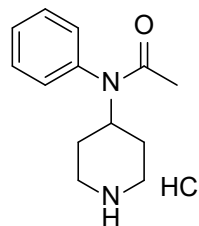


Certificate of Analysis

Acetyl norfentanyl (hydrochloride)
N-phenyl-N-4-piperidinyl-acetamide, monohydrochlorideItem #: ISO00130
Batch #: 0450748
CAS Registry Number: 22352-82-5Expiry Date: 10SEP2020 (valid from date of certification)
Description: Crystalline solid
Storage and Handling: Store at -20°C.
Warm to room temperature prior to opening
Safety: PoisonISO/IEC 17025
#AT-1773
ISO Guide 34
#AR-1774

REFERENCE MATERIAL PRODUCER



Compound Information

Chemical Formula	C ₁₃ H ₁₈ N ₂ O • HCl
Formula Weight	254.80
UV λ _{max}	205nm, 257nm

Quality Information

Qualifier	Method	Limit	Result	Meets Specification
Appearance	Visual inspection	Crystalline solid	Crystalline Solid	Y
Chromatographic Purity, HPLC	Cayman Method TST SD57	≥98.00%	>99.90% ± 0.17%	Y
Identity, LCMS	Cayman Method TST SD13, +ESI	219.0 ± 0.5 amu	219.4 amu	Y
Identity, GCMS	Cayman Method TST SD12	Conforms	Conforms	Y
FTIR	USP<851> (diamond ATR)	Conforms	Conforms	Y
% LOD	Cayman Method TST SD24	<3.00%	0.18% ± 0.15%	Y
% ROI	Cayman Method TST SD06	<2.00%	0.92% ± 0.12%	Y
NMR*	¹ H NMR	Conforms	Conforms	Y

*NMR is provided as supplemental info but is not within scope of ISO accreditation

Measurement Uncertainty

All measurement uncertainties are expressed as expanded uncertainties in accordance with ISO 17025 and Guide 34 at the approximate 95% confidence interval using a coverage factor of k=2.

Cayman Chemical certifies that this standard meets the specifications stated in this certificate and warrants this product to meet the stated acceptance criteria through the expiration date when stored unopened as recommended.

Approval:  Title: Cayman Chemical ISO Quality Manager Certification Date: 10SEP2013

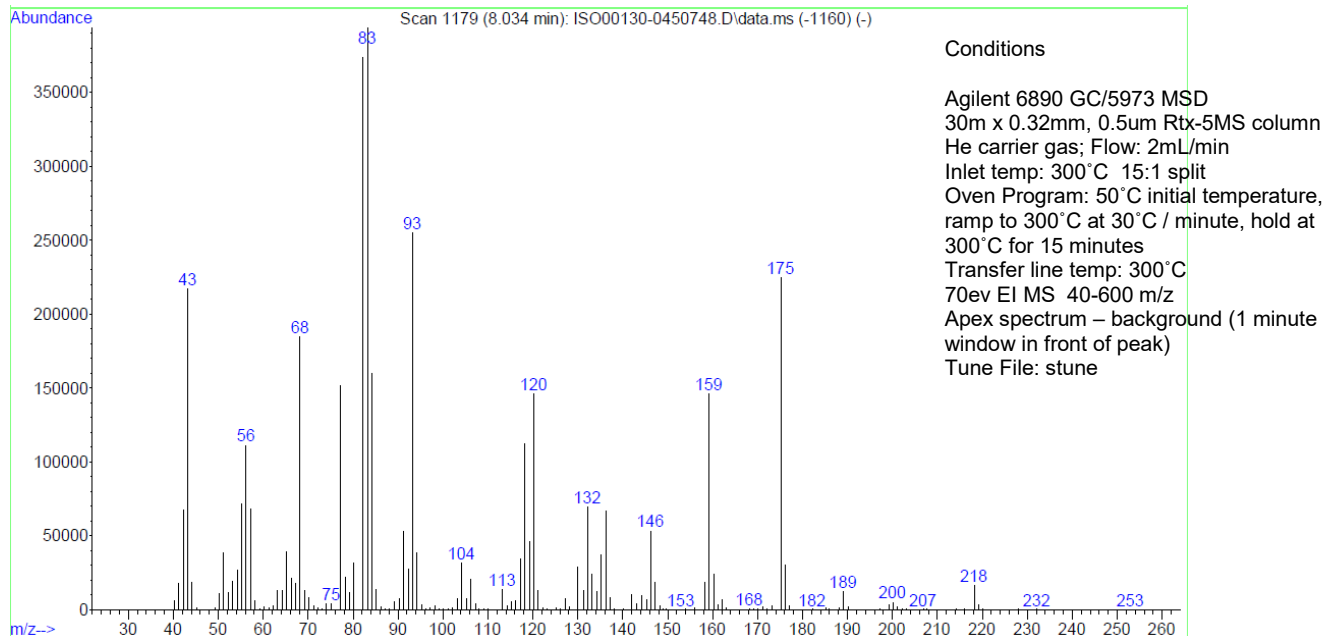
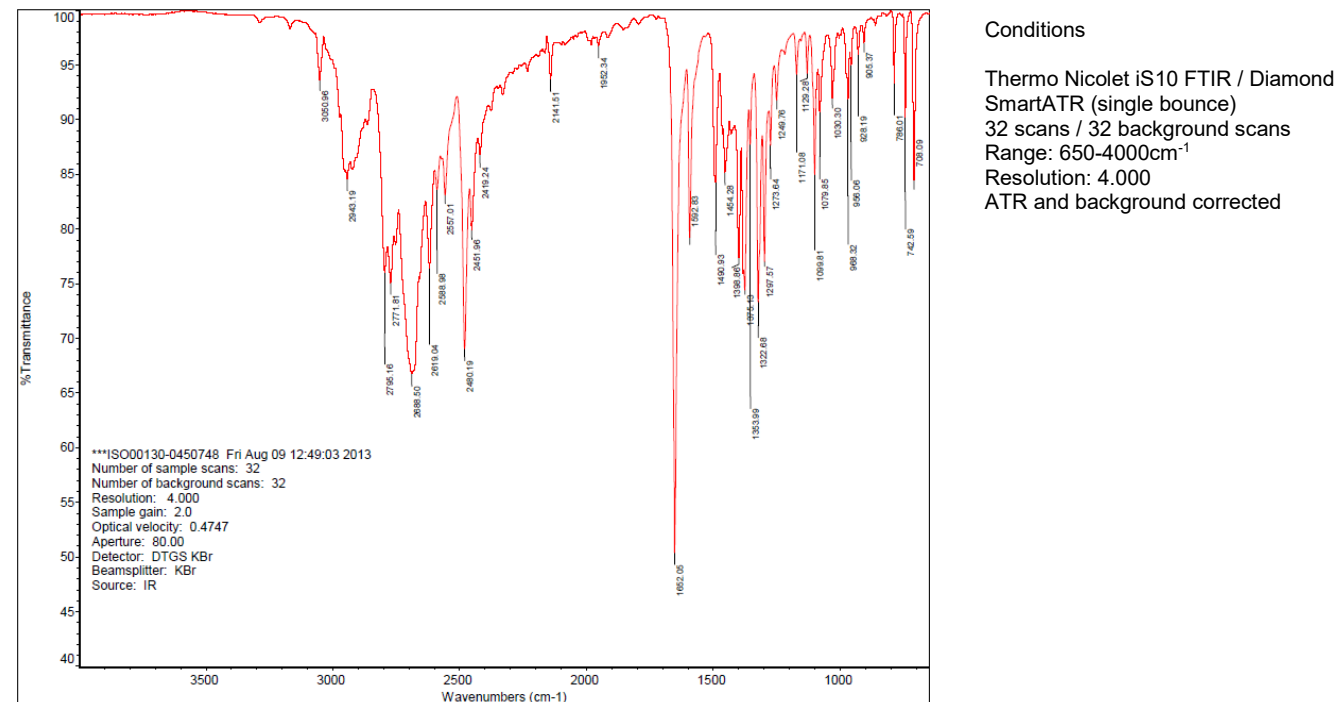
Cayman Chemical Co.

1180 E. Ellsworth Rd
Ann Arbor, MI 48108
www.caymanchem.com

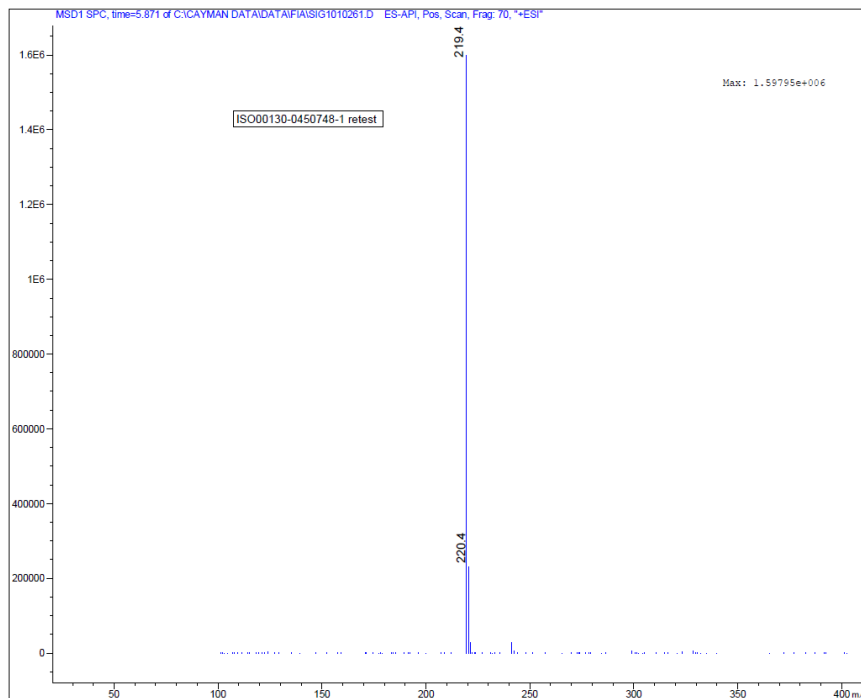
Contact Us:

1-800-364-9897 or (734)971-3335
Fax: (734)971-3640
Email: crmquality@caymanchem.com

For R&D purposes only. Not intended for human or animal use.

Supplemental Data**GC-MS****FTIR**

ESI-MS



Conditions

Agilent 1100 HPLC / G1956MSD
FIA-MS (no column)
Mobile phase: 50:50:0.1
MeCN/H₂O/formic acid
Flow: 1mL/min
+ESI 100-1000m/z range
Nebulizer: 60psi
Desolvation Gas: 13L/min
Desolvation Temp: 350°C
Electrospray Voltage: 4kV
MS collected across peak width at half height

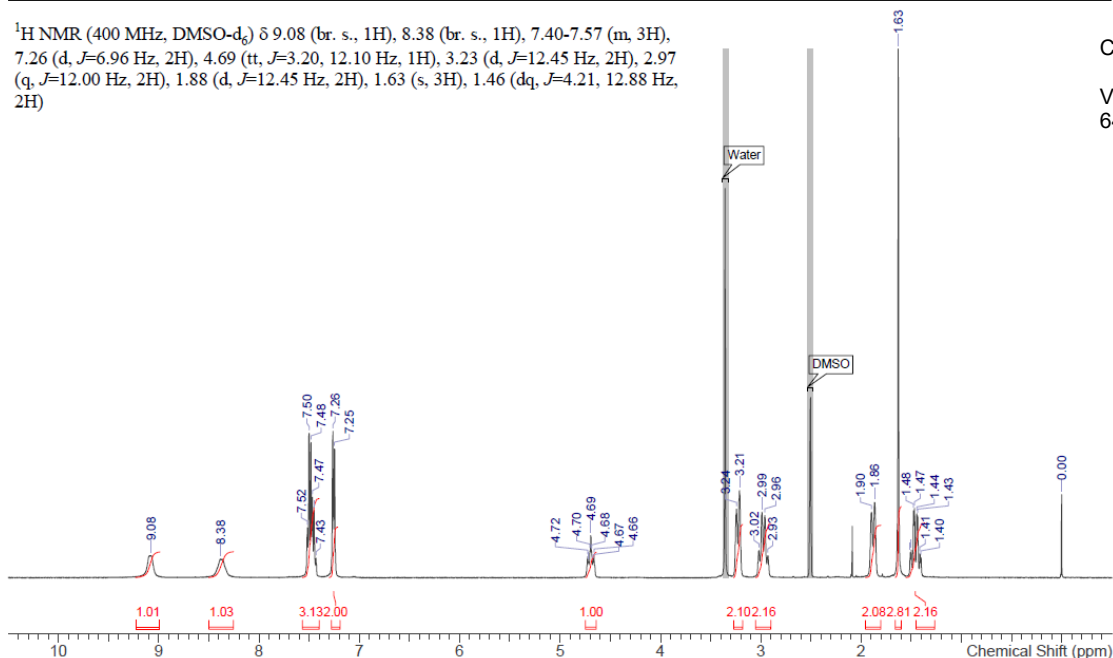
NMR *not within scope of ISO 17025/Guide 34 accreditation

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Date	Aug 9 2013	Nucleus	¹ H	Frequency (MHz)
Solvent	DMSO-d ₆	Comment	Acetyl norfentanyl (hydrochloride)	399.97
				Number of Transients 64

¹H NMR (400 MHz, DMSO-d₆) δ 9.08 (br. s., 1H), 8.38 (br. s., 1H), 7.40-7.57 (m, 3H), 7.26 (d, J=6.96 Hz, 2H), 4.69 (tt, J=3.20, 12.10 Hz, 1H), 3.23 (d, J=12.45 Hz, 2H), 2.97 (q, J=12.00 Hz, 2H), 1.88 (d, J=12.45 Hz, 2H), 1.63 (s, 3H), 1.46 (dq, J=4.21, 12.88 Hz, 2H)

Conditions

Varian Inova 400MHz NMR
64 scans



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Homogeneity

A minimum sample size of 4.6µg was used to determine homogeneity of the bulk solid. Homogeneity was evaluated by randomly sampling 3x1mg sample weigh outs and comparing HPLC purity and MS identity to the bulk solid. Purity and identity of all samples were acceptable.

The recommended minimum quantity for use is 4.6µg. Quantities below this have not been evaluated.

Short Term Stability Summary

No decrease in purity was observed at ambient conditions or 60°C after two weeks. This data supports shipping of this product at ambient temperature.

Long Term Stability

Long term stability data predicts 7 years stability at the -20°C storage temperature.

Revision History

Revision #	Date	Reason for Revision
01	10SEP2013	Initial
02	03JUN2014	Expiry Date update
03	05FEB2016	Expiry Date update
04	10JUN2016	Expiry Date update and item name revision
05	12JUN2017	Expiry Date update
06	21JUN2018	Expiry Date update
07	25JUN2019	Expiry Date update

Disclaimers**Material Safety Data**

This material should be considered hazardous until information to the contrary becomes available. Do not ingest, swallow, or inhale. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. This information contains some but not all of the information required for the safe and proper use of this material. Before use, review the complete Material Safety Data Sheet, which has been sent via email to your institution.

Warranty and Limitation of Remedy

Cayman Chemical Company makes no warranty or guarantee of any kind, whether written or oral, expressed or implied, including without limitation, any warranty of fitness for a particular purpose, suitability and merchantability, which extends beyond the description of the chemicals hereof. Cayman warrants only to the original customer that the material will meet our specifications at the time of delivery.

Cayman will carry out its delivery obligations with due care and skill. Thus, in no event will Cayman have any obligation or liability, whether in tort (including negligence) or in contract, for any direct, indirect, incidental or consequential damages, even if Cayman is informed about their possible existence.

This limitation of liability does not apply in the case of intentional acts or negligence of Cayman, its directors or its employees.

Buyer's exclusive remedy and Cayman's sole liability hereunder shall be limited to a refund of the purchase price, or at Cayman's option, the replacement, at no cost to Buyer, of all material that does not meet our specification.

Said refund or replacement is conditioned on Buyer giving written notice to Cayman within thirty (30) days after arrival of the material at its destination. Failure of Buyer to give said notice within thirty (30) days shall constitute a waiver of Buyer of all claims hereunder with respect to said material.

For further details, please refer to our Warranty and Limitations of Remedy located on our website and in our catalog.

This Certificate shall not be reproduced except in full, without written approval from the Cayman Chemical ISO Quality Manager