METHAMPHETAMINE



2. CHEMICAL AND PHYSICAL DATA

2.1. CHEMICAL DATA

Form	Chemical Formula	Molecular Weight	Melting Range (°C)
Base	$C_{10}H_{15}N$	149.2	Liquid at room temp.
Hydrochloride	C ₁₀ H ₁₆ NCl	185.7	172-174

2.2. SOLUBILITY

Form	Α	С	Е	Н	Μ	W
Base	S	S	S	S	S	SS
Hydrochloride	VSS	FS	Ι	Ι	FS	FS

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 TEST

REAGENT	COLOR PRODUCED
Marquis	Orange-brown
Sodium nitroprusside	Blue

3.2. CRYSTAL TESTS

REAGENT	TEST	DESCRIPTION OF CRYSTALS
Platinic chloride in diluted H ₃ PO ₄ (d and d,l isomer specific)	Volatility	Grains with sharp edges which aggregate in chains and short prisms; birefringent.
Gold chloride in diluted H ₃ PO ₄ (d and d,l isomer specific)	Direct or volatility	Long blades and jointed crystals, fairly high birefringence
Bismuth iodide in diluted H ₂ SO ₄ (d and d,l isomer specific)	Volatility	Drops, long orange splinters, blades, needles; also deep red angular grains (red prisms only after evaporation): drops crystallizing in orange-red prisms with conspicuously slanting ends; also "mossy" formation of grains and some large deep red grains.

3.3. THIN-LAYER CHROMATOGRAPH

Visualization

Acidified iodoplatinate solution

Acidified potassium permanganate solution

	RELATIVE R ₁		
COMPOUND	System TLC6	System TLC5	
adrenaline	0.1	0.0	
amphetamine	0.6	1.3	
caffeine	1.4	1.6	
cathine	0.3	1.3	
ephedrine	0.4	0.9	
methamphetamine	1.0	1.0	
phenylpropanolamine	0.3	1.4	
pseudoephedrine	0.3	1.1	

3.4. GAS CHROMATOGRAPHY

Method MEM-GCS1

Instrument:	Gas chromatograph operated in split mode with FID
Column:	5% phenyl/95% methyl silicone 10 m x 0.32 mm x 0.52 μm
Carrier gas:	Hydrogen at 1.5 mL/min
Temperatures:	Injector: 280°C Detector: 280°C Oven program: 1) 120°C initial temperature for 1.0 min 2) Ramp to 280°C at 25°C/min 3) Hold final temperature for 1.0 min
Injection Parameters:	Split Ratio = 100:1, 1 μ L injected

Samples are to be dissolved in chloroform and filtered.

COMPOUND	RRT	COMPOUND	RRT
dimethylsulfone	0.38	dimethylphthalate	2.13
phenyl-2-propanone	0.79	guaifenesin	2.97
amphetamine	0.79	caffeine	3.64
methamphetamine	1.00 (1.42 min)	lidocaine	3.81
phenylpropanolamine	1.61	cocaine	4.89
ephedrine	1.80	triprolidine	5.05
pseudoephedrine	1.81	heroin	6.12
nicotinamide	1.85		

3.5. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Method MEM-LCS1

Instrument:	High performance liquid chromatograph equipped with diode array
Column:	5 µm ODS, 150 mm x 4.6mm at 35°C
Detector:	UV, 207 nm
Flow:	1.0 mL/min
Injection Volume:	5.0 µL
Buffer:	$4000\ mL$ distilled water, 22.5 mL phosphoric acid, adjust to pH 2.3 with triethanolamine
Mobile Phase:	Buffer: acetonitrile 90:10

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

COMPOUND	RRT	COMPOUND	RRT
phenylpropanolamine	0.20	caffeine	0.86
ephedrine	0.38	methamphetamine	1.00 (5.5 min)
pseudoephedrine	0.38	cocaine	7.92
amphetamine	0.71	heroin	8.53

3.6. CAPILLARY ELECTROPHORESIS

Method MEM-CES

Internal Standard Stock Solution:

0.15 mg/mL phenethylamine in 100 mM sodium phosphate buffer at pH of 3.5.

Standard Solution Preparation:

Accurately weigh and prepare a standard solution of d-methamphetamine hydrochloride, l-methamphetamine hydrochloride, d-amphetamine hydrochloride, l-amphetamine hydrochloride, d-ephedrine hydrochloride, l-ephedrine hydrochloride and l-pseudoephedrine hydrochloride at approximately 0.15 mg/mL each using above internal standard stock solution.

Sample Preparation:

Accurately weigh an amount of sample into a volumetric flask and dilute with internal standard stock solution. If necessary, dilute the sample so the final concentration approximates the standard concentration.

Mode:	Free zone
Column:	47 cm x 50 μm fused silica capillary
Run Buffer:	200 mM sodium phosphate buffer with 30 mM hydroxy-propyl- β -cyclodextrin pH 3.5
Detector:	UV, 210 nm
Voltage:	26 kV
Temperature:	20°C liquid cooled
Injection:	1 s hydrodynamic
Run Time:	12 min
Rinse Time:	2 min

COMPOUND	RMT	COMPOUND	RMT
phenethylamine	0.55	d-amphetamine	0.93
l-pseudoephedrine	0.85	d-pseudoephedrine	0.95
d-ephedrine	0.88	l-methamphetamine	0.97
l-ephedrine	0.90	d-methamphetamine	1.00 (10.54 min)
1-amphetamine	0.91		

4. SEPARATION TECHNIQUES

Methamphetamine hydrochloride can be isolated from several adulterants and diluents by the use of solvent washes. For example, ephedrine hydrochloride and pseudoephedrine hydrochloride can be separated from methamphetamine based on differences in chloroform solubilities. Methamphetamine is very soluble in chloroform while ephedrine and pseudoephedrine are not very soluble in chloroform. These components can be separated from a mixture by collecting the methamphetamine in the first couple of drops of a chloroform rinse.

Another useful technique is multiple solvent recrystallization. For example, nicotinamide, caffeine, and dimethylsulfone are slightly soluble in ether whereas methamphetamine hydrochloride is practically insoluble. The separation is accomplished by dissolving a mixture of methamphetamine and these diluents in 2 mL of methanol followed by dilution with 40 mL ether. The methamphetamine hydrochloride will precipitate out of the ether whereas the adulterants remain dissolved.

5. QUANTITATIVE PROCEDURE

5.1. GAS CHROMATOGRAPHY

Method MEM-GCQ1

Internal Standard Stock Solution: 0.25 mg/mL dimethylphthalate in chloroform.

Standard Solution Preparation:

Accurately weigh and prepare a standard solution of methamphetamine hydrochloride at approximately 1.0 mg/mL using above internal standard stock solution.

Sample Preparation:

Accurately weigh an amount of sample into a volumetric flask and dilute with internal standard stock solution. If necessary, dilute the sample so the final concentration approximates the standard concentration

Instrument:	Gas chromatograph operated in split mode with FID
Column:	5% phenyl/95% methyl silicone 10 m x 0.32 mm x 0.52 μm film thickness

Carrier gas:	Hydrogen at 1.0 mL/min		
Temperatures:	Injector: 280°C Detector: 280°C Oven program: 1) 140°C initial temperature for 0.8 min 2) Ramp to 200°C at 25°C/min 3) Hold final temperature for 1.8 min		
Injection Parameters:	Split Ratio = 20:1, 1 μ L injected		
Typical Retention Time:	Methamphetamine: 1.30 min Dimethylphthalate: 2.50 min		
Linear Range:	0.05 - 2.0 mg/mL		
Repeatability:	RSD less than 0.5%		
Correlation Coefficient:	0.999		
Accuracy:	Error less than 5%		

COMPOUND	RRT	COMPOUND	RRT
dimethylsulfone	0.53	pseudoephedrine	1.63
amphetamine	0.86	nicotinamide	1.66
methamphetamine	1.00 (1.3 min)	dimethylphthalate	1.89
phenylpropanolamine	1.45	guaifenesin	2.68
ephedrine	1.62	caffeine	3.47

5.2. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Method MEM-LCQ1

Standard Solution Preparation:

Accurately weigh and prepare a standard solution of methamphetamine hydrochloride at approximately 0.5 mg/mL using methanol.

Sample Preparation:

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.

Instrument:	High performance liquid chromatograph equipped with diode array	
Column:	5 μm ODS, 150 mm x 4.6 mm	
Detector:	UV, 207 nm	
Flow:	1.00 mL/min	
Injection Volume:	5.0 µL	
Buffer:	4000 mL distilled water, 22.5 mL phosphoric acid, adjust pH to 2.3 with triethanolamine	
Mobile Phase:	Buffer: acetonitrile 90:10	
Typical Retention Time:	Methamphetamine: 5.5 min	
Linear Range:	0.05 - 2.0 mg/mL	
Repeatability:	RSD less than 0.5%	
Correlation Coefficient:	0.9999	
Accuracy:	Error less than 5%	

COMPOUND	RRT	COMPOUND	RRT
phenylpropanolamine	0.20	caffeine	0.86
ephedrine	0.38	methamphetamine	1.00 (5.5 min)
pseudoephedrine	0.38	cocaine	7.92
amphetamine	0.71	heroin	8.53

5.3. CAPILLARY ELECTROPHORESIS

Method MEM-CEQ1

Internal Standard Stock Solution: 0.15 mg/mL thiamine in 10 mM sodium phosphate buffer at pH of 2.4.

Standard Solution Preparation:

Accurately weigh and prepare a standard solution of methamphetamine hydrochloride at approximately 0.4 mg/mL using above internal standard stock solution.

Sample Preparation:

Accurately weigh an amount of sample into a volumetric flask and dilute with internal standard stock solution. If necessary, dilute the sample so the final concentration approximates the standard concentration.

Mode:	Free zone
Column:	48 cm x 50 μ m fused silica capillary
Run Buffer:	50 mM sodium phosphate buffer, pH 2.4
Detector:	UV, 210 nm
Voltage:	25 kV
Temperature:	30°C air cooled
Injection:	5 s at 50 mbar hydrodynamic
Run Time:	6 min
Rinse Time:	2 min
Linear Range:	0.04 - 1.0 mg/mL
Repeatability:	RSD less than 0.8%
Correlation Coefficient:	0.999
Accuracy:	Error less than 5%

COMPOUND	RMT	COMPOUND	RMT
thiamine	0.81	pseudoephedrine	1.05
nicotinamide	0.92	phenylpropanolamine	1.07
amphetamine	0.99	ephedrine	1.08
methamphetamine	1.00 (4.0 min)		

6. QUALITATIVE DATA

6.1. INFRARED SPECTROSCOPY (FT-IR)

An additional difficulty in comparing the IR spectra of methamphetamine arises from the existence of different isomers and of ionic exchange with the matrix. To overcome this difficulty, both sample and standard should be subjected to the same preparations.

See spectra on the following pages for FT/IR, GC/MS, NMR, and Vapor Phase IR.

7. REFERENCES

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Horwitz William, Sr. Ed., *Official Methods of Analysis*, The Association of Official Analytical Chemists, Washington, DC., Eleventh Edition, 1970.

Moffat A. C., Sr. Ed., *Clarke's Isolation and Identification of Drugs*, The Pharmaceutical Press, London, Second Edition, 1996.

8. ADDITIONAL RESOURCES

Forendex

Wikipedia







