Supplementary Materials

**Microencapsulation of Grape Pomace Extracts with Alginate-Based Coatings by Freeze-Drying: Release Kinetics and In Vitro Bioaccessibility Assessment of Phenolic Compounds**

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**Figure S1.** Cumulative release of total phenolic compounds (TPC) from freeze-dried microencapsulated powders containing grape pomace phenol-rich extracts (A. – Cabernet Sauvignon, B. – Cabernet Franc and C. – Merlot) coated with sodium alginate (SA), sodium alginate with gum arabica (SA-GA) and sodium alginate with gelatin (SA-GEL) expressed as mg gallic acid equivalent (GAE) per g of freeze-dried microencapsulated powders (mgGAE/gP).

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Continuing **Figure S2.**

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**Figure S2.** Kinetics of phenolic compound release from the freeze-dried microencapsulated powders containing grape pomace extracts of Cabernet Sauvignon, Cabernet Franc and Merlot varieties prepared with different coatings (NA – sodium alginate; SA-GA – combination of sodium alginate and gum Arabic; SA-GEL – combination of sodium alginate ang gelatin; symbols – experimental data, lines – approximate curves according to different mathematical models).

**Table S1.** Content of individual phenolic compounds of phenol-rich grape pomace extract Cabernet Sauvignon (CSE), sodium alginate microencapsulated powder (SA), sodium alginate with gum Arabic microencapsulated powder (SA-GA), and sodium alginate with gelatin microencapsulated powder (SA-GEL) during three phases of in vitro simulated digestion.

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| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| Gallic acid | CSE | 0.70 ± 0.04 | - | 1.25 ± 0.01 | - | 36.26 ± 1.29 | 22.4 ± 0.8 |
| SA | 3.49 ± 0.37 | 14.19 ± 0.70 | 9.94 ± 0.11 | 37.44 ± 1.89 | 7.81 ± 0.92 | 4.8 ± 0.6 |
| SA-GA | 1.81 ± 0.02 | 7.77 ± 0.00 | 13.98 ± 1.69 | 66.39 ± 0.39 | 52.84 ± 0.84 | 32.6 ± 0.5 |
| SA-GEL | 3.66 ± 0.03 | 6.93 ± 0.10 | 5.85 ± 0.36 | 41.98 ± 1.13 | 42.46 ± 7.08 | 26.2 ± 4.4 |
| 3,4‑Dihydroxybenzoic acid | CSE | nd | - | nd | - | 11.36 ± 0.37 | 18.3 ± 0.6 |
| SA | nd | nd | nd | 9.80 ± 0.84 | 6.41 ± 0.18 | 10.3 ± 0.3 |
| SA-GA | nd | nd | nd | 22.01 ± 0.13 | 17.89 ± 0.45 | 28.8 ± 0.7 |
| SA-GEL | nd | nd | nd | 11.50 ± 0.41 | 19.52 ± 0.10 | 31.5 ± 0.2 |
| Syringic acid | CSE | 9.94 ± 0.04 | - | 3.10 ± 0.06 | - | nd | 0.0 |
| SA | 3.89 ± 0.09 | 3.84 ± 0.37 | 3.59 ± 0.15 | nd | nd | 0.0 |
| SA-GA | 3.79 ± 0.00 | 4.53 ± 0.06 | 4.93 ± 0.49 | nd | nd | 0.0 |
| SA-GEL | 4.57 ± 0.44 | 4.52 ± 0.62 | 4.76 ± 0.67 | nd | nd | 0.0 |
| Vanillic acid | CSE | nd | - | nd | - | 2.39 ± 0.11 | 22.9 ± 1.1 |
| SA | nd | nd | nd | 3.86 ± 0.09 | 4.42 ± 0.62 | 42.3 ± 5.9 |
| SA-GA | nd | nd | nd | 4.52 ± 0.06 | 5.59 ± 0.19 | 57.4 ± 1.9 |
| SA-GEL | nd | nd | nd | 6.26 ± 0.82 | 7.40 ± 0.62 | 70.9 ± 5.9 |
| Ellagic acid | CSE | nd | - | nd | - | 1.63 ± 0.11 | 1.7 ± 0.1 |
| SA | nd | 2.10 ± 0.07 | 2.18 ± 0.13 | 13.66 ± 0.31 | 12.67 ± 0.40 | 13.4 ± 0.4 |
| SA-GA | nd | nd | nd | 2.37 ± 0.00 | 6.18 ± 0.06 | 6.5 ± 0.1 |
| SA-GEL | 1.42 ± 0.52 | 3.21 ± 0.10 | 4.55 ± 0.87 | 30.85 ± 2.06 | 25.84 ± 0.62 | 27.3 ± 0.7 |

**Table S1.** – continued

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| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| *p*-Hydroxybenzoic acid | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| *o*-Coumaric acid | CSE | nd | - | nd | - | 5.87 ± 0.93 | 78.7 ± 12.4 |
| SA | 10.96 ± 0.41 | 21.80 ± 0.11 | 22.08 ± 0.24 | 16.53 ± 0.57 | 15.65 ± 0.31 | 209.8 ± 4.1 |
| SA-GA | nd | nd | nd | 29.54 ± 0.45 | 26.35 ± 0.39 | 353.2 ± 5.2 |
| SA-GEL | 15.91 ± 0.70 | 18.23 ± 0.62 | 30.29 ± 2.31 | 18.55 ± 1.34 | 15.46 ± 1.74 | 207.2 ± 23.4 |
| *p*-Coumaric acid | CSE | 0.59 ± 0.14 | - | 0.21 ± 0.07 | - | 2.99 ± 0.11 | 87.0 ± 3.3 |
| SA | nd | nd | nd | 4.64 ± 0.04 | 0.68 ± 0.00 | 20.0 ± 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Caffeic acid | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Ferulic acid | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Stilbenes* (μg/100 mgEXT)** |
| Resveratrol | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ε-Viniferin | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

**Table S1.** – continued

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| --- | --- | --- | --- | --- | --- |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavanols* (μg/100 mgEXT)** |
| Epicatechin | CSE | 79.11 ± 1.67 | - | 34.62 ± 0.71 | - | 50.19 ± 1.13 | 49.8 ± 1.1 |
| SA | 47.93 ± 0.70 | 92.28 ± 0.84 | 87.55 ± 3.57 | 275.31 ± 1.06 | 261.25 ± 6.43 | 259.4 ± 6.4 |
| SA-GA | 33.06 ± 0.06 | 78.24 ± 0.06 | 102.89 ± 7.62 | 297.23 ± 0.39 | 247.32 ± 8.80 | 245.6 ± 8.7 |
| SA-GEL | 79.90 ± 1.08 | 101.49 ± 1.34 | 182.25 ± 17.90 | 287.26 ± 18.11 | 224.20 ± 0.10 | 222.6 ± 0.1 |
| Catechin | CSE | 61.78 ± 1.82 | - | 12.14 ± 0.57 | - | nd | 0.0 |
| SA | 59.59 ± 0.64 | 55.82 ± 3.06 | 66.85 ± 1.28 | nd | nd | 0.0 |
| SA-GA | 40.33 ± 0.02 | 56.31 ± 0.10 | 67.50 ± 6.64 | nd | nd | 0.0 |
| SA-GEL | 54.37 ± 5.44 | 24.64 ± 4.74 | 74.91 ± 2.26 | nd | nd | 0.0 |
| Epicatechin gallate | CSE | nd | - | 6.99 ± 0.16 | - | 6.75 ± 0.76 | 116.8 ± 13.2 |
| SA | nd | 24.12 ± 0.04 | 27.89 ± 0.75 | 26.61 ± 0.04 | 33.64 ± 2.86 | 582.6 ± 49.5 |
| SA-GA | nd | 13.35 ± 0.13 | 15.59 ± 0.52 | 37.67 ± 0.32 | 38.11 ± 0.19 | 659.9 ± 3.4 |
| SA-GEL | nd | nd | 6.69 ± 0.10 | 55.44 ± 6.59 | 55.38 ± 0.72 | 958.9 ± 12.4 |
| Gallocatechin gallate | CSE | nd | - | nd | - | 182.35 ± 7.51 | 251.4 ± 10.4 |
| SA | nd | nd | nd | 333.26 ± 3.17 | 330.87 ± 8.58 | 456.2 ± 11.8 |
| SA-GA | nd | nd | nd | 426.04 ± 0.58 | 478.95 ± 12.75 | 660.3 ± 17.6 |
| SA-GEL | nd | nd | nd | 671.87 ± 19.14 | 716.07 ± 5.75 | 987.3 ± 7.9 |
| Procyanidin B1 | CSE | 21.28 ± 1.36 | - | nd | - | nd | 0.0 |
| SA | 26.27 ± 0.02 | 21.43 ± 3.50 | 18.75 ± 5.57 | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Procyanidin B2 | CSE | 22.85 ± 0.34 | - | 8.81 ± 0.07 | - | nd | 0.0 |
| SA | 14.38 ± 0.23 | 19.62 ± 1.17 | 18.24 ± 0.75 | nd | nd | 0.0 |
| SA-GA | 7.98 ± 0.02 | 11.71 ± 0.06 | 15.68 ± 1.36 | nd | nd | 0.0 |
| SA-GEL | 10.01 ± 0.90 | nd | nd | nd | nd | 0.0 |

**Table S1.** – continued

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| --- | --- | --- | --- | --- | --- |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavonols* (μg/100 mgEXT)** |
| Quercetin | CSE | 17.75 ± 0.06 | - | 1.60 ± 0.08 | - | nd | 0.0 |
| SA | 13.34 ± 0.18 | 17.60 ± 0.86 | 17.86 ± 0.31 | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | 7.70 ± 0.77 | 7.84 ± 1.50 | 11.67 ± 0.36 | nd | nd | 0.0 |
| Rutin | CSE | 4.95 ± 0.13 | - | 2.53 ± 0.07 | - | nd | 0.0 |
| SA | 2.79 ± 0.53 | 3.25 ± 0.07 | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Kaempferol | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Oenin chloride | CSE | 47.12 ± 0.25 | - | 64.71 ± 0.01 | - | 31.42 ± 2.56 | 34.4 ± 2.8 |
| SA | 28.57 ± 0.36 | 50.48 ± 0.35 | 46.26 ± 0.37 | 8.62 ± 0.13 | 7.91 ± 0.18 | 8.7 ± 0.2 |
| SA-GA | 40.73 ± 3.87 | 15.23 ± 0.52 | 15.86 ± 0.26 | nd | nd | 0.0 |
| SA-GEL | 57.80 ± 1.01 | 44.69 ± 1.96 | 44.03 ± 1.29 | 13.53 ± 0.62 | 12.92 ± 0.21 | 14.2 ± 0.2 |
| Myrtillin chloride | CSE | 2.29 ± 0.03 | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Petunidin chloride | CSE | 0.96 ± 0.04 | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Peonidin-3-*O*-glucoside chloride | CSE | 5.40 ± 0.04 | - | 6.29 ± 0.21 | - | 2.41 ± 0.42 | 24.7 ± 4.3 |
| SA | 2.36 ± 0.21 | 4.39 ± 0.48 | 3.53 ± 0.24 | nd | nd | 0.0 |
| SA-GA | 3.66 ± 0.34 | 1.81 ± 0.29 | 1.60 ± 0.13 | nd | nd | 0.0 |
| SA-GEL | 4.08 ± 0.52 | 3.17 ± 0.77 | 2.65 ± 0.26 | nd | nd | 0.0 |

**Table S1.** – continued

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| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Kuromanin chloride | CSE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

GP – gastric phase, IP – intestinal phase, OP – oral phase, nd – not detected, ˝-„ – not determined. Index numbers associated with abbreviations indicate the time interval when a certain sample was taken (i.e. .GP123 – 123rd minute of the gastric phase). For the CSE, only the endpoints of the oral, gastric, and intestinal phases are shown (OP3, GP123, IP243). Phenolic contents are expressed as mean value (μg/100 mgEXT) ± SD.

**Table S2.** Content of individual phenolic compounds of phenol-rich grape pomace extract Cabernet Franc (CFE), sodium alginate microencapsulated powder (SA), sodium alginate with gum Arabic microencapsulated powder (SA-GA), and sodium alginate with gelatin microencapsulated powder (SA-GEL) during three phases of in vitro simulated digestion.

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| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| Gallic acid | CFE | 2.09 ± 0.06 | - | 1.19 ± 0.17 | - | 141.38 ± 6.37 | 108.8 ± 4.9 |
| SA | 0.86 ± 0.16 | 5.17 ± 0.96 | 3.16 ± 0.37 | 4.79 ± 0.00 | 16.01 ± 0.75 | 12.3 ± 0.6 |
| SA-GA | nd | 6.15 ± 1.96 | 2.72 ± 0.51 | 102.85 ± 7.20 | 90.77 ± 1.22 | 69.8 ± 0.9 |
| SA-GEL | 2.93 ± 0.08 | 8.47 ± 0.16 | 3.94 ± 0.11 | 11.65 ± 0.31 | 9.51 ± 0.00 | 7.3 ± 0.0 |
| 3,4‑Dihydroxybenzoic acid | CFE | nd | - | nd | - | 17.01 ± 0.08 | 70.6 ± 0.4 |
| SA | nd | nd | nd | 13.95 ± 0.00 | 8.61 ± 0.04 | 35.7 ± 0.2 |
| SA-GA | nd | nd | nd | 32.76 ± 1.99 | 30.00 ± 0.51 | 124.5 ± 2.1 |
| SA-GEL | nd | nd | nd | 5.64 ± 0.21 | 15.90 ± 0.00 | 66.0 ± 0.0 |
| Syringic acid | CFE | 6.92 ± 0.78 | - | nd | - | nd | 0.0 |
| SA | 3.49 ± 0.07 | 5.79 ± 0.09 | 3.75 ± 0.77 | nd | nd | 0.0 |
| SA-GA | 9.51 ± 0.66 | 6.85 ± 0.51 | 8.92 ± 0.80 | 2.23 ± 0.19 | 2.36 ± 0.26 | 78.3 ± 8.5 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Vanillic acid | CFE | nd | - | nd | - | 4.39 ± 0.00 | 29.6 ± 0.0 |
| SA | nd | nd | nd | 3.92 ± 0.00 | 3.89 ± 0.13 | 26.2 ± 0.9 |
| SA-GA | nd | nd | nd | 5.59 ± 0.58 | 5.23 ± 0.06 | 35.2 ± 0.4 |
| SA-GEL | nd | nd | nd | 6.23 ± 0.00 | 6.98 ± 0.00 | 47.1 ± 0.0 |
| Ellagic acid | CFE | nd | - | nd | - | 1.28 ± 0.00 | 1.6 ± 0.0 |
| SA | nd | 1.41 ± 0.15 | 1.73 ± 0.07 | 13.01 ± 0.00 | 13.46 ± 0.13 | 16.5 ± 0.2 |
| SA-GA | nd | nd | nd | 9.54 ± 1.67 | 9.68 ± 0.45 | 11.9 ± 0.6 |
| SA-GEL | nd | 1.57 ± 0.21 | 1.60 ± 0.05 | 16.77 ± 0.00 | 19.16 ± 0.00 | 23.6 ± 0.0 |

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| **Table S2.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| *p*-Hydroxybenzoic acid | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| *o*-Coumaric acid | CFE | nd | - | nd | - | 9.37 ± 0.06 | 48.1 ± 0.3 |
| SA | 20.41 ± 0.20 | 27.06 ± 0.72 | 25.98 ± 0.57 | 18.49 ± 0.00 | 21.54 ± 0.66 | 110.6 ± 3.4 |
| SA-GA | nd | nd | nd | 68.42 ± 5.78 | 82.63 ± 2.57 | 424.2 ± 13.2 |
| SA-GEL | 17.23 ± 1.37 | 21.67 ± 1.21 | 22.92 ± 1.16 | 15.58 ± 0.00 | 19.76 ± 0.00 | 101.4 ± 0.0 |
| *p*-Coumaric acid | CFE | 0.43 ± 0.06 | - | 0.44 ± 0.00 | - | 3.93 ± 0.70 | 272.8 ± 49.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Caffeic acid | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Ferulic acid | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Stilbenes* (μg/100 mgEXT)** |
| Resveratrol | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ε-Viniferin | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

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| **Table S2.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavanols* (μg/100 mgEXT)** |
| Epicatechin | CFE | 343.19 ± 7.06 | - | 324.16 ± 4.16 | - | nd | 0.0 |
| SA | 160.11 ± 4.18 | 171.72 ± 0.64 | 180.02 ± 6.53 | 200.24 ± 0.00 | 167.33 ± 1.10 | 30.6 ± 0.2 |
| SA-GA | 210.82 ± 0.90 | 352.28 ± 7.83 | 417.18 ± 4.40 | 100.63 ± 8.93 | 80.82 ± 2.31 | 14.8 ± 0.4 |
| SA-GEL | 154.16 ± 4.14 | 185.78 ± 5.80 | 155.10 ± 1.26 | 107.82 ± 3.88 | 164.60 ± 1.68 | 30.1 ± 0.3 |
| Catechin | CFE | 100.95 ± 12.01 | - | 139.84 ± 2.90 | - | nd | 0.0 |
| SA | 102.30 ± 2.23 | 77.12 ± 0.15 | 49.66 ± 3.21 | nd | nd | 0.0 |
| SA-GA | 118.90 ± 0.08 | 96.28 ± 1.51 | 90.47 ± 8.70 | nd | nd | 0.0 |
| SA-GEL | 21.09 ± 0.66 | 42.90 ± 1.37 | 45.21 ± 1.21 | nd | nd | 0.0 |
| Epicatechin gallate | CFE | nd | - | nd | - | 32.06 ± 0.06 | 98.8 ± 0.2 |
| SA | nd | nd | nd | 27.46 ± 0.00 | 25.68 ± 1.06 | 79.1 ± 3.3 |
| SA-GA | nd | nd | nd | 47.61 ± 3.34 | 51.82 ± 2.83 | 159.7 ± 8.7 |
| SA-GEL | nd | nd | nd | 61.29 ± 2.52 | 54.82 ± 0.00 | 168.9 ± 0.0 |
| Gallocatechin gallate | CFE | nd | - | nd | - | 190.83 ± 6.03 | 150.0 ± 4.7 |
| SA | nd | nd | nd | 381.74 ± 0.00 | 374.86 ± 5.85 | 294.6 ± 4.6 |
| SA-GA | nd | nd | nd | 443.58 ± 6.17 | 450.08 ± 1.41 | 353.8 ± 1.1 |
| SA-GEL | nd | nd | nd | 558.30 ± 1.68 | 601.79 ± 0.00 | 473.0 ± 0.0 |
| Procyanidin B1 | CFE | 60.20 ± 0.10 | - | 72.36 ± 7.13 | - | nd | 0.0 |
| SA | 81.43 ± 6.36 | 61.88 ± 2.52 | 49.69 ± 3.26 | nd | nd | 0.0 |
| SA-GA | 68.20 ± 3.38 | 61.72 ± 4.24 | 66.34 ± 1.73 | nd | nd | 0.0 |
| SA-GEL | 24.87 ± 4.01 | nd | nd | nd | nd | 0.0 |
| Procyanidin B2 | CFE | 111.71 ± 5.15 | - | 137.25 ± 3.75 | - | nd | 0.0 |
| SA | 3.49 ± 0.07 | 5.79 ± 0.09 | 3.75 ± 0.77 | nd | nd | 0.0 |
| SA-GA | 64.41 ± 0.29 | 65.10 ± 4.08 | 92.86 ± 3.02 | 24.12 ± 4.95 | 34.95 ± 6.36 | 27.6 ± 5.0 |
| SA-GEL | 31.92 ± 0.05 | 28.87 ± 0.95 | 38.66 ± 3.74 | nd | nd | 0.0 |

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| **Table S2.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavonols* (μg/100 mgEXT)** |
| Quercetin | CFE | 19.62 ± 0.67 | - | 15.89 ± 0.38 | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Rutin | CFE | 46.81 ± 0.68 | - | 64.19 ± 0.00 | - | 18.86 ± 1.80 | 29.0 ± 2.8 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Kaempferol | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Oenin chloride | CFE | 511.54 ± 1.17 | - | 733.77 ± 1.11 | - | 259.78 ± 23.24 | 32.7 ± 2.9 |
| SA | 355.94 ± 2.52 | 224.77 ± 12.53 | 219.88 ± 33.29 | 61.27 ± 3.61 | 96.68 ± 10.81 | 12.2 ± 1.4 |
| SA-GA | 378.04 ± 18.53 | 277.57 ± 2.05 | 306.86 ± 19.26 | 61.97 ± 1.28 | 65.32 ± 4.56 | 8.2 ± 0.6 |
| SA-GEL | 310.17 ± 0.24 | 254.76 ± 0.58 | 248.77 ± 0.26 | 60.92 ± 0.94 | 49.10 ± 4.31 | 6.2 ± 0.5 |
| Myrtillin chloride | CFE | 7.98 ± 0.30 | - | 6.73 ± 0.01 | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Petunidin chloride | CFE | 3.11 ± 0.17 | - | 3.62 ± 0.22 | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Peonidin-3-*O*-glucoside chloride | CFE | 45.42 ± 0.90 | - | 61.59 ± 1.32 | - | 18.64 ± 2.23 | 24.0 ± 2.9 |
| SA | 28.84 ± 1.23 | 16.32 ± 0.70 | 19.68 ± 2.71 | 4.36 ± 0.18 | 7.24 ± 0.31 | 9.3 ± 0.4 |
| SA-GA | 29.92 ± 1.97 | 20.60 ± 0.06 | 22.77 ± 2.09 | nd | nd | 0.0 |
| SA-GEL | 22.91 ± 1.61 | 19.44 ± 0.58 | 18.79 ± 0.58 | nd | nd | 0.0 |

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| **Table S2.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Kuromanin chloride | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Callistephin chloride | CFE | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

GP – gastric phase, IP – intestinal phase, OP – oral phase, nd – not detected, ˝-„ – not determined. Index numbers associated with abbreviations indicate the time interval when a certain sample was taken (i.e. GP123 – 123rd minute of the gastric phase). For the CFE, only the endpoints of the oral, gastric, and intestinal phases are shown (OP3, GP123, IP243). Phenolic contents are expressed as mean value (μg/100 mgEXT) ± SD.

**Table S3.** Content of individual phenolic compounds of phenol-rich grape pomace extract Merlot (ME), sodium alginate microencapsulated powder (SA), sodium alginate with gum Arabic microencapsulated powder (SA-GA), and sodium alginate with gelatin microencapsulated powder (SA-GEL) during three phases of in vitro simulated digestion.

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| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| Gallic acid | ME | 1.57 ± 0.16 | - | 1.61 ± 0.04 | - | 98.41 ± 0.59 | 47.4 ± 0.3 |
| SA | nd | nd | nd | 78.31 ± 9.37 | 30.06 ± 0.26 | 14.5 ± 0.1 |
| SA-GA | nd | nd | nd | 113.77 ± 1.33 | 95.89 ± 0.00 | 46.2 ± 0.0 |
| SA-GEL | nd | nd | nd | 101.35 ± 4.29 | 183.87 ± 0.61 | 88.5 ± 0.3 |
| 3,4‑Dihydroxybenzoic acid | ME | nd | - | nd | - | 9.33 ± 0.17 | 12.3 ± 0.2 |
| SA | nd | nd | nd | 17.19 ± 0.60 | 8.59 ± 0.04 | 11.4 ± 0.1 |
| SA-GA | nd | nd | nd | 21.94 ± 0.51 | 23.50 ± 0.00 | 31.1 ± 0.0 |
| SA-GEL | nd | nd | nd | 24.18 ± 1.33 | 35.90 ± 0.51 | 47.5 ± 0.7 |
| Syringic acid | ME | 12.14 ± 2.90 | - | 11.88 ± 0.13 | - | nd | 0.0 |
| SA | 3.49 ± 0.01 | 2.77 ± 0.19 | 4.09 ± 0.00 | nd | nd | 0.0 |
| SA-GA | 7.04 ± 0.76 | 3.25 ± 0.60 | nd | nd | nd | 0.0 |
| SA-GEL | 5.38 ± 0.03 | nd | nd | nd | nd | 0.0 |
| Vanillic acid | ME | nd | - | nd | - | 2.72 ± 0.08 | 22.1 ± 0.7 |
| SA | nd | nd | nd | 3.80 ± 0.64 | 4.04 ± 0.30 | 32.7 ± 2.4 |
| SA-GA | nd | nd | nd | 6.13 ± 0.19 | 6.52 ± 0.00 | 52.9 ± 0.0 |
| SA-GEL | nd | nd | nd | 5.20 ± 0.20 | 6.55 ± 0.10 | 53.1 ± 0.8 |
| Ellagic acid | ME | nd | - | nd | - | 2.52 ± 0.08 | 15.5 ± 0.5 |
| SA | nd | nd | nd | 2.37 ± 0.17 | 3.13 ± 0.04 | 19.2 ± 0.3 |
| SA-GA | nd | nd | nd | 4.52 ± 0.19 | 6.12 ± 0.19 | 37.5 ± 1.2 |
| SA-GEL | nd | nd | nd | 11.62 ± 1.33 | 13.16 ± 0.51 | 80.7 ± 3.1 |

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| **Table S3.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Phenolic acids* (μg/100 mgEXT)** |
| *p*-Hydroxybenzoic acid | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| *o*-Coumaric acid | ME | nd | - | nd | - | 5.92 ± 0.06 | 61.7 ± 0.6 |
| SA | nd | nd | nd | 14.49 ± 0.13 | 15.49 ± 0.09 | 161.4 ± 0.9 |
| SA-GA | nd | nd | nd | 25.57 ± 2.22 | 23.24 ± 0.00 | 242.2 ± 0.0 |
| SA-GEL | nd | nd | nd | 28.87 ± 4.08 | 23.74 ± 2.44 | 247.4 ± 25.4 |
| *p*-Coumaric acid | ME | 0.28 ± 0.03 | - | 0.36 ± 0.03 | - | 2.16 ± 0.08 | 65.4 ± 2.5 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Caffeic acid | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Ferulic acid | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Stilbenes* (μg/100 mgEXT)** |
| Resveratrol | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ε-Viniferin | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

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| **Table S3.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavanols* (μg/100 mgEXT)** |
| Epicatechin | ME | 190.58 ± 9.18 | - | 200.57 ± 2.08 | - | 38.79 ± 0.53 | 15.6 ± 0.2 |
| SA | 50.41 ± 0.00 | 181.44 ± 24.74 | 111.66 ± 0.00 | 219.09 ± 2.49 | 221.07 ± 3.99 | 89.0 ± 1.6 |
| SA-GA | 138.47 ± 5.04 | 212.47 ± 20.05 | 167.31 ± 6.31 | 266.94 ± 11.40 | 227.80 ± 0.00 | 91.7 ± 0.0 |
| SA-GEL | 103.49 ± 0.13 | 104.19 ± 0.00 | 179.46 ± 2.04 | 279.58 ± 8.88 | 223.65 ± 16.18 | 90.1 ± 6.5 |
| Catechin | ME | 101.90 ± 6.52 | - | 98.69 ± 1.03 | - | nd | 0.0 |
| SA | 58.13 ± 0.10 | 52.31 ± 0.98 | 71.67 ± 0.00 | nd | nd | 0.0 |
| SA-GA | 68.05 ± 3.73 | 52.45 ± 2.16 | 36.20 ± 5.81 | nd | nd | 0.0 |
| SA-GEL | 62.14 ± 0.20 | 37.59 ± 0.00 | 73.99 ± 0.61 | 69.16 ± 11.03 | 56.83 ± 1.02 | 20.9 ± 0.4 |
| Epicatechin gallate | ME | nd | - | nd | - | 7.35 ± 0.73 | 88.7 ± 8.8 |
| SA | nd | nd | nd | 26.40 ± 1.16 | 27.54 ± 1.07 | 332.4 ± 13.0 |
| SA-GA | nd | 17.68 ± 1.46 | 17.79 ± 0.28 | 35.91 ± 4.69 | 39.32 ± 0.00 | 474.6 ± 0.0 |
| SA-GEL | nd | nd | nd | 53.06 ± 3.57 | 59.13 ± 2.44 | 713.7 ± 29.5 |
| Gallocatechin gallate | ME | 104.18 ± 3.47 | - | 114.91 ± 2.29 | - | 178.11 ± 0.17 | 234.0 ± 0.2 |
| SA | nd | nd | nd | 269.21 ± 1.46 | 277.94 ± 2.58 | 365.2 ± 3.4 |
| SA-GA | nd | nd | nd | 405.34 ± 0.82 | 442.38 ± 0.00 | 581.2 ± 0.0 |
| SA-GEL | nd | nd | nd | 747.57 ± 27.97 | 782.73 ± 7.63 | 1028.4 ± 10.0 |
| Procyanidin B1 | ME | 28.71 ± 0.46 | - | 44.79 ± 5.83 | - | nd | 0.0 |
| SA | 27.64 ± 0.00 | 27.82 ± 2.35 | 38.08 ± 0.00 | nd | nd | 0.0 |
| SA-GA | 38.59 ± 1.25 | 27.73 ± 1.08 | 18.21 ± 3.28 | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Procyanidin B2 | ME | 58.30 ± 2.27 | - | 61.28 ± 0.54 | - | nd | 0.0 |
| SA | 14.74 ± 0.00 | 28.74 ± 0.19 | 19.83 ± 0.00 | nd | nd | 0.0 |
| SA-GA | 40.40 ± 1.49 | 23.78 ± 2.03 | 21.67 ± 2.81 | nd | nd | 0.0 |
| SA-GEL | 12.15 ± 0.13 | 55.77 ± 0.00 | 50.29 ± 0.10 | nd | nd | 0.0 |

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| **Table S3.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Flavonols* (μg/100 mgEXT)** |
| Quercetin | ME | 13.12 ± 0.81 | - | 5.93 ± 0.31 | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Rutin | ME | 7.00 ± 1.00 | - | 8.30 ± 0.01 | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Kaempferol | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Oenin chloride | ME | 26.58 ± 0.64 | - | 38.08 ± 0.28 | - | 20.56 ± 1.49 | 62.6 ± 4.5 |
| SA | 16.06 ± 1.29 | 13.09 ± 0.11 | 13.25 ± 0.00 | 9.27 ± 0.21 | 8.99 ± 0.09 | 27.4 ± 0.3 |
| SA-GA | 12.66 ± 0.21 | 6.44 ± 0.22 | 5.33 ± 0.16 | 3.90 ± 0.44 | 2.86 ± 0.13 | 8.7 ± 0.4 |
| SA-GEL | 14.26 ± 0.41 | 7.25 ± 0.46 | 9.11 ± 0.56 | 10.03 ± 0.10 | 8.06 ± 0.20 | 24.5 ± 0.6 |
| Myrtillin chloride | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Petunidin chloride | ME | 0.27 ± 0.01 | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |
| Peonidin-3-*O*-glucoside chloride | ME | 5.49 ± 0.20 | - | 7.34 ± 0.13 | - | 3.04 ± 0.42 | 42.4 ± 5.9 |
| SA | 2.69 ± 0.09 | 2.42 ± 0.17 | 2.17 ± 0.17 | 2.25 ± 0.17 | 1.61 ± 0.04 | 22.5 ± 0.6 |
| SA-GA | 1.83 ± 0.05 | nd | nd | nd | nd | 0.0 |
| SA-GEL | 2.14 ± 0.03 | nd | nd | nd | nd | 0.0 |

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| **Table S3.** – continued |
| **Component** | **Sample** | **Oral phase** | **Gastric phase** | **Intestinal phase** | **Bioaccessibility index** |
| **OP3** | **GP63** | **GP123** | **IP183** | **IP243** | ***BI* (%)** |
| ***Anthocyanins* (μg/100 mgEXT)** |
| Kuromanin chloride | ME | nd | - | nd | - | nd | 0.0 |
| SA | nd | nd | nd | nd | nd | 0.0 |
| SA-GA | nd | nd | nd | nd | nd | 0.0 |
| SA-GEL | nd | nd | nd | nd | nd | 0.0 |

GP – gastric phase, IP – intestinal phase, OP – oral phase, nd – not detected, ˝-„ – not determined. Index numbers associated with abbreviations indicate the time interval when a certain sample was taken (i.e. GP123 – 123rd minute of the gastric phase). For the ME, only the endpoints of the oral, gastric, and intestinal phases are shown (OP3, GP123, IP243). Phenolic contents are expressed as mean value (μg/100 mgEXT) ± SD.