

Tech Tip 001 - Reference Standards Product Grades

ChromaDex product grades are differentiated by the level of characterization and testing performed and reported for each lot of material.

| Grade | Chemical Data | Adjusted Purity | HPLC/GC % | Water % | Solvent % | NMR | Mass Spec |
|---------------------------------|---------------|-----------------|-----------|---------|-----------|-----|-----------|
| Primary Analytical Standard (P) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Analytical Standard* (AS) | ✓ | | ✓ | | | | ✓ |
| Reagent Grade (RG) | ✓ | | | | | | |

Depending on your project and needs, different end uses require different product grades. Here is an overview of some typical uses and appropriate ChromaDex product grades for each.

| Grade | Quantitative HPLC/GC | Quality Control | Method Devel. | Working Stnd. | Cell Assays | Basic Research |
|---------------------------------|----------------------|-----------------|---------------|---------------|-------------|----------------|
| Primary Analytical Standard (P) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Analytical Standard (AS) | ✓* | ✓* | ✓ | ✓ | ✓ | ✓ |
| Reagent Grade (RG) | | | | | ✓ | ✓ |

*Since Analytical Standard (AS) grade products are not corrected for water and solvent content, quantitative results from these standards will give content on chromatographic purity only and will not account for the water and solvent that is contained in the sample being tested. Whenever possible for the most accurate analytical results, the best choice for quantitative analysis is a Primary Analytical Standard (P).

In addition to our three product grades, ChromaDex offers two additional specialized types of Primary Standards. These products are full Primary Standards with additional value-added testing and results.

Primary Certified Reference Material (CRM)

For increased compliance if your laboratory is ISO accredited, ChromaDex produces select Primary Standards in accordance with our ISO 17034 Certified Reference Material Producer and ISO/IEC 17025 Chemical Testing Laboratory accreditations. Our Primary CRMs are the most rigorously tested materials in our catalogue, providing the best accuracy and most thorough certificates of analysis. In addition to the full Primary characterization, these materials include a reported uncertainty value for the HPLC or GC chromatographic purity. This overall value incorporates the uncertainty of the test method analysis, sample homogeneity, stability, and transport. The extra reported information will allow your laboratory to properly calculate measurement uncertainty for your sample analyses.

Compendial Traceable Primary Analytical Standards (CT)

As an added value to our clients, ChromaDex is now offering Primary Analytical Standards (P) that are also traceable to a compendial reference material. These products undergo full Primary characterization and also have a purity assay value tested against a compendial material such as supplied by the United States Pharmacopeia (USP), National Institute of Standards and Technology (NIST), or other similar international compendial. Certificates of Analysis for these products include full data for Primary Analytical Standards along with a listing of the compendial source, lot number, and assay value.

Tech Tip 001 - Reference Standards Product Grades

Example: Primary Grade Certificate of Analysis

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PRODUCT NAME Aloin B
PART NUMBER 00001626
STANDARD TYPE Primary (P)
LOT NUMBER 00001626-573
REPORT NUMBER CDXA-RSS-9170-00
SAMPLE NUMBER CDXP-20-00733
DATE OF SAMPLE 09/23/2020
DATE OF REPORT 10/21/2020

CHEMICAL NAMES (10R)-10-β-D-glucopyranosyl-1,8-dihydroxy-3-(hydroxymethyl)-9(10H)-anthracenone; isobarbaloin
CHEMICAL FORMULA C₁₇H₁₂O₆
MOLECULAR WEIGHT (MW) 418.39
CHEMICAL FAMILY Quinones
CAS NUMBER [28371-16-6]
EC(INECS) N/A
RECS CB1543000

ANALYTICAL RESULTS

| TEST | METHOD | SPECIFICATION | RESULT |
|-------------------|-------------------|-----------------------|---|
| Adjusted Purity | NA | ≥ 85% | 85.9% |
| HPLC | 0.700.10.2.METH22 | ≥ 90% | 96.6% |
| NMR | 0.700.12.4 | Conforms to structure | Conforms to structure |
| Mass Spectrum | 0.700.12.2 | Conforms | Conforms |
| Residual Solvent* | USP <467> | NA | Acetonitrile - 827 ppm 1,2-Dichloroethane - 92,500 ppm |
| Water | 0.700.12.37 | NA | 1.8% |
| Appearance | NA | NA | White powder |

*Testing performed at an ISO 17025 accredited subcontracted laboratory.
ADJUSTED PURITY: 85.9% IS BASED ON (100 - 9.3 SOLVENTS - 1.8 WATER) X 96.6% HPLC

STORAGE CONDITIONS
STORAGE -20 °C in a dry place.
EXPIRATION DATE 09/2025 under the above conditions.

Digitally signed by Elizabeth Hughes
Date: 2020.10.21 09:40:18 -06'00'

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ANALYTICAL CONDITIONS

INSTRUMENT AGILENT 1260 HPLC UV-VIS (DAD); AB-SCIEX 6600 TRIPLE TOF
COLUMN Phenomenex Luna C18(2) 150 x 2.00 mm, 5 μm particle size
MOBILE PHASE A - 0.1% trifluoroacetic acid in Ultrapure water, B - Acetonitrile; Isocratic 5% B for 5 minutes, then increasing to 95% B over 20 minutes. Hold at 95% B for 15 minutes, then decreasing to 5% B over 1 minute.
COLUMN TEMP. 60 °C
FLOW RATE 0.4 mL/minute
INJECTION VOL. 0.4 μL
INJECTION CONC. 1.3 mg/mL in Methanol
DETECTION 205 ± 4 nm

HPLC CHROMATOGRAM OF ALOIN B (CDXP-20-00733)

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UV SPECTRUM AT RT = 13.1 MINUTES

HPLC CHROMATOGRAM OF DILUENT BLANK

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MASS SPECTRUM OF ALOIN B (CDXP-20-00733)

¹H-NMR SPECTRUM OF ALOIN B (CDXP-20-00733) IN CD₃OD

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¹³C-NMR SPECTRUM ALOIN B (CDXP-20-00733) IN CD₃OD

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COSY-NMR SPECTRUM OF ALOIN B (CDXP-20-00733) IN CD₃OD

REVISION HISTORY

| Revision History | Date of Revision | Document Changes |
|------------------|------------------|------------------|
| 00 | 10/21/2020 | New report |

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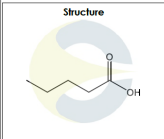
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Example: Analytical Standard Grade Certificate of Analysis

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| | | |
|-----------------------|--------------------------|---|
| PRODUCT NAME | Valeric acid |  <p>Structure</p> |
| PART NUMBER | 00022195 | |
| STANDARD TYPE | Analytical Standard (AS) | |
| LOT NUMBER | 00022195-WKF | |
| REPORT NUMBER | CDXA-RSS-7454-01 | |
| SAMPLE NUMBER | CDXA-17-000507 | |
| DATE OF SAMPLE | 01/11/2017 | |
| DATE OF RE-EVALUATION | 03/05/2021 | |
| DATE OF REPORT | 03/31/2021 | |

CHEMICAL NAMES 1-Butanecarboxylic acid; n-Pentanoic acid; Pentanoic acid; Propylacetic acid
CHEMICAL FORMULA C₆H₁₂O₂
MOLECULAR WEIGHT (MW) 102.13
CHEMICAL FAMILY Oils
CAS NUMBER [109-52-4]
EC(ENECs) 203-677-2
RTECS YV610000

| TEST | METHOD | SPECIFICATION | RESULT |
|---------------|---------------------|---------------|----------|
| GC | 0.700.10.2\METH1.40 | 2.75% | 99.2% |
| Mass Spectrum | 0.700.10.2\METH1.40 | Conforms | Conforms |
| Appearance | NA | NA | Liquid |

ANALYTICAL RESULTS

STORAGE CONDITIONS
STORAGE +4 °C in a dry place.
EXPIRATION DATE 03/2026 under the above conditions.

Digitally signed by Elizabeth Hughes
Date: 2021.03.31 16:01:26 -06'00'

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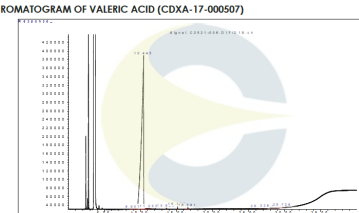
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ANALYTICAL CONDITIONS

INSTRUMENT AGILENT 7890B WITH FLAME IONIZATION DETECTOR (FID) AND AGILENT 8973A MASS SELECTIVE DETECTOR (MSD)
COLUMN Phenomenex Zebron ZB-Splus, 30 m x 0.32 mm x 0.25 µm
CARRIER GAS Helium
COLUMN TEMP. Isothermic 40 °C for 5.0 minutes, then increasing at 10.0 °C/minute to 340 °C. Hold at 340 °C for 5.0 minutes.
FLOW RATE 2.0 mL/minute
INJECTOR TEMP. 300 °C
INJECTOR SPLIT RATIO 20:1
INJECTION VOL. 1.0 µL
INJECTION CONC. 1.9 mg/mL in Chloroform
DETECTION FID (350 °C) & MSD (Transfer line 280 °C, Source 230 °C, Quad 150 °C)

GC CHROMATOGRAM OF VALERIC ACID (CDXA-17-000507)



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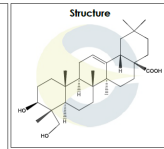
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Example: Reagent Grade Certificate of Analysis

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| | | |
|-----------------------|--------------------|--|
| PRODUCT NAME | Hederagenin |  <p>Structure</p> |
| PART NUMBER | 00008047 | |
| STANDARD TYPE | Reagent grade (RG) | |
| LOT NUMBER | 00008047-815 | |
| REPORT NUMBER | CDXA-RSS-7202-01 | |
| SAMPLE NUMBER | CDXP-21-00204 | |
| DATE OF SAMPLE | 07/13/2016 | |
| DATE OF RE-EVALUATION | 03/25/2021 | |
| DATE OF REPORT | 04/01/2021 | |

CHEMICAL NAMES [38,4a]-3,23-Dihydroxyolean-12-en-28-oic acid; Astragaligenin E; Cauloapogenin; Hederagenic acid; Hederagenin
CHEMICAL FORMULA C₃₀H₄₈O₄
MOLECULAR WEIGHT (MW) 472.70
CHEMICAL FAMILY Triterpenes
CAS NUMBER [465-99-6]
EC(ENECs) 207-369-9
RTECS RK017780

STORAGE CONDITIONS
STORAGE Room Temperature in a dry place.
EXPIRATION DATE 03/2026 under the above conditions.

Digitally signed by Elizabeth Hughes
Date: 2021.04.01 16:15:57 -06'00'

| Revision History | Date of Revision | Document/Changes |
|------------------|------------------|--|
| 00 | 08/03/2016 | New report |
| 01 | 04/01/2021 | Passed re-evaluation by MS. Updated expiration date and removed melting point. |

Note - Reagent Grade (RG) chemicals are not guaranteed as quantitative standards. This product line has been developed for research and qualitative purposes only.

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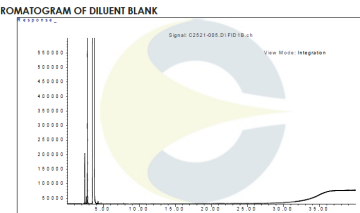
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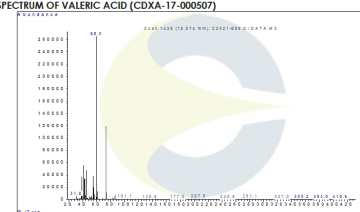
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GC CHROMATOGRAM OF DILUTED BLANK



MASS SPECTRUM OF VALERIC ACID (CDXA-17-000507)



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|------------------|------------------|---|
| 00 | 03/09/2017 | New report |
| 01 | 03/31/2021 | Material passed re-eval by GC-MS. Updated analytical results, analytical conditions, chromatograms, spectrum, and expiration date. Removed melting point. |

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