**Supporting Information**

**Development, analytical characterization, and bioactivity evaluation of Boswellia Serrata extract-layered double hydroxide hybrid composites**

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**Supplementary schemes**

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**Scheme S1**.

Putative fragmentation mechanism illustrating the formation of the acetate ion (*m/z* 59.0139) from precursor ions exhibiting the same structural features of the first of the five condensed rings constituting the molecular backbone of acetyl α-boswellic acid (α-ABA) and 3-acetyl β-boswellic acid (β-ABA).

**Supplementary tables**

**Table S1**.

1. Parameters (mathematical equation and coefficient of determination) of the calibration curves obtained after serial dilutions and analysis of a methanolic solution of lyophilized BSE (see **Section 3.3.6** for details). Here “y”represents the analytical response, *i.e.*, the EIC peak area normalized to the internal standard (oleic acid), while “x” can be interpreted as the loading percentage of the analyte in the LDH/LDHc-BSE composites (see **Section 3.3.6** for details).
2. Parameters (mathematical equation and coefficient of determination) of the calibration curves for the absolute quantification of α-BA and β-BA (see **Section 3.3.6** for details).

**A)**

|  |  |  |
| --- | --- | --- |
| **Analyte** | **Equation of the calibration curve** | **Coefficient of determination (R2)** |
| *β-KBA* | y = (7.38⋅10-3) x + 4.64⋅10-3 | 0.9986 |
| *β-AKBA* | y = (2.67⋅10-3) x + 6.75⋅10-4 | 0.9997 |
| *BA isomer 3* | y = (2.24⋅10-3) x + 1.81⋅10-3 | 0.9994 |
| *BA isomer 4* | y = (4.34⋅10-3) x + 1.03⋅10-3 | 1.0000 |
| *BA isomer 5* | y = (2.12⋅10-2) x + 1.03⋅10-3 | 0.9997 |
| *BA isomer 6* | y = (-6.78⋅10-6) x2 + (2.14⋅10-3) x + 8.42⋅10-4 | 0.9999 |
| *α-BA* | y = (-2.5⋅10-5) x2 + (5.90⋅10-3) x + 10-2 | 0.9964 |
| *β-BA* | y = (-4.46⋅10-5) x2 + (1.26⋅10-2) x + 2.75⋅10-2 | 0.9957 |
| *BA isomer 7* | y = (-5.81⋅10-6) x2 + (2.79⋅10-3) x + 8.71⋅10-4 | 0.9999 |
| *ABA isomer 1* | y = (1.39⋅10-3) x + 1.03⋅10-3 | 0.9987 |
| *ABA isomer 2* | y = (4.07⋅10-4) x + 2.14⋅10-4 | 0.9998 |
| *ABA isomer 3* | y = (3.37⋅10-4) x + 3.40⋅10-4 | 0.9977 |
| *ABA isomer 4* | y = (-1.55⋅10-6) x2 + (7.32⋅10-4) x + 5.36⋅10-5 | 1.0000 |
| *α-ABA* | y = (-6.91⋅10-6) x2 + (2.41⋅10-3) x + 1.20⋅10-3 | 0.9998 |
| *β-ABA* | y = (-2.82⋅10-5) x2 + (7.43⋅10-3) x + 5.50⋅10-3 | 0.9994 |

**B)**

|  |  |  |
| --- | --- | --- |
| **Analyte** | **Equation of the calibration curve** | **Coefficient of determination (R2)** |
| *α-BA* | y = (-3.01⋅10-4) x2 + (7.57⋅10-2) x + 4.41⋅10-2 | 0.9997 |
| *β-BA* | y = (-5.79⋅10-5) x2 + (1.12⋅10-1) x + 4.32⋅10-2 | 0.9998 |

**Table S2**.

1. Estimated percent loaded amount of boswellic acids in the LDH-BSE and LDHc-BSE composites. These values represent the percentage content of each analyte embedded in a given mass of LDH/LDHc-BSE composite, in respect to the amount that is enclosed in the same mass of BSE. The values are reported in the form of mean ± standard deviation (SD). Here, the mean and the SD refer to three extraction replicates performed on both the LDH-BSE and LDHc-BSE composite, following the extraction protocols described in **Section 3.3.5**.
2. Estimated loaded amount (μg/mg) of α-BA and β-BA in BSE, LDH-BSE and LDHc-BSE composites. In the latter two cases, the values are reported in the form of mean ± standard deviation (SD). Here, the mean and the SD refer to three extraction replicates performed on each inorganic-organic composite, following the protocols described in **Section 3.3.5**. In the case of BSE the value refers to the estimated α-BA and β-BA starting from the RPLC-ESI(-)-FTMS analysis of a methanolic solution (100 μg/mL) of lyophilized BSE.

**A)**

|  |  |
| --- | --- |
|  | **Loaded amount (%)** |
| **Analyte** | **LDH-BSE** | **LDHc-BSE** |
| *β-KBA* | 43 ± 6 | 45.0 ± 0.2 |
| *β-AKBA* | 41 ± 5 | 52.6 ± 1.7 |
| *BA isomer 3* | 45 ± 4 | 57.3 ± 1.9 |
| *BA isomer 4* | 45 ± 6 | 61.7 ± 0.8 |
| *BA isomer 5* | 50 ± 7 | 67 ± 4 |
| *BA isomer 6* | 53 ± 4 | 71 ± 8 |
| *α-BA* | 61 ± 11 | 105 ± 3 |
| *β-BA* | 63 ± 9 | 104 ± 2 |
| *BA isomer 7* | 44 ± 7 | 64.3 ± 1.6 |
| *ABA isomer 1* | 58 ± 10 | 80.4 ± 1.6 |
| *ABA isomer 2* | 70 ± 7 | 93 ± 8 |
| *ABA isomer 3* | 58 ± 9 | 77 ± 5 |
| *ABA isomer 4* | 62 ± 7 | 88.3 ± 1.3 |
| *α-ABA* | 58 ± 7 | 90 ± 3 |
| *β-ABA* | 56 ± 8 | 99.0 ± 0.4 |

**B)**

|  |  |
| --- | --- |
|  | **Amount (μg/mg)** |
| **Analyte** | **LDH-BSE** | **LDHc-BSE** | **BSE** |
| *α-BA* | 31 ± 3 | 42.8 ± 0.4 | 42 |
| *β-BA* | 55 ± 5 | 72.4 ± 0.9 | 74 |

**Supplementary figures**

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**Figure S1**.

Chemical structures of α-boswellic acid (α-BA), β-boswellic acid (β-BA), 11-keto-β-boswellic acid (β-KBA), 3-acetyl α-boswellic acid (α-ABA), 3-acetyl β-boswellic acid (β-ABA), and 3-acetyl 11-keto-β-boswellic acid (β-AKBA).

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**Figure S2**.

Extracted ion chromatograms (EIC) referring to the RPLC-ESI(-)-FTMS analysis of a methanolic solution (100 μg/mL) of lyophilized BSE. The EIC traces were obtained by setting a 5 ppm extraction window centred on the theoretical *m/z* of the [M-H]− ions of (**A**) α-BA and β-BA (*m/z* 455.3531), (**C**) α-ABA, and β-ABA (497.3636), (**D**) β-KBA (469.3323), and (**E**) β-AKBA (*m/z* 511.3429).

Panel **B** displays the overlap of two EIC traces referring to the RPLC-ESI(-)-FTMS analysis performed on each of the two equally concentrated (10 μg/mL) methanolic solutions of the α-BA and β-BA analytical standards.

Panel **F** shows the RPLC-UV-DAD chromatogram recorded at 250 nm for a 1 mg/mL methanolic solution of lyophilized BSE.

The peak tags labelled with “\*” refer to those species that were tentatively identified on the basis of the information emerging from experimental data (retention time, MS/MS and UV-Vis spectra) and previous literature studies (see the main text for details). For some peaks (*i.e.*, those corresponding to α-BA, β-BA, α-ABA, and β-ABA) the information about the retention time is also shown to support what stated in the main text.