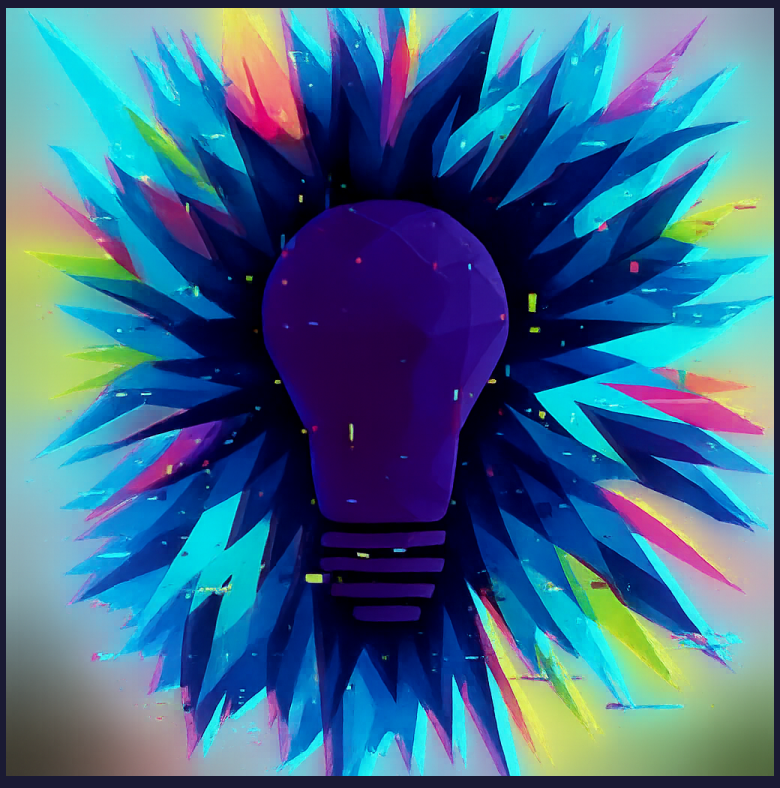
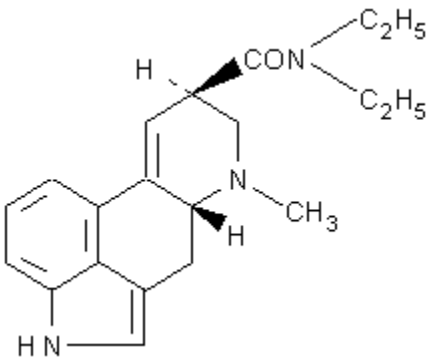
LYSERGIC ACID DIETHYLAMIDE (1)

A Breakthrough by Cole EverDark



LYSERGIC ACID DIETHYLAMIDE

Latest Revision: February 15, 1999



1. SYNONYMS

CFR:	Lysergic acid diethylamide
CAS #:	Base: 50-37-3
Other Names:	D-lysergic acid diethylamide N, N-diethyl-D-lysergamid Lysergsäure diethylamid LAD LSD LSD-25 9,10-Didehydro-N,N diethyl-6-methylergoline-8-β-carboxamide

Warning - LSD POWDER
LSD powder should be handled with the utmost care.

The analyst should work with an assistant using an empty hood where lights can be used to aid in UV light examination for LSD contamination. Once the container is opened, the chemist's hands and immediate area of the hood become contaminated. Anything needed outside the hood should be handled by the assistant. Dust mask, apron, and latex gloves should be worn. Dampening the gloves with a damp rag helps avoid problems associated with static electricity. Cloth gloves may be used over the latex gloves to minimize static as well. After analysis, the LSD container should be wiped off with a damp rag before replacing in the evidence bag. The chemist's gloves and the hood, including its contents should be decontaminated using diluted bleach. Decontamination is complete when all blue LSD fluorescence has been converted to yellow.

2. CHEMICAL AND PHYSICAL DATA

2.1. CHEMICAL DATA

Form	Chemical Formula	Molecular Weight	Melting Point (°C)
Base	$C_{20}H_{25}N_3O$	323.4	80-85

Tartrate	$C_{46}H_{64}N_6O_{10}$*	861.0	198-200

2.2. SOLUBILITY

Form	A	C	E	H	M	W
Base	VS	VS	VS	SS	VS	***
Tartrate	***	I	I	I	S	S

A = acetone, C = chloroform, E = ether, H = hexane, M = methanol and W = water, VS = very soluble, FS = freely soluble, S = soluble, PS = sparingly soluble, SS = slightly soluble, VSS = very slightly soluble and I = insoluble

3. SCREENING TECHNIQUES

3.1. COLOR TESTS

REAGENT	COLOR PRODUCED
p-Dimethylaminobenzaldehyde	Violet
UV light (long wave)	Blue fluorescence
UV light (short wave)	Blue fluorescence

For LSD dosage forms that contain dyes, the *p*-dimethylaminobenzaldehyde (PDMAB) color test should be done on a methanol extract of the sample. In a spot plate, add one drop of acidified PDMAB to the methanol extract and observe color. Alternatively for "blotters", a more sensitive method is to extract and concentrate the LSD with methanol followed by spotting onto a TLC plate. Allow it to dry then swab with PDMAB followed by exposure to hydrochloric acid fumes.

Note: Be aware that LSD will degrade with prolonged exposure to UV light. Many substances fluoresce blue with long wave or short wave UV light, but not both. Most types of paper fluoresce. Also, some colored paper and tablets absorb UV light so the blue fluorescence is not seen.

3.2. THIN-LAYER CHROMATOGRAPHY

Visualization

UV light (long or short wave)	Blue fluorescence
p-Dimethylamino-benzaldehyde	Violet
Acidified iodoplatinate	Black/purple

COMPOUND	RELATIVE R_1	
	System TLC1	System TLC2
LSD	1.0	1.0
LSD (UV degradation)	0.2 1.2 1.4 1.6 1.8	*** *** *** *** ***
LAMPA	0.8	0.9
LAMPA (UV degradation)	0.2 1.1 1.3 1.5 1.8	*** *** *** *** ***
iso-LSD	***	0.6

3.3. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Method LSD-LCS1

Instrument:	High performance liquid chromatograph equipped with diode array
Column:	5 µm Hypersil, 100 mm x 4.6 mm
Detector:	UV, 310 nm
Flow:	1.2 mL/min
Injection Volume:	5.0 µL

Buffer: 2 mL concentrated ammonia, 400 mL methanol and 1598 mL chloroform

Mobile Phase: Buffer: cyclohexane 30:70

Samples are to be dissolved in methanol and filtered with a 0.45-micron filter.

COMPOUND	RRT	COMPOUND	RRT
LSD	**1.00**	iso-LSD	1.42
LAMPA	1.00	ergonovine	3.71
ergotamine	1.34		

4. SEPARATION TECHNIQUES

Paper squares are extracted by soaking in dilute acid followed by basic extraction into methylene chloride. This provides LSD base for TLC, GC/MS, or Vapor Phase IR. Additional cleanup is needed for FT-IR as below. For fluorescence screening and color tests, extract the paper with methanol. For quantitation, soak the sample in methanol for at least four hours in the dark. Extracting overnight in the dark is preferred.

Tablets or capsules should be crushed then extracted similarly to the paper squares. Prior to the basic extraction, filter the acid extract to remove stearates and milk powder excipients. Dissolve gelatin squares in warm water before the acid-base extraction. Methanol may extract enough LSD from gelatin squares for fluorescence screening and color tests.

Another method is to use a micro-alumina column. Pre-rinse the column with methylene chloride then place the LSD base extract on the column. Elute the LSD off the column with a mixture of 5 drops methanol per 10 mL methylene chloride. Periodically, follow the LSD through the column with a fluorescent light. Change receivers just as the LSD comes off the micro-column. For samples containing iso-LSD, only collect the first two-thirds of the fluorescent band, because it closely follows behind LSD. Evaporate the solvent to produce residue suitable for FT-IR.

Separation of LSD from iso-LSD and trace excipients is also accomplished by developing a heavily spotted TLC plate. After developing, scrape off the streak and soak in dilute acid followed by basic extraction into methylene chloride. For paper not containing iso-LSD, basic extraction with hexane containing a small amount of chloroform may produce LSD pure enough for IR identification.

5. QUANTITATIVE PROCEDURES

5.1. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Method LSD-LCQ1

Standard Solution Preparation:
Accurately weigh and prepare a standard solution of lysergic acid diethylamide (LSD) tartrate at approximately 100 mg/mL using methanol.

Sample Preparation:
Powder: Accurately weigh an amount of sample into a volumetric flask and dilute with methanol. If necessary, dilute the sample so the final concentration approximates the standard concentration. Filter sample with 0.45-micron filter. Take great caution in the amount of sample weighed due to its possible high purity.
Blotter Paper: Place 5 to 10 squares (approximately " x " each) into a volumetric flask and add methanol. Allow the LSD to extract from the paper in the dark for at least four hours. If necessary, dilute the sample so the final concentration approximates the standard concentration. Filter sample with 0.45-micron filter.

Instrument:	High performance liquid chromatograph equipped with diode array
Column:	5 µm Hypersil, 100 mm x 4.6 mm
Detector:	UV, 310 nm
Flow:	1.2 mL/min
Injection Volume:	5.0 µL
Buffer:	2 mL concentrated ammonia, 400 mL methanol and 1598 mL chloroform
Mobile Phase:	Buffer: cyclohexane 30:70
Typical Retention Time:	LSD: 4.0 min
Linear Range:	0.03 - 2.0 mg/mL
Repeatability:	RSD less than 0.6%
Correlation Coefficient:	0.999
Accuracy:	Error less than 5%

6. QUALITATIVE DATA

6.1. ULTRAVIOLET SPECTROPHOTOMETRY

LSD Tartrate at 40 µg/mL

SOLVENT	MAXIMUM ABSORBANCE (NM)

Methanol	310
Sulfuric acid	310
Ammonium hydroxide	308

See spectra on the following pages for FT-IR, Mass Spectrometry, Nuclear Magnetic Resonance, and Vapor Phase IR.

7. REFERENCES

Bailey K., Verner D., and Legault D., "Distinction of Some Dialkyl Amides of Lysergic and iso-Lysergic Acids from LSD," *Journal of the AOAC*, Vol. 56, No. 1, 1973, pp. 88-99.

Clark C. C., "The Differentiation of Lysergic Acid Diethylamide (LSD) from N-Methyl-N-Propyl and N-Butyl Amides of Lysergic Acid," *Journal of Forensic Sciences*, Vol. 34, No. 3, May 1989, pp. 532-546.

Harris H. A. and Kane T., "A Method for Identification of Lysergic Acid Diethylamide (LSD) Using a Microscope Sampling Device with Fourier Transform infrared (FT/IR) Spectroscopy," *Journal of Forensic Sciences*, Vol. 36, No. 4, July 1991, pp. 1186-1191.

Heagy J., Moriwaki W. and Chan K., "LSD Extraction from Blotter Paper," *Microgram*, Vol. XXVIII, No. 6, 1993, pp. 85-88.

Lerner M., "LSD Analysis in Seizures," *Bulletin on Narcotics*, Vol. XIX, 1967, pp. 39-45.

McDonald P. A., Martin C. F., Woods D. J., Baker P. B. and Gough T. A., "An Analytical Study of Illicit Lysergide," *Journal of Forensic Sciences*, Vol. 29, No. 1, Jan. 1984, pp. 120-130.

Morales R., "Quantitative Analysis of LSD by Gas-Liquid Chromatography," *Microgram*, Vol. XXVI, No. 6, 1993, pp. 129-136.

Ripani L., Schiavone S. and Garofano L., "GC Quantitative Determination of Illicit LSD," *Journal of Forensic Sciences*, Vol. 39, No. 2, March 1994, pp. 512-517.

Veress T., "Study of the Extraction of LSD from Illicit Blotters for HPLC Determination," *Journal of Forensic Sciences*, Vol. 38, No. 5, Sept. 1993, pp. 1105-1110.

Wittwer J., "HPLC Analysis of Heroin," *Forensic Science International*, Vol. 18, 1981, pp. 215-224.

Wittwer J. D. and Kluckhohn J. H., "Liquid Chromatographic Analysis of LSD," *Journal of Chromatographic Science*, Vol. 11, Jan. 1973, pp. 1-3.

Fuelster R., *Microgram*, Vol. VII, No. 12, 1974, pp. 143-144.

Kebabjian D., *Microgram*, Vol. VIII, No. 4, 1975, pp. 53-54.

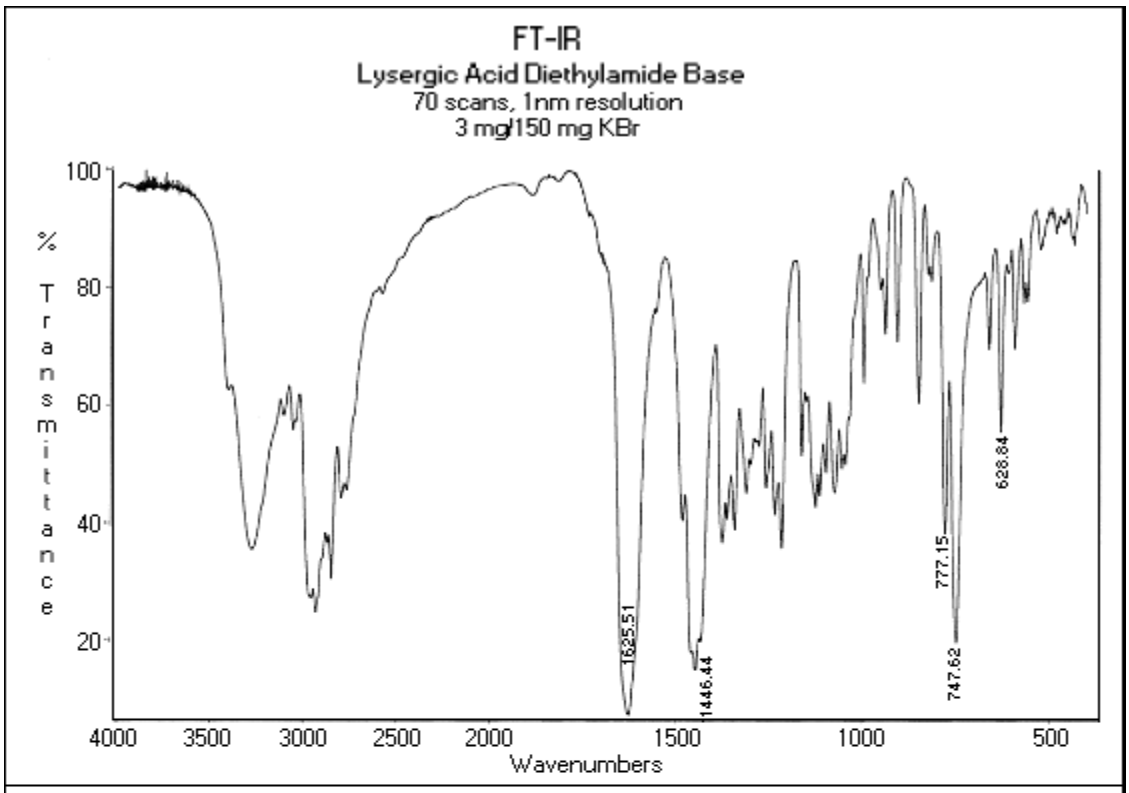
Clarke, E.G.C., *Isolation and Identification of Drugs, 2nd Edition*, The Pharmaceutical Press, 1986.

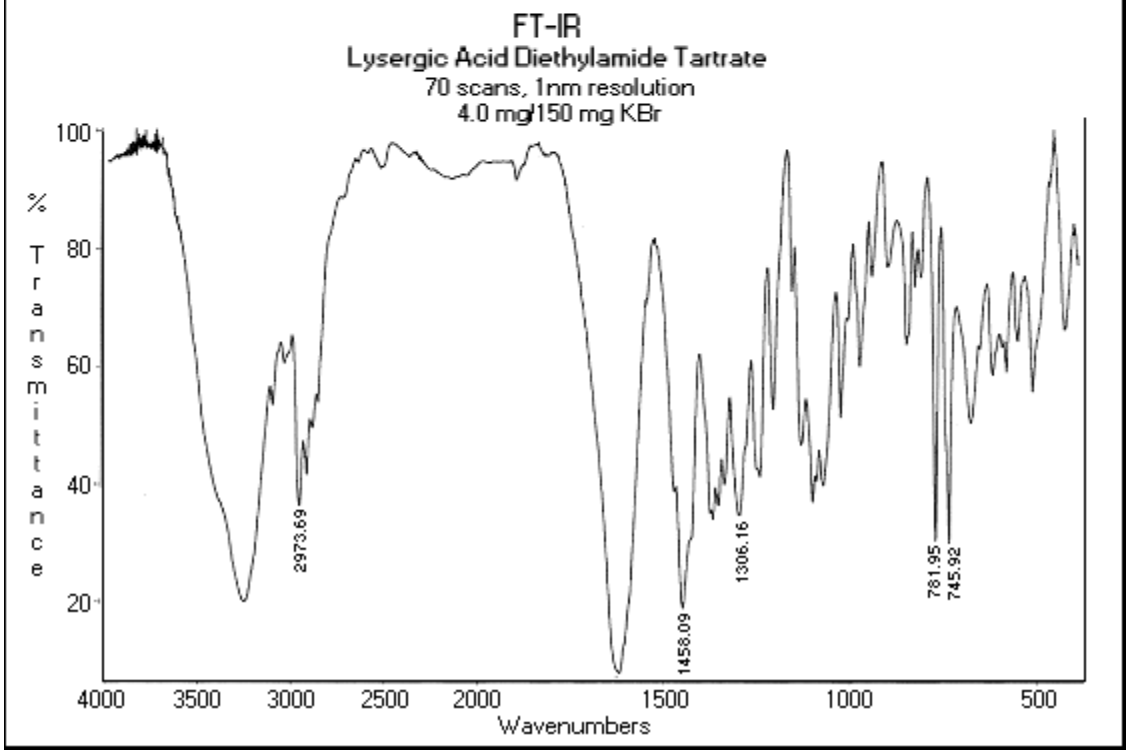
Budavari, S., *The Merck Index, 11th Edition*, Merck and Co., Inc., 1996, p. 887.

8. ADDITIONAL RESOURCES

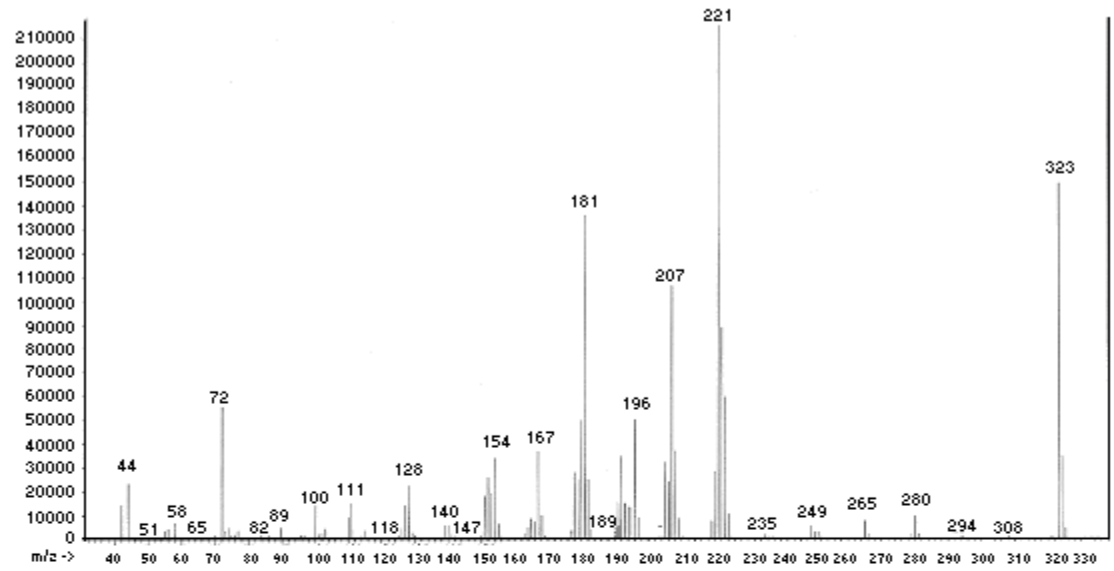
Forendex

Wikipedia


FT-IR
Lysergic Acid Diethylamide Base
70 scans, 1nm resolution
3 mg/150 mg KBr
% Transmittance
100
80
60
40
20
1625.51
1446.44
777.15
747.62
628.84
4000
3500
3000
2500
2000
1500
1000
500
Wavenumbers

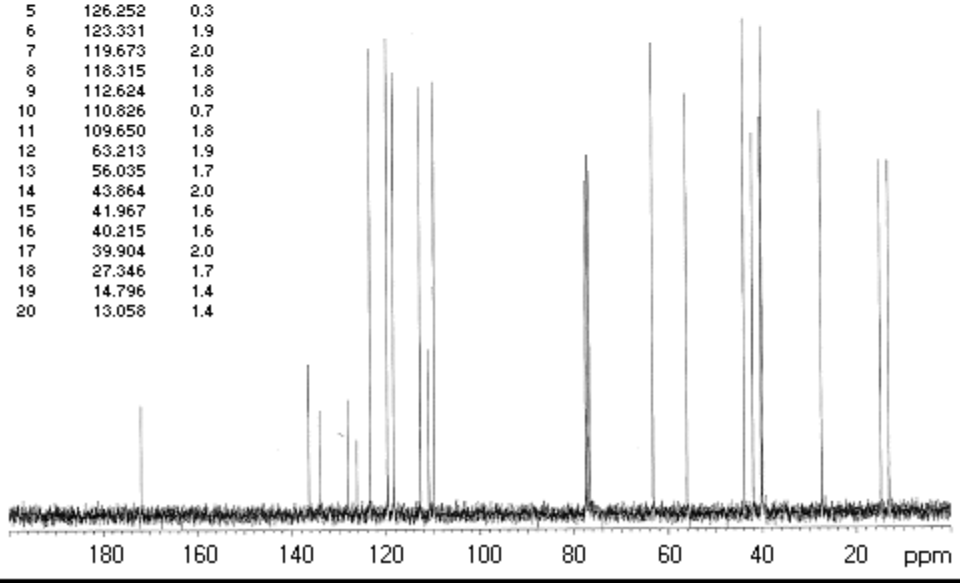

FT-IR
Lysergic Acid Diethylamide Tartrate
70 scans, 1nm resolution
4.0 mg/150 mg KBr
% Transmittance
100
80
60
40
20
2973.69
1458.09
1306.16
781.95
745.92
4000
3500
3000
2500
2000
1500
1000
500
Wavenumbers

Mass Spectrometry
Lysergic Acid Diethylamide



Nuclear Magnetic Resonance (carbon)
Lysergic Acid Diethylamide Base
50 mg/mL in $CDCL_3$ with TMS
75 MHz

PEAK	PPM	HEIGHT
1	170.885	0.4
2	136.329	0.6
3	134.045	0.4
4	128.149	0.5
5	126.252	0.3
6	123.331	1.9
7	119.673	2.0
8	118.315	1.8
9	112.624	1.8
10	110.826	0.7
11	109.650	1.8
12	63.213	1.9
13	56.035	1.7
14	43.864	2.0
15	41.967	1.6
16	40.215	1.6
17	39.904	2.0
18	27.346	1.7
19	14.796	1.4
20	13.058	1.4



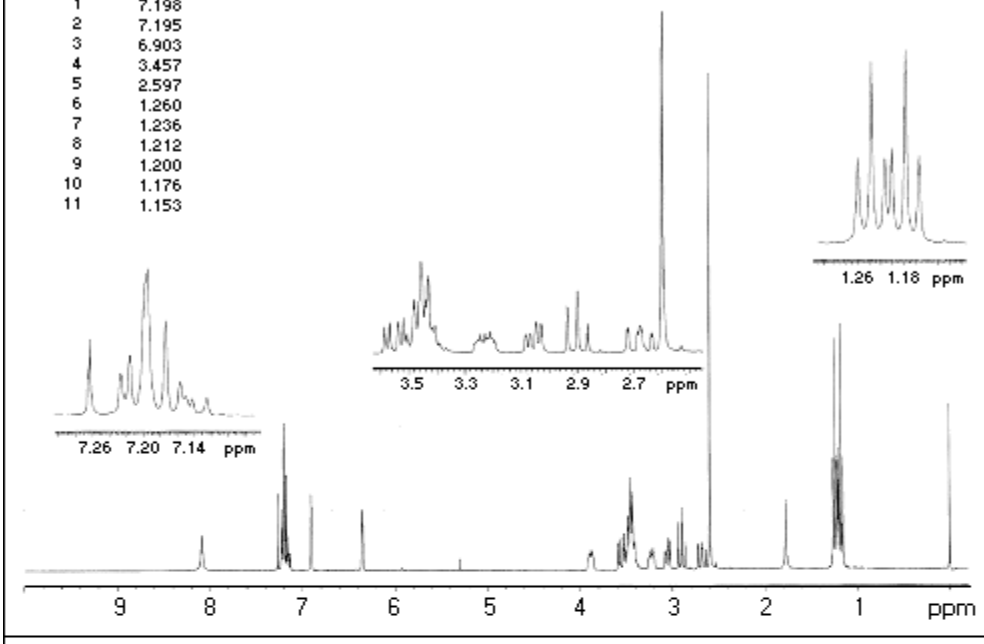
Nuclear Magnetic Resonance (proton)

Lysergic Acid Diethylamide Base

10 mg/mL in $CDCL_3$ with TMS

300 MHz

PEAK	PPM
1	7.198
2	7.195
3	6.903
4	3.457
5	2.597
6	1.260
7	1.236
8	1.212
9	1.200
10	1.176
11	1.153



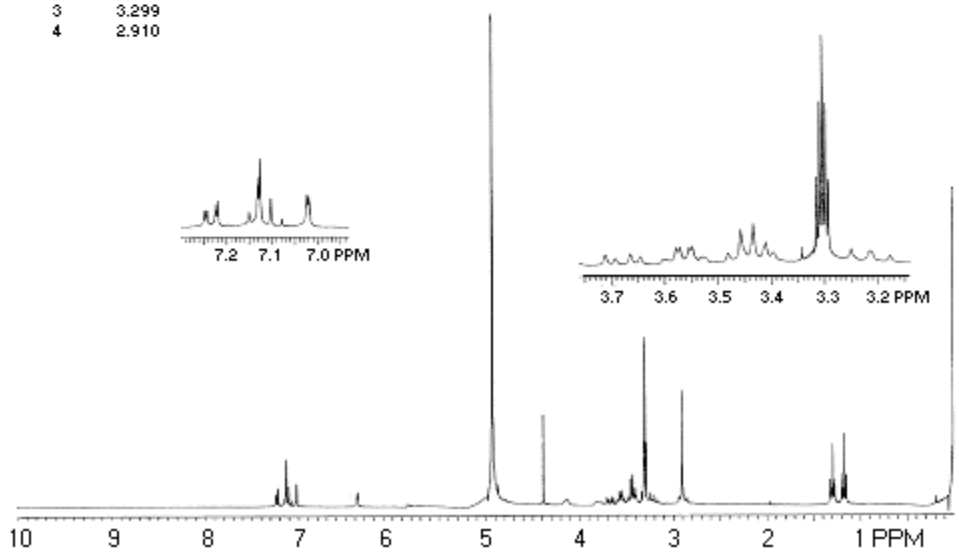
Nuclear Magnetic Resonance (proton)

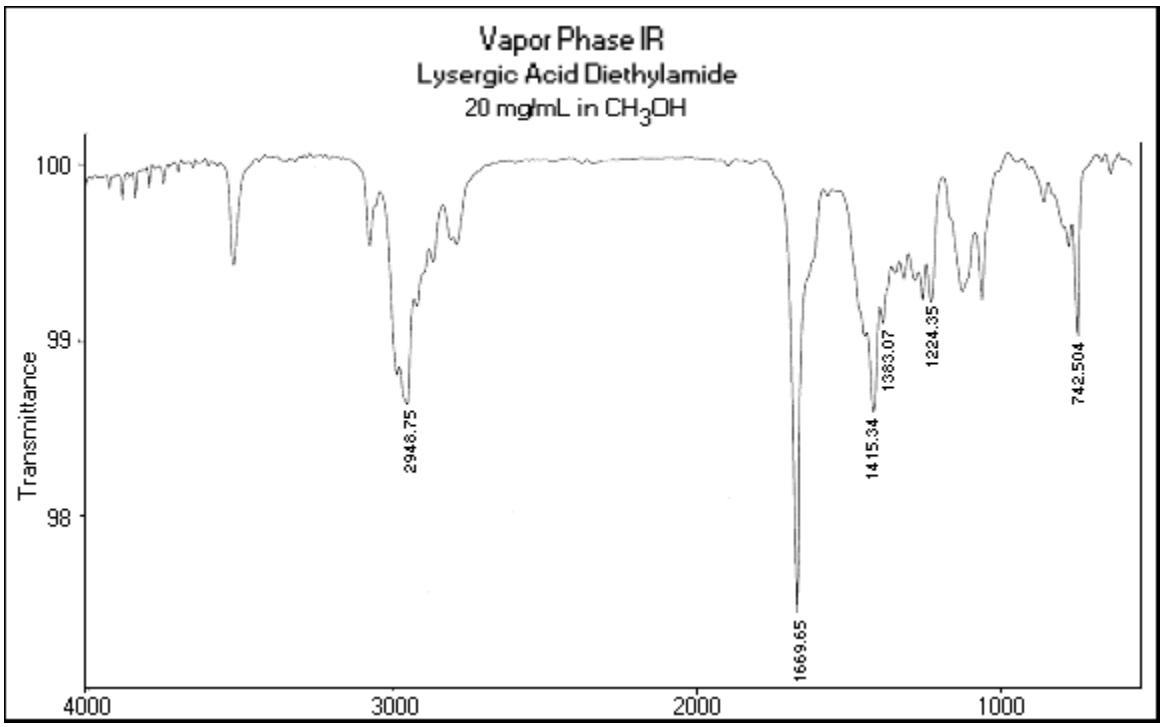
Lysergic Acid Diethylamide Tartrate

10 mg/mL in $CDCL_3$ with TMS

300 MHz

PEAK	PPM
1	3.310
2	3.305
3	3.299
4	2.910





* Solvated with methanol $(C_{20}H_{25}N_3O)_2\ C_4H_6O_6\ 2\ CH_3OH$
*** No data available