

Table S1. Types and contents of volatile compounds in wine samples.

| volatile compounds             | content (mg/L)            |                           |                          |                          |                          |                          |
|--------------------------------|---------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                | A7                        | A50                       | B28                      | 31-DH                    | BS-V2                    | Before MLF               |
| Ethyl Acetate                  | 4.70±0.19 <sup>ab</sup>   | 3.91±0.44 <sup>b</sup>    | 4.13±0.08 <sup>ab</sup>  | 3.68±0.07 <sup>b</sup>   | 3.92±0.14 <sup>b</sup>   | 5.48±0.23 <sup>a</sup>   |
| Butanoic Acid Ethyl Ester      | 0.42±0.01 <sup>ab</sup>   | 0.34±0.01 <sup>ab</sup>   | 0.38±0.03 <sup>ab</sup>  | 0.35±0.01 <sup>ab</sup>  | 0.27±0.09 <sup>b</sup>   | 0.45±0.01 <sup>a</sup>   |
| 1-Propanol-2-Methyl            | 1.35±0.13 <sup>bc</sup>   | 1.25±0.05 <sup>c</sup>    | 1.37±0.12 <sup>bc</sup>  | 1.50±0.01 <sup>abc</sup> | 1.58±0.08 <sup>ab</sup>  | 1.73±0.07 <sup>a</sup>   |
| 1-Butanol-3-Methyl-Acetate     | 8.14±0.64 <sup>a</sup>    | 6.30±0.01 <sup>ab</sup>   | 7.19±0.45 <sup>ab</sup>  | 6.35±0.25 <sup>ab</sup>  | 6.00±0.39 <sup>b</sup>   | 7.73±0.26 <sup>ab</sup>  |
| 1-Butanol-3-Methyl             | 75.33±4.28 <sup>ab</sup>  | 69.04±3.57 <sup>c</sup>   | 71.70±2.52 <sup>bc</sup> | 73.96±1.71 <sup>bc</sup> | 82.17±2.08 <sup>ab</sup> | 85.46±0.73 <sup>a</sup>  |
| Hexanoic Acid Ethyl Ester      | 13.50±0.33 <sup>a</sup>   | 10.79±1.28 <sup>ab</sup>  | 10.88±0.49 <sup>ab</sup> | 8.70±0.55 <sup>b</sup>   | 9.15±0.55 <sup>ab</sup>  | 13.02±0.19 <sup>ab</sup> |
| Acetic Acid Hexyl Ester        | 0.27±0.03 <sup>a</sup>    | 0.16±0.03 <sup>ab</sup>   | 0.15±0.05 <sup>ab</sup>  | 0.13±0.02 <sup>b</sup>   | 0.17±0.06 <sup>ab</sup>  | 0.18±0.01 <sup>ab</sup>  |
| Heptanoic Acid Ethyl Ester     | 0.20±0.05 <sup>a</sup>    | 0.12±0.02 <sup>ab</sup>   | 0.10±0.01 <sup>b</sup>   | 0.08±0.01 <sup>b</sup>   | 0.09±0.02 <sup>b</sup>   | 0.12±0.01 <sup>ab</sup>  |
| 2-Hexenoic Acid Ethyl Ester    | 0.37±0.01 <sup>a</sup>    | 0.31±0.03 <sup>ab</sup>   | 0.28±0.02 <sup>ab</sup>  | 0.24±0.02 <sup>ab</sup>  | 0.21±0.02 <sup>b</sup>   | 0.35±0.01 <sup>a</sup>   |
| 1-Hexanol                      | 2.75±0.08 <sup>ab</sup>   | 2.55±0.23 <sup>ab</sup>   | 2.49±0.01 <sup>ab</sup>  | 2.34±0.10 <sup>b</sup>   | 2.77±0.04 <sup>ab</sup>  | 2.87±0.05 <sup>a</sup>   |
| Isopentyl Hexanoate            | 0.70±0.64 <sup>a</sup>    | 0.34±0.01 <sup>ab</sup>   | 0.28±0.45 <sup>b</sup>   | ND                       | 0.18±0.40 <sup>b</sup>   | 0.22±0.26 <sup>b</sup>   |
| Caprylic Acid Methyl Ester     | 0.47±0.08 <sup>a</sup>    | 0.27±0.23 <sup>ab</sup>   | ND                       | 0.17±0.10 <sup>ab</sup>  | ND                       | 0.29±0.01 <sup>ab</sup>  |
| Octanoic Acid Ethyl Ester      | 113.13±21.81 <sup>a</sup> | 85.81±16.72 <sup>ab</sup> | 69.49±7.57 <sup>ab</sup> | 51.36±4.21 <sup>b</sup>  | 51.84±6.41 <sup>b</sup>  | 77.98±0.58 <sup>ab</sup> |
| Nonanoic Acid Ethyl Ester      | 0.68±0.07 <sup>a</sup>    | 0.38±0.05 <sup>ab</sup>   | 0.34±0.06 <sup>b</sup>   | 0.24±0.02 <sup>b</sup>   | 0.20±0.02 <sup>b</sup>   | 0.41±0.03 <sup>ab</sup>  |
| Octanoic Acid-2-Butyl Ester    | 0.14±0.04 <sup>a</sup>    | ND                        | 0.07±0.01 <sup>ab</sup>  | ND                       | ND                       | ND                       |
| Tetradecanoic Acid Ethyl Ester | 0.61±0.10 <sup>a</sup>    | 0.46±0.18 <sup>ab</sup>   | 0.22±0.05 <sup>b</sup>   | 0.31±0.10 <sup>ab</sup>  | 0.29±0.02 <sup>b</sup>   | 0.26±0.02 <sup>b</sup>   |
| Benzaldehyde                   | ND                        | 0.15±0.03 <sup>ab</sup>   | 0.16±0.01 <sup>ab</sup>  | 0.23±0.01 <sup>ab</sup>  | 0.32±0.02 <sup>a</sup>   | ND                       |
| Amyl Butyrate                  | ND                        | ND                        | ND                       | ND                       | ND                       | 0.02±0.01 <sup>a</sup>   |
| 4-Methyl-1-Pentanol            | ND                        | ND                        | 0.03±0.02 <sup>a</sup>   | 0.04±0.02 <sup>a</sup>   | ND                       | ND                       |
| 4-Nonanol-2,6,8-Trimethyl      | 0.52±0.05 <sup>a</sup>    | 0.44±0.08 <sup>ab</sup>   | 0.30±0.02 <sup>b</sup>   | 0.26±0.01 <sup>b</sup>   | 0.35±0.04 <sup>ab</sup>  | 0.40±0.02 <sup>ab</sup>  |
| Methyl-8-Methyl-Nonanoate      | 0.09±0.04 <sup>a</sup>    | ND                        | 0.09±0.01 <sup>a</sup>   | 0.06±0.01 <sup>a</sup>   | 0.08±0.01 <sup>a</sup>   | ND                       |
| Decanoic Acid Ethyl Ester      | 77.08±16.03 <sup>a</sup>  | 51.98±10.64 <sup>ab</sup> | 38.58±4.48 <sup>b</sup>  | 29.57±1.68 <sup>b</sup>  | 27.70±3.51 <sup>b</sup>  | 30.12±0.03 <sup>b</sup>  |

|   |                            |                           |                         |                         |                           |                           |
|---|----------------------------|---------------------------|-------------------------|-------------------------|---------------------------|---------------------------|
| Octanoic Acid-3-Methylbutyl Ester                               | 1.49±0.42 <sup>a</sup>     | 0.83±0.14 <sup>ab</sup>   | 0.65±0.11 <sup>b</sup>  | 0.43±0.03 <sup>b</sup>  | 0.43±0.05 <sup>b</sup>    | 0.44±0.08 <sup>b</sup>    |
| Butanedioic Acid Diethyl Ester                                  | 0.81±0.04 <sup>abc</sup>   | 0.74±0.08 <sup>abc</sup>  | 0.56±0.02 <sup>c</sup>  | 0.63±0.07 <sup>bc</sup> | 0.98±0.01 <sup>ab</sup>   | 1.10±0.14 <sup>a</sup>    |
| 1-Propanol-3-(Methylthio)                                       | 0.50±0.02 <sup>ab</sup>    | 0.48±0.03 <sup>ab</sup>   | 0.30±0.01 <sup>b</sup>  | 0.36±0.08 <sup>b</sup>  | 0.79±0.13 <sup>a</sup>    | 0.85±0.01 <sup>a</sup>    |
| Acetic Acid-2-Phenylethyl Ester                                 | 2.00±0.22 <sup>ab</sup>    | 1.74±0.16 <sup>ab</sup>   | 1.49±0.08 <sup>ab</sup> | 1.34±0.05 <sup>b</sup>  | 2.06±0.21 <sup>ab</sup>   | 2.51±0.17 <sup>a</sup>    |
| 2-Buten-1-One-1-(2,6,6-Trimethyl-1,3-Cyclohexadien-1-yl)-, (E)- | 0.28±0.01 <sup>a</sup>     | 0.21±0.03 <sup>ab</sup>   | 0.18±0.01 <sup>ab</sup> | 0.14±0.01 <sup>b</sup>  | 0.22±0.03 <sup>ab</sup>   | 0.30±0.01 <sup>a</sup>    |
| Dodecanoic Acid Ethyl Ester                                     | 5.50±2.06 <sup>a</sup>     | 4.02±1.03 <sup>ab</sup>   | 2.83±0.37 <sup>ab</sup> | 1.54±0.01 <sup>b</sup>  | 2.00±0.26 <sup>b</sup>    | 1.48±0.01 <sup>b</sup>    |
| Pentadecanoic Acid-3-Methylbutyl Ester                          | 0.62±0.34 <sup>a</sup>     | 0.23±0.07 <sup>ab</sup>   | 0.30±0.02 <sup>ab</sup> | 0.21±0.02 <sup>ab</sup> | ND                        | ND                        |
| Benzyl Alcohol  | 0.56±0.07 <sup>a</sup>     | 0.40±0.03 <sup>ab</sup>   | 0.38±0.01 <sup>ab</sup> | 0.30±0.01 <sup>b</sup>  | 0.50±0.02 <sup>ab</sup>   | 0.55±0.05 <sup>a</sup>    |
| Phenylethyl Alcohol   | 123.69±14.85 <sup>bc</sup> | 119.30±9.20 <sup>bc</sup> | 93.52±7.52 <sup>c</sup> | 98.59±3.40 <sup>c</sup> | 176.75±9.20 <sup>ab</sup> | 203.78±19.50 <sup>a</sup> |
| Butanoic Acid-4-Hydroxy   | 0.44±0.15 <sup>a</sup>     | ND                        | ND                      | ND                      | ND                        | ND                        |
| Octanoic Acid   | 2.28±0.60 <sup>abc</sup>   | 1.91±0.25 <sup>bc</sup>   | 1.62±0.70 <sup>c</sup>  | 2.13±0.09 <sup>bc</sup> | 3.30±0.06 <sup>ab</sup>   | 3.72±0.35 <sup>a</sup>    |
| 2,4-Di-Tert-Butylphenol   | ND                         | 0.74±0.25 <sup>a</sup>    | 0.68±0.05 <sup>a</sup>  | 0.34±0.04 <sup>ab</sup> | 0.42±0.09 <sup>ab</sup>   | 0.37±0.01 <sup>ab</sup>   |
| Nonanal   | 0.52±0.04 <sup>a</sup>     | 0.64±0.14 <sup>a</sup>    | 0.54±0.13 <sup>a</sup>  |                         | 0.39±0.06 <sup>ab</sup>   | 0.42±0.04 <sup>ab</sup>   |
| Heptyl Isobutyl Ketone  | 1.16±0.09 <sup>a</sup>     | 0.87±0.14 <sup>ab</sup>   | 0.63±0.10 <sup>bc</sup> | 0.39±0.06 <sup>c</sup>  | 0.37±0.12 <sup>c</sup>    | 0.52±0.01 <sup>bc</sup>   |
| Decanal   | 0.44±0.16 <sup>a</sup>     | 0.29±0.06 <sup>ab</sup>   | 0.10±0.03 <sup>b</sup>  | 0.25±0.14 <sup>ab</sup> | 0.14±0.04 <sup>b</sup>    | 0.14±0.01 <sup>b</sup>    |
| 2-Hexadecanol   | 0.26±0.10 <sup>a</sup>     | ND                        | ND                      | ND                      | ND                        | ND                        |
| 1-Heptatriacotanol  | 0.05±0.02 <sup>a</sup>     | ND                        | ND                      | ND                      | ND                        | ND                        |
| Decyl Formate   | 0.11±0.03 <sup>a</sup>     | ND                        | ND                      | ND                      | ND                        | ND                        |
| 2-Tridecanone   | 0.43±0.14 <sup>a</sup>     | 0.19±0.02 <sup>ab</sup>   | ND                      | ND                      | ND                        | ND                        |
| Hexanoic Acid   | 0.39±0.08 <sup>b</sup>     | 0.22±0.06 <sup>b</sup>    | 0.38±0.01 <sup>b</sup>  | 0.38±0.01 <sup>b</sup>  | 0.55±0.03 <sup>b</sup>    | 1.01±0.16 <sup>a</sup>    |
| Butanedioic Acid Ethyl 3-Methylbutyl Ester                      | 0.08±0.01 <sup>ab</sup>    | 0.09±0.01 <sup>ab</sup>   | 0.06±0.01 <sup>b</sup>  | 0.06±0.01 <sup>b</sup>  | 0.10±0.01 <sup>ab</sup>   | 0.11±0.01 <sup>a</sup>    |
| 1-Tetradecanol  | 0.21±0.02 <sup>a</sup>     | ND                        | ND                      | ND                      | ND                        | ND                        |
| Palmitic Acid Ethyl Ester                                       | 0.24±0.05 <sup>a</sup>     | 0.18±0.09 <sup>a</sup>    | 0.10±0.02 <sup>a</sup>  | 0.25±0.02 <sup>a</sup>  | 0.18±0.02 <sup>a</sup>    | 0.18±0.02 <sup>a</sup>    |
| 2,6-Di-Tert-Butylhydroquinone                                   | 0.24±0.01 <sup>ab</sup>    | 0.19±0.01 <sup>ab</sup>   | 0.14±0.01 <sup>ab</sup> | ND                      | ND                        | 0.25±0.02 <sup>a</sup>    |
| Phenylacetaldehyde  | ND                         | 0.06±0.01 <sup>a</sup>    | ND                      | 0.06±0.01 <sup>a</sup>  | ND                        | ND                        |

|                         |    |                        |                         |                         |                         |                        |
|-------------------------|----|------------------------|-------------------------|-------------------------|-------------------------|------------------------|
| Ethyl Trans-4-Decenoate | ND | 0.10±0.01 <sup>a</sup> | 0.07±0.01 <sup>ab</sup> | ND                      | ND                      | ND                     |
| Ethyl Undecanoate       | ND | 0.05±0.01 <sup>a</sup> | ND                      | ND                      | ND                      | ND                     |
| Decyl Alcohol           | ND | 0.10±0.01 <sup>a</sup> | ND                      | ND                      | ND                      | ND                     |
| 2-Undecanone            | ND | ND                     | 0.20±0.03 <sup>a</sup>  | ND                      | ND                      | ND                     |
| Ethyl Phenylacetate     | ND | ND                     | 0.06±0.01 <sup>a</sup>  | ND                      | ND                      | ND                     |
| Methyl-2-Butyl-Caproate | ND | ND                     | ND                      | 0.14±0.04 <sup>a</sup>  | ND                      | ND                     |
| 2-Benzylpropionic Acid  | ND | ND                     | ND                      | 0.05±0.01 <sup>b</sup>  | 0.08±0.01 <sup>ab</sup> | 0.10±0.01 <sup>a</sup> |
| Decanoic Acid           | ND | ND                     | 0.33±0.10 <sup>a</sup>  | 0.14±0.01 <sup>ab</sup> | 0.24±0.01 <sup>ab</sup> | ND                     |
| 4-Hydroxybutyric Acid   | ND | ND                     | ND                      | ND                      | 0.47±0.08 <sup>a</sup>  | 0.49±0.12 <sup>a</sup> |

Note: <sup>a</sup>, <sup>b</sup>, and <sup>c</sup> indicate significance analysis.