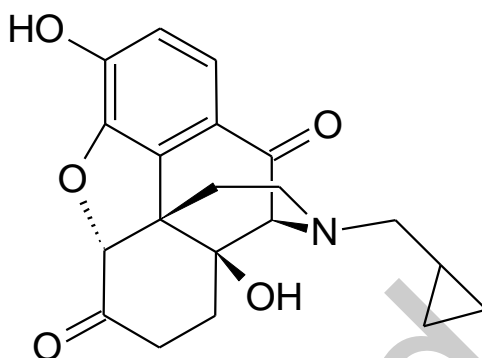


Reference Material Product Information Sheet

Epichem's Quality System conforms to ISO9001:2015 as certified by ECAAS Pty Ltd - Certification number 616061.



| | |
|-----------------------------|---|
| Name | 10-Ketonaltrexone |
| BP Name | Naltrexone Hydrochloride Impurity I |
| Synonym(s) | 17-(cyclopropylmethyl)-4,5 α -epoxy-3,14-dihydroxymorphinan-6,10-dione |
| Epichem Item # | EPL-AA210 Batch 1 |
| CAS # | 96445-14-6 |
| Molecular Formula | C ₂₀ H ₂₁ NO ₅ |
| Molecular Weight | 355.38 g/mol |
| Appearance | Yellow solid |
| Melting Point | 195.3-198.8°C |
| Combustion Analysis | Required (%): C:67.6; H:6.0; N:3.9. Found (%): C:68.3; H:6.0; N:4.0. |
| Purity | 98.7% |
| Date of Manufacture | 8 December 2016 |
| Storage Requirements | Protect from heat, light and moisture. |
| Special Precautions | This compound is for laboratory use only. Its toxicological properties may not have been fully established. It should be handled only by suitably qualified personnel. |
| Date of Shipment | TBA |
| | This certificate is valid for one year from the date of shipment provided the substance is unopened and stored under the recommended conditions. |
| Retest Date | TBA (Proper Storage and Handling Required) |

EPL-AA210 Batch 1

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ABN 80 106 769 902

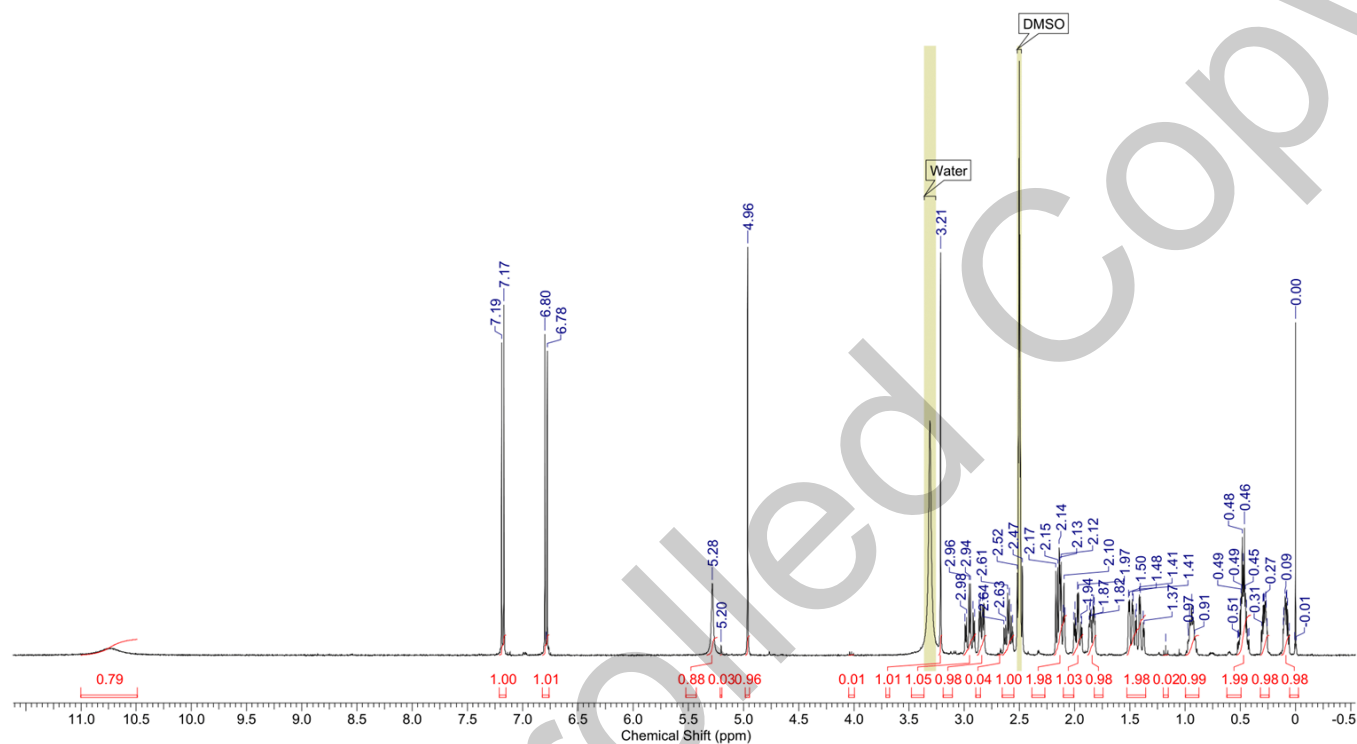
I. Identity

The identity of this product was established using the following analyses:

Ia. ¹HNMR Spectrum

Conditions: 400 MHz, DMSO-d₆

¹HNMR spectrum consistent with chemical structure.

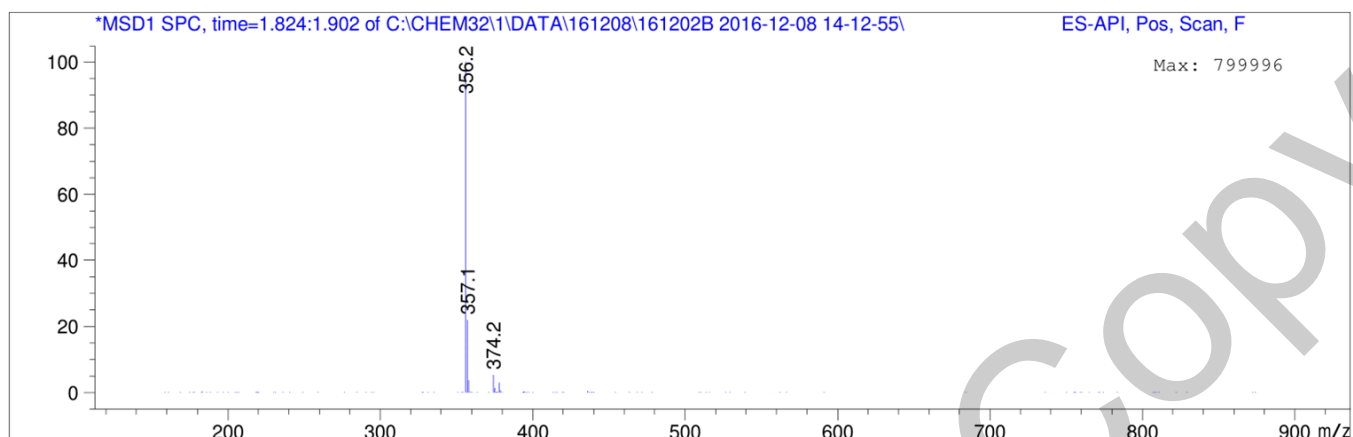


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Ib. Mass Spectrum

Method: 5% to 100% ACN in water gradient (+0.1% formic acid)
Poroshell 120 EC-C18, 4.6 x 50 mm, 2.7 micron



Theoretical value: 356.2 [M+H]⁺.

The signal of the Mass Spectrum is consistent with the theoretical value and its interpretation is consistent with the structural formula.

EPL-AA210 Batch 1

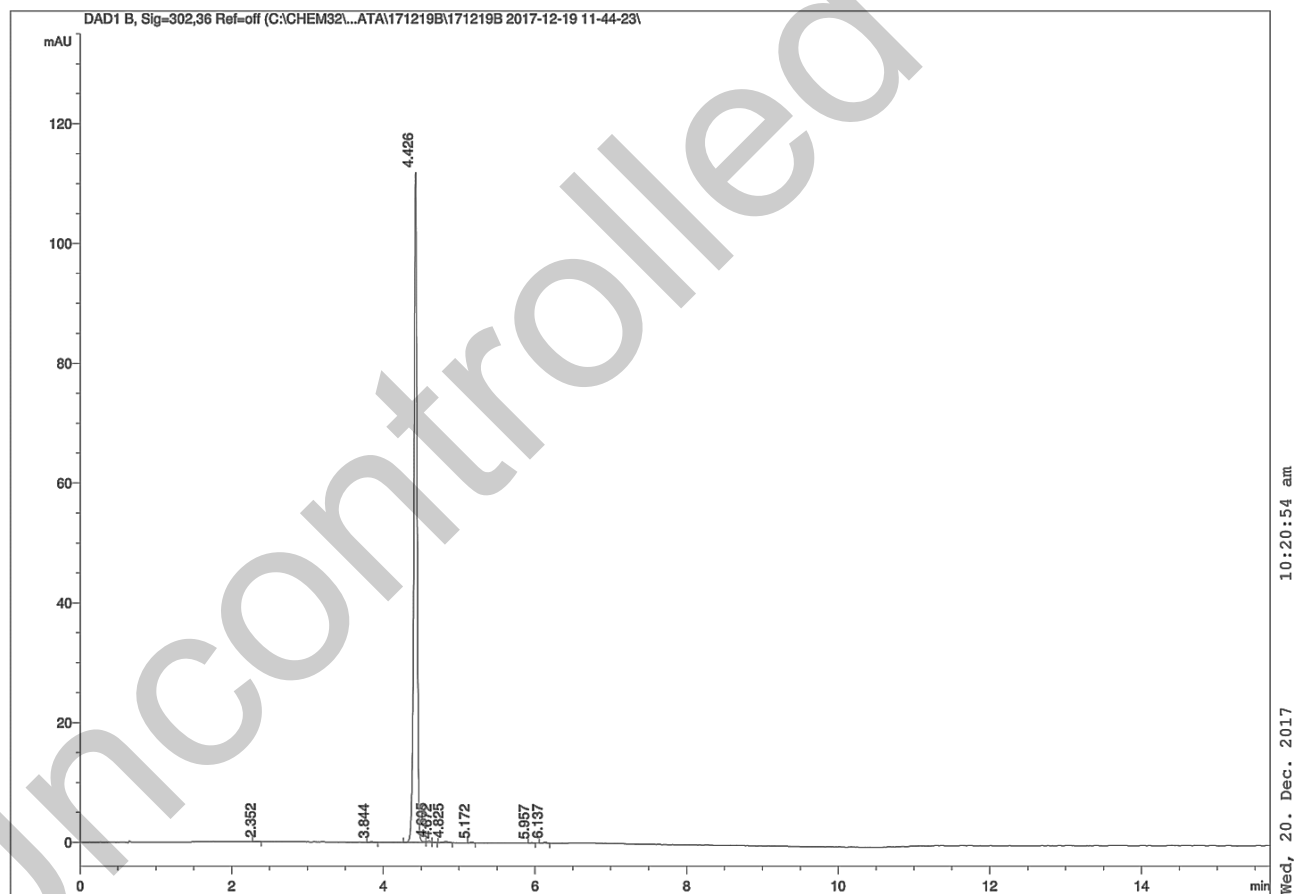
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II. Purity

The purity of this material was analysed by high performance liquid chromatography (HPLC) using in-house EM005.WI07.

HPLC Conditions:

| Column | Conditions | | | | Detector | Injector |
|---|------------|-----------------------------------|--|--------------------|--------------|---|
| Agilent Poroshell 120 EC-C18 4.6 x 50mm 2.7 micron | 60°C | | | | DAD 302nm | Auto 1.0 µL 0.2 mg/mL 100% water (+0.1% TFA) |
| | Time (min) | % Line A (Water + 0.1% (v/v) TFA) | % Line B (Acetonitrile + 0.1% (v/v) TFA) | Flow rate (mL/min) | | |
| | 0.00 | 95 | 5 | 1.0 | | |
| | 5.00 | 75 | 25 | 1.0 | | |
| | 9.50 | 5 | 95 | 1.0 | | |
| | 14.50 | 5 | 95 | 1.0 | | |
| | 15.50 | 95 | 5 | 1.0 | | |
| | 18.50 | 95 | 5 | 1.0 | | |



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Area Percent Report – Sorted by Signal

| Peak Number | Retention Time (rounded) | Area | Area % (rounded) |
|-------------|--------------------------|--------|------------------|
| 1 | 2.35 | 0.18 | 0.06 |
| 2 | 3.84 | 0.33 | 0.10 |
| 3 | 4.43 | 318.61 | 98.91 |
| 4 | 4.61 | 0.85 | 0.26 |
| 5 | 4.67 | 0.21 | 0.07 |
| 6 | 4.83 | 0.84 | 0.26 |
| 7 | 5.17 | 0.29 | 0.09 |
| 8 | 5.96 | 0.22 | 0.07 |
| 9 | 6.14 | 0.59 | 0.18 |
| Totals | | 322.12 | 100.00 |

For the calculation the system peaks were ignored. The content of the analyte was determined as a ratio of the peak area of the analyte and the cumulative areas of the impurities, added up to 100%.

Results:

Average 98.9% (average of 10 duplicate analyses)

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III. Water Content

Method: Karl-Fischer titration using in-house EM005.WI04.

Results:

Average 0.1%

IV. Ash Content

Method: BP2016 Ash (Appendix XI J) as per WS001/C30018

Result:

Contains <0.1% ash.

V. Residual Solvents

Method: ¹HNMR

Result:

Contains 0.1% Ethyl acetate by ¹H NMR analysis.

VI. Final Result

| | |
|-------------------------------|-------|
| Chromatographic purity (HPLC) | 98.9% |
| Water content | 0.1% |
| Ash content | <0.1% |
| Residual solvents | 0.1% |
| Purity* | 98.7% |

This purity is assessed to be 98.7%.

Product Reviewed By:

Product Released By:

John Moursounidis, PhD
Head Fine Chemicals and Technical Services

Boon Tan
Quality Manager

Release Date: 21 December 2017

*The calculation of the purity follows the formula:

$$\text{Purity(\%)} = \frac{((\text{Chromatographicpurity[HPLC]}) \times (100 - (\text{watercontent} + \text{ashcontent} + \text{volatilecontents})))}{100}$$

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