide | Must | 0.88 ± 0.12 | 0.84 ± 0.09 | 1.05 ± 0.15 | 0.90 ± 0.11 | 0.82 ± 0.1 |
| 50%AF | 2.08 ± 0.87 | 4.05 ± 0.35 | 4.87 ± 0.20 | 5.17 ± 0.52 | 4.59 ± 0.4 |
| AF | 4.86 ± 0.38 | 4.28 ± 0.37 | 4.12 ± 0.48 | 4.71 ± 0.54 | 4.84 ± 0.59 |
| MLF | 6.42 ± 0.40 | 5.6 ± 0.75 | 4.27 ± 0.24 | 5.16 ± 0.81 | 4.61 ± 0.42 |
| YB | 5.85 ± 0.30 | 4.25 ± 0.75 | 3.83 ± 0.33 | 4.05 ± 0.44 | 4.04 ± 0.50 |
| Procyanidin A2 | Must | 0.08 ± 0.00 | 0.06 ± 0.01 | 0.07 ± 0.01 | 0.06 ± 0.01 | 0.06 ± 0.00 |
| 50%AF | 0.08 ± 0.01 | 0.09 ± 0.01 | 0.09 ± 0.01 | 0.10 ± 0.01 | 0.12 ± 0.01 |
| AF | 0.19 ± 0.05 | 0.24 ± 0.04 | 0.33 ± 0.07 | 0.35 ± 0.02 | 0.31 ± 0.03 |
| MLF | 0.23 ± 0.01 | 0.28 ± 0.04 | 0.31 ± 0.05 | 0.35 ± 0.05 | 0.30 ± 0.10 |
| YB | 0.16 ± 0.04 | 0.17 ± 0.06 | 0.16 ± 0.02 | 0.14 ± 0.01 | 0.15 ± 0.01 |
| Malvidin chloride | Must | 0.79 ± 0.37 | 0.29 ± 0.03 | 0.29 ± 0.02 | 0.27 ± 0.01 | 0.29 ± 0.01 |
| 50%AF | 6.55 ± 0.69 | 6.58 ± 0.52 | 7.52 ± 0.66 | 8.14 ± 0.76 | 5.97 ± 0.56 |
| AF | 5.22 ± 0.47 | 5.32 ± 0.44 | 5.45 ± 0.32 | 5.83 ± 0.65 | 6.11 ± 0.39 |
| MLF | 5.35 ± 0.40 | 5.23 ± 0.41 | 3.96 ± 0.25 | 5.06 ± 0.79 | 4.09 ± 0.34 |
| YB | 2.57 ± 0.19 | 1.16 ± 0.14 | 1.27 ± 0.10 | 1.58 ± 0.13 | 1.27 ± 0.11 |
| Malvidin-3-glucoside | Must | 24.82 ± 2.58 | 17.99 ± 3.39 | 17.67 ± 1.51 | 17.91 ± 2.15 | 14.70 ± 1.26 |
| 50%AF | 176.98 ± 20.15 | 163.65 ± 6.09 | 167.54 ± 4.62 | 173.19 ± 15.95 | 161.1 ± 16.32 |
| AF | 175.58 ± 23.26 | 160.31 ± 2.39 | 153.07 ± 6.68 | 168.97 ± 6.33 | 148.83 ± 5.23 |
| MLF | 133.35 ± 2.40 | 147.97 ± 9.95 | 142.94 ± 5.52 | 155.83 ± 14.37 | 140.68 ± 3.96 |
| YB | 93.34 ± 4.90 | 44.32 ± 1.73 | 48.05 ± 1.03 | 54.65 ± 2.00 | 43.36 ± 2.38 |
| Delphinidin-3-glucoside | Must | 7.20 ± 2.04 | 0.72 ± 0.22 | 0.71 ± 0.04 | 0.67 ± 0.11 | 0.60 ± 0.04 |
| 50%AF | 32.81 ± 8.36 | 24.89 ± 2.09 | 25.91 ± 1.11 | 27.89 ± 0.58 | 26.36 ± 2.20 |
| AF | 20.05 ± 5.14 | 20.05 ± 4.65 | 11.89 ± 1.31 | 13.07 ± 1.14 | 16.45 ± 1.87 |
| MLF | 18.37 ± 4.03 | 18.4 ± 4.46 | 10.23 ± 1.08 | 11.8 ± 1.84 | 11.78 ± 1.18 |
| YB | 11.68 ± 2.33 | 4.88 ± 1.73 | 3.42 ± 0.21 | 4.70 ± 0.32 | 3.73 ± 0.38 |
| Cyanidin-3-glucoside | Must | 3.71 ± 0.75 | 2.10 ± 0.39 | 1.97 ± 0.08 | 2.01 ± 0.24 | 1.72 ± 0.26 |
| 50%AF | 1.21 ± 0.12 | 1.11 ± 0.25 | 0.97 ± 0.09 | 0.98 ± 0.12 | 0.98 ± 0.12 |
| AF | ND | ND | ND | ND | ND |
| MLF | ND | ND | ND | ND | ND |
| YB | ND | ND | ND | ND | ND |
| Anthocyanin 1 | Must | 4.44 ± 0.73 | 0.95 ± 0.39 | 0.83 ± 0.08 | 0.84 ± 0.15 | 0.64 ± 0.04 |
| 50%AF | 25.56 ± 1.49 | 22.87 ± 2.26 | 24.28 ± 1.49 | 26.17 ± 1.11 | 23.54 ± 1.93 |
| AF | 31.79 ± 7.08 | 26.56 ± 1.85 | 21.38 ± 0.72 | 24.22 ± 2.34 | 26.49 ± 1.98 |
| MLF | 28.35 ± 2.16 | 25.44 ± 1.56 | 19.17 ± 1.98 | 24.00 ± 3.34 | 21.99 ± 0.96 |
| YB | 17.40 ± 1.96 | 7.37 ± 2.11 | 6.37 ± 0.36 | 8.36 ± 0.37 | 6.62 ± 0.49 |
| Anthocyanin 2 | Must | 0.90 ± 0.05 | 0.49 ± 0.06 | 0.55 ± 0.05 | 0.54 ± 0.04 | 0.45 ± 0.03 |
| 50%AF | ND | ND | ND | ND | ND |
| AF | ND | ND | ND | ND | ND |
| MLF | ND | ND | ND | ND | ND |
| YB | ND | ND | ND | ND | ND |
| Anthocyanin 3 | Must | 0.76 ± 0.12 | ND | ND | ND | ND |
| 50%AF | 5.05 ± 0.57 | 4.68 ± 0.48 | 5.00 ± 0.21 | 5.18 ± 0.49 | 4.31 ± 0.56 |
| AF | 4.99 ± 0.36 | 5.59 ± 0.56 | 4.63 ± 0.44 | 4.83 ± 0.60 | 5.31 ± 0.66 |
| MLF | 4.83 ± 0.58 | 4.94 ± 0.54 | 3.74 ± 0.30 | 4.71 ± 0.53 | 3.87 ± 0.26 |
| YB | 2.31 ± 0.22 | 1.04 ± 0.15 | 0.99 ± 0.09 | 1.38 ± 0.13 | 1.06 ± 0.11 |
| Anthocyanin 4 | Must | 1.44 ± 0.38 | 0.64 ± 0.06 | 0.67 ± 0.05 | 0.60 ± 0.09 | 0.64 ± 0.06 |
| 50%AF | 13.34 ± 1.21 | 12.89 ± 1.46 | 13.69 ± 0.93 | 14.63 ± 1.88 | 13.85 ± 1.78 |
| AF | 15.09 ± 0.65 | 14.24 ± 1.36 | 13.63 ± 1.26 | 14.75 ± 2.05 | 15.62 ± 1.95 |
| MLF | 14.53 ± 1.20 | 12.81 ± 1.31 | 11.26 ± 0.86 | 13.78 ± 1.62 | 12.04 ± 0.51 |
| YB | 6.64 ± 0.46 | 3.00 ± 0.33 | 3.10 ± 0.27 | 3.99 ± 0.40 | 3.30 ± 0.20 |

NC: negative control; PC: positive control; ME: stem extract; MM: stem extract mixed with SO2; MS: stem powder.

50%AF: mid alcoholic fermentation; AF: end of alcoholic fermentation; MLF: end of malolactic fermentation; YB: after one year in the bottle.

**Table S4**. Results of the triangle test. Two-by-two comparison of the different treatments analyzed

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **PC** | **NC** | **ME** | **MM** | **MS** |
| **PC** |  |  |  |  |  |
| **NC** |  |  |  |  |  |
| **ME** |  |  |  |  |  |
| **MM** |  |  |  |  |  |
| **MS** |  |  |  |  |  |

PC: positive control; NC: negative control; ME: stem extract; MM: stem extract mixed with SO2; MS: stem powder. Red color indicates that both samples are organoleptically different and green color indicates that the samples could not be organoleptically differentiated. The confidence level of these results was 99%.

The samples marked as different in this table can be differentiated by 100% of the population with 99% confidence.