

## 1. SYNONYMS

<b>CFR:</b>	Schedule I
<b>CAS #:</b>	2759-28-6
<b>Stride II:</b>	N-Benzylpiperazine
<b>Other Names:</b>	1-Benzylpiperazine N-Benzylpiperazine 1-(phenylmethyl)piperazine 4-Benzylpiperazine

## 2. CHEMICAL AND PHYSICAL DATA

### 2.1. CHEMICAL DATA

Form	Chemical Formula	Molecular Weight	Density
Base	C <sub>11</sub> H <sub>16</sub> N <sub>2</sub>	176.26	1.014 g/mL at 25 °C

### 2.2. SOLUBILITY

Form	A	C	E	H	M	W
Base	VS	PS	FS	VSS	S	I

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
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Cobalt thiocyanate	No reaction
Nitroprusside	Blue
Marquis	No reaction

### 3.2. CRYSTAL TESTS

REAGENT	COLOR PRODUCED
Platinic Bromide	Rectangles with indented ends

### 3.3. THIN-LAYER CHROMATOGRAPHY

#### Visualization

Acidified iodoplatinate solution

COMPOUND	RELATIVE R <sub>1</sub> System TLC5
<b>BZP</b>	1.0
TFMPP	1.5
2-MeOPP	1.0
3-MeOPP	1.2
4-MeOPP	1.1

### 3.4. GAS CHROMATOGRAPHY

#### *Method PIPERAZINE-GCSI*

**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 1.8 mL/min

**Temperatures:**

Injector: 280°C  
 Detector: 280°C  
 Oven program:

- 1) 100°C initial temperature for 1.0 min
- 2) Ramp to 280°C at 25 degrees/min
- 3) Hold final temperature for 3.0 min

**Injection Parameters:** Split Ratio = 50:1, 1 µL injected

Samples are to be dissolved in methanol.

COMPOUND	RRT	COMPOUND	RRT
dimethyl sulfone	0.277	3,4-methylenedioxyamphetamine	1.043
methamphetamine	0.615	2-methoxyphenylpiperazine	1.155
dimethylphthalate	0.947	4-methoxyphenylpiperazine	1.287
<b>benzylpiperazine</b>	<b>1.00 (4.212 min)</b>	3-methoxyphenylpiperazine	1.303
3-trifluoromethylphenylpiperazine	1.039	caffeine	1.362

#### 4. SEPARATION TECHNIQUES

The solubility properties provided in the table 2.2 can be utilized to extract diluents and adulterants. For example, ether or acetone may be used to separate BZP from 3-MeOPP from 2-MeOPP since neither of those two compounds are very soluble in ether or acetone. 1-Benzylpiperazine is also insoluble in water; this property could be utilized to separate BZP from hydrochloride salts.

#### 5. QUANTITATIVE PROCEDURES

##### 5.1. GAS CHROMATOGRAPHY

###### *Method PIPERAZINE1-GCQ1*

###### *Internal Standard Stock Solution:*

0.25 mg/mL dimethylphthalate in methanol.

###### *Standard Solution Preparation:*

Accurately weigh and prepare a standard solution of benzylpiperazine 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) 130°C initial temperature for 1.0 min  
2) Ramp to 200°C at 25°C/min  
3) Hold final temperature for 1.0 min

**Injection Parameters:** Split Ratio = 50:1, 1 µL injected

**Typical Retention Time:** Benzylpiperazine: 2.245 min  
Dimethylphthalate: 2.050 min

**Linear Range:** 0.050-1.206 mg/mL

**Repeatability:** RSD less than 0.5%

**Correlation Coefficient:** 0.999

**Accuracy:** Error less than 5%

COMPOUND	RRT	COMPOUND	RRT
methamphetamine	0.472	2-methoxyphenylpiperazine	1.279
dimethylphthalate	0.917	3-methoxyphenylpiperazine	1.506
<b>benzylpiperazine</b>	<b>1.00 (2.233 min)</b>	4-methoxyphenylpiperazine	1.547
3-trifluoromethylphenylpiperazine	1.073	caffeine	1.969

## 5.2. HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

### *Method BZP-LCQ1*

#### *Sample Preparation:*

Accurately weigh an amount of sample into a volumetric flask and dilute with 0.01 N HCl. If necessary, dilute the sample so the final concentration approximates the standard concentration.

**Instrument:** High performance liquid chromatograph equipped with diode array

**Column:** 4.6 mm x 250 mm, 10 µm. C18(2)

<b>Detector:</b>	UV, 210 nm
<b>Flow:</b>	1.00 mL/min
<b>Injection Volume:</b>	3.0 µL
<b>Buffer:</b>	4000 mL distilled water, 10 g sodium hydroxide, 30.0 mL phosphoric acid and 8.0 mL hexylamine (NaHAP buffer)
<b>Mobile Phase:</b>	100% NaHAP Buffer
<b>Linear Range:</b>	0.256-1.023 mg/mL
<b>Repeatability:</b>	Less than 3% RSD
<b>Correlation Coefficient:</b>	0.9993
<b>Accuracy:</b>	Error less than 5%

COMPOUND	RRT	COMPOUND	RRT
BZP	1.00 (3.09 min)	3-MeOPP	2.13
TFMPP	Not eluted after 20 min	4-MeOPP	2.13
2-MeOPP	2.13		

### 5.3. CAPILLARY ELECTROPHORESIS

#### *Method PIP-CEQ1*

##### *Internal Standard Stock Solution:*

Thiamine hydrochloride internal standard at a concentration of 0.2 mg/mL.

##### *Standard Solution Preparation:*

Accurately weigh and prepare a standard solution at approximately 0.4mg/mL using the internal standard stock solution.

##### *Sample Preparation:*

Accurately weigh an amount of sample and dilute with internal standard stock solution. The sample concentration should approximate the standard.

<b>Mode:</b>	Free zone
<b>Column:</b>	34 cm x 50 µm fused silica capillary
<b>Run Buffer:</b>	100 mM lithium phosphate buffer at pH 2.3
<b>Detector:</b>	UV, 210 nm
<b>Voltage:</b>	20 kV
<b>Temperature:</b>	20°C air cooled
<b>Injection:</b>	Hydrodynamic, 50 mbar for 2.5 s
<b>Run Time:</b>	6 min
<b>Rinse Time:</b>	1 min
<b>Typical Migration Time:</b>	benzylpiperazine: 3.525 thiamine: 3.144
<b>Linear Range:</b>	0.05 - 1.2 mg/mL
<b>Repeatability:</b>	RSD less than 3%
<b>Correlation Coefficient:</b>	0.999
<b>Accuracy:</b>	Error less than 5%

COMPOUND	RMT	COMPOUND	RMT
thiamine	0.892	1-(2-methoxyphenyl)-piperazine	1.337
<b>benzylpiperazine</b>	<b>1</b>	1-(3-methoxyphenyl)-piperazine	1.349
methamphetamine	1.26	1-(3-trifluoromethylphenyl)-piperazine	1.417
1-(4-methoxyphenyl)-piperazine	1.296		

## 6. QUALITATIVE DATA

### 6.1. ULTRAVIOLET SPECTROPHOTOMETRY

SOLVENT	MAXIMUM ABSORBANCE (NM)
Aqueous acid	193

## **7. REFERENCES**

<http://webbook.nist.gov/cgi/cbook.cgi?ID=2759-28-6&Units=SI> ; accessed June 2005.

[http://webster/dea/programs/diversion/schedules/listby\\_sched/sched1.htm](http://webster/dea/programs/diversion/schedules/listby_sched/sched1.htm) ; accessed June 2005.

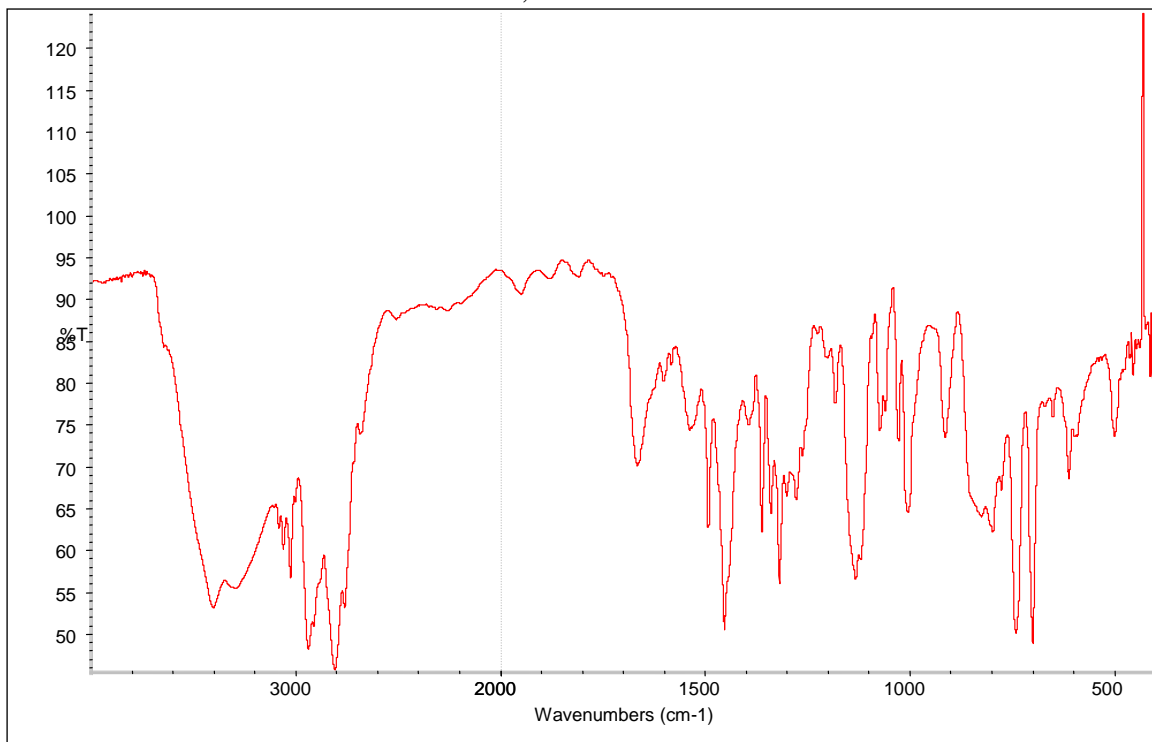
## **8. ADDITIONAL RESOURCES**

[Forendex](#)

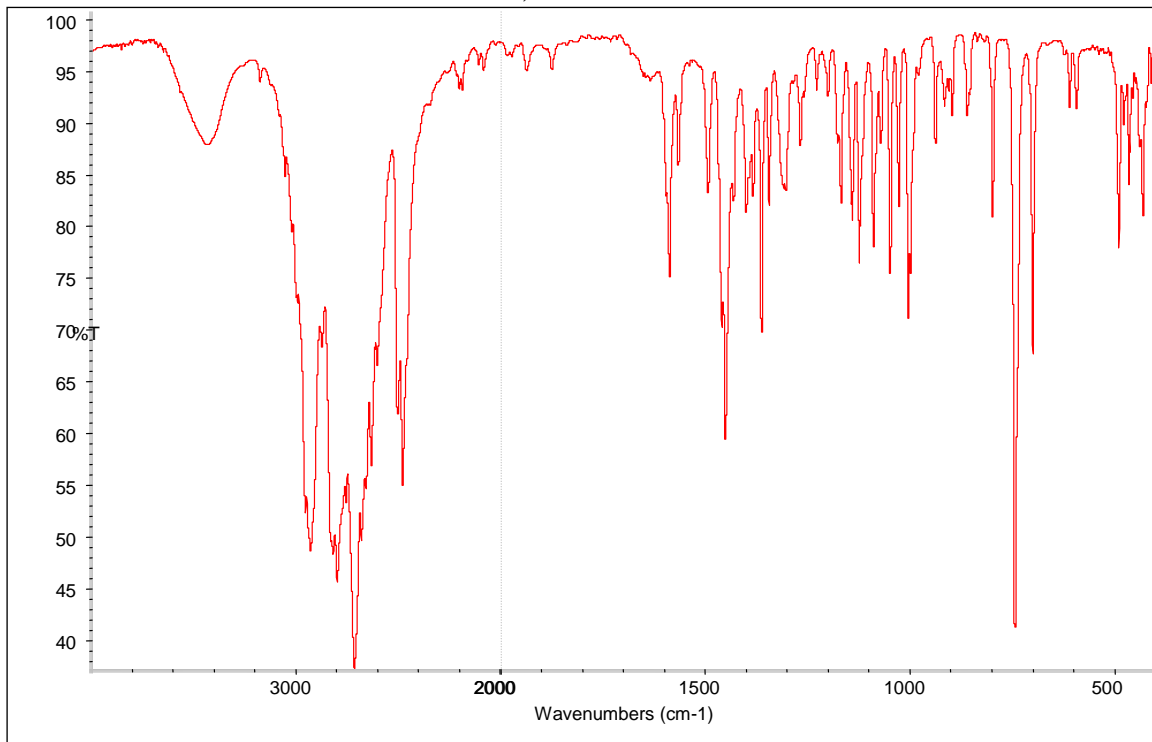
[Wikipedia](#)

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FTIR (KBr): Benzylpiperazine base  
16 scans, 4 cm<sup>-1</sup> resolution

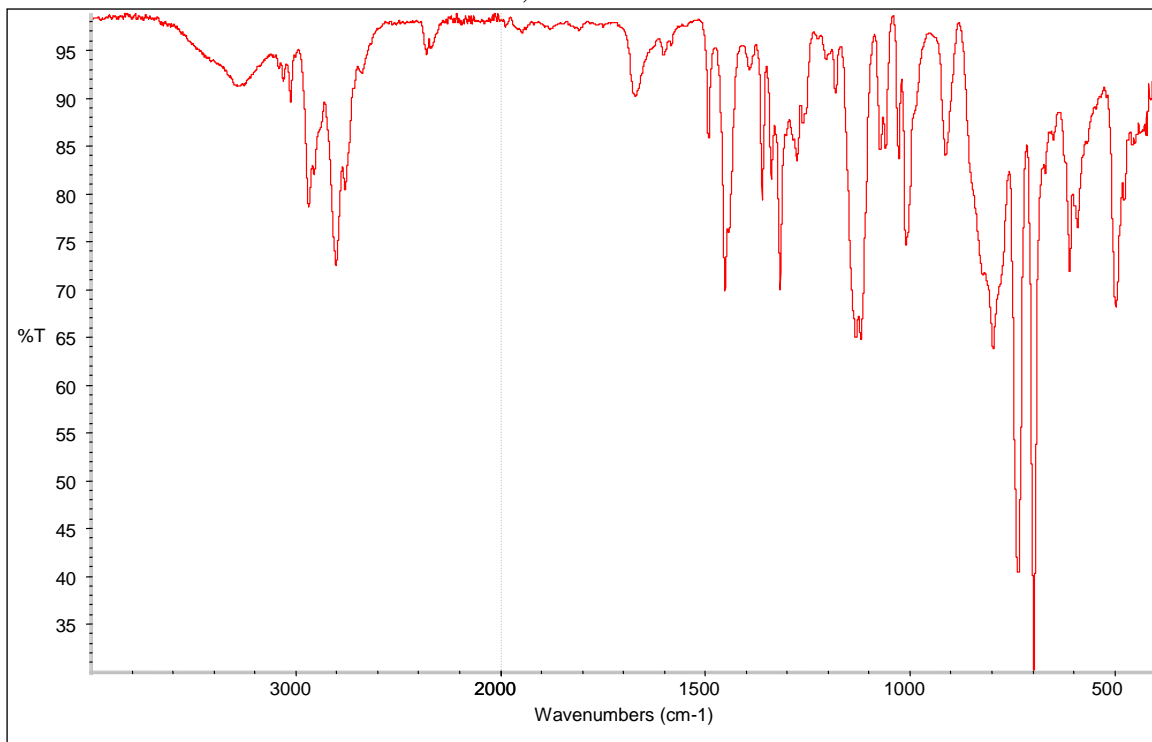


FTIR (KBr): Benzylpiperazine HCl  
16 scans, 4 cm<sup>-1</sup> resolution

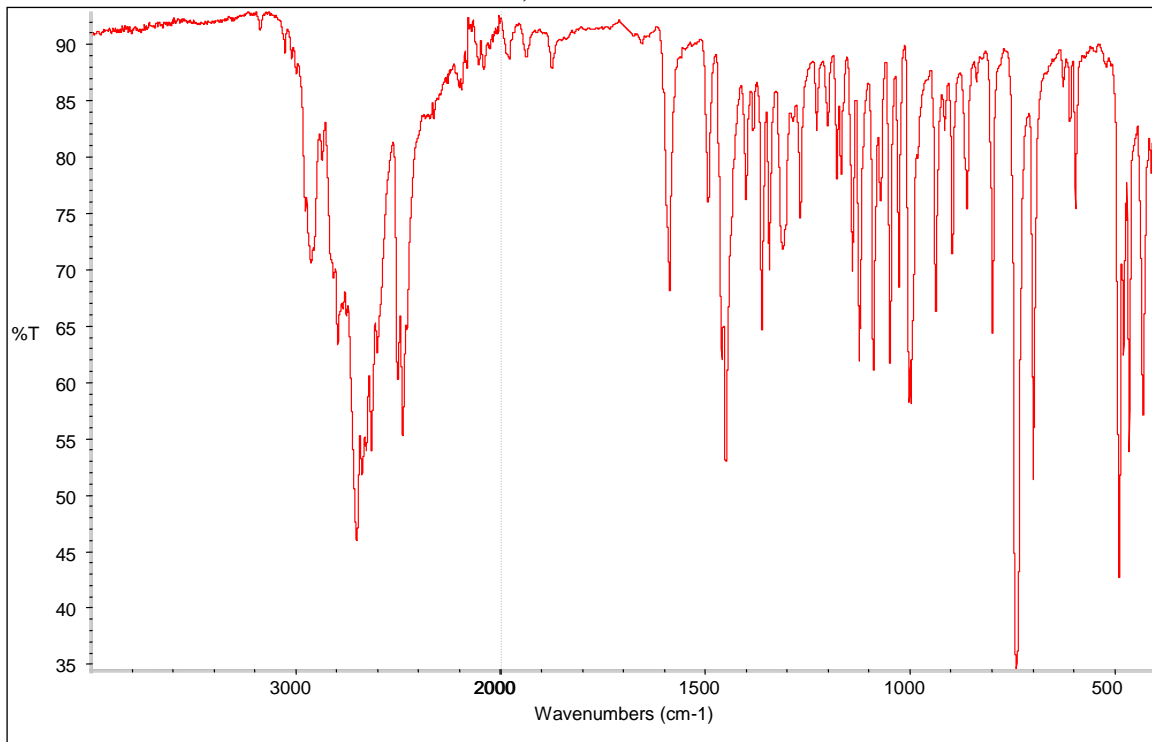




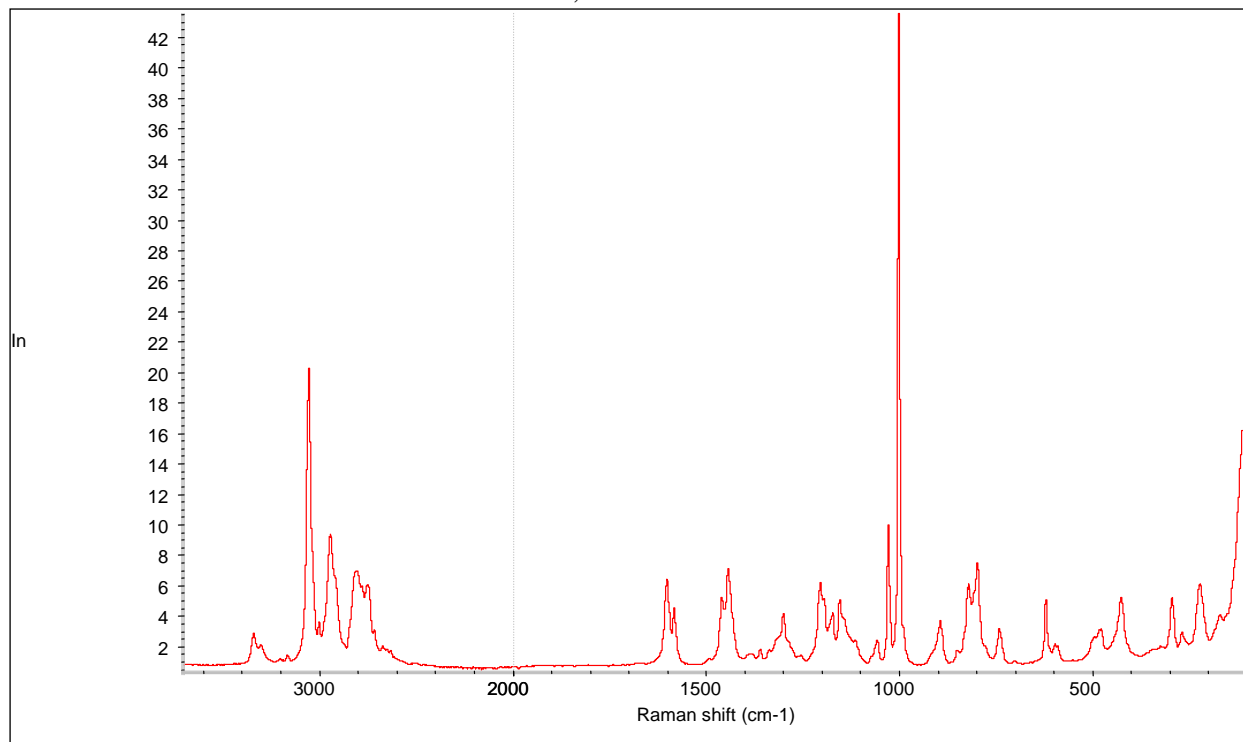
FTIR (ATR): Benzylpiperazine base  
16 scans, 4 cm<sup>-1</sup> resolution



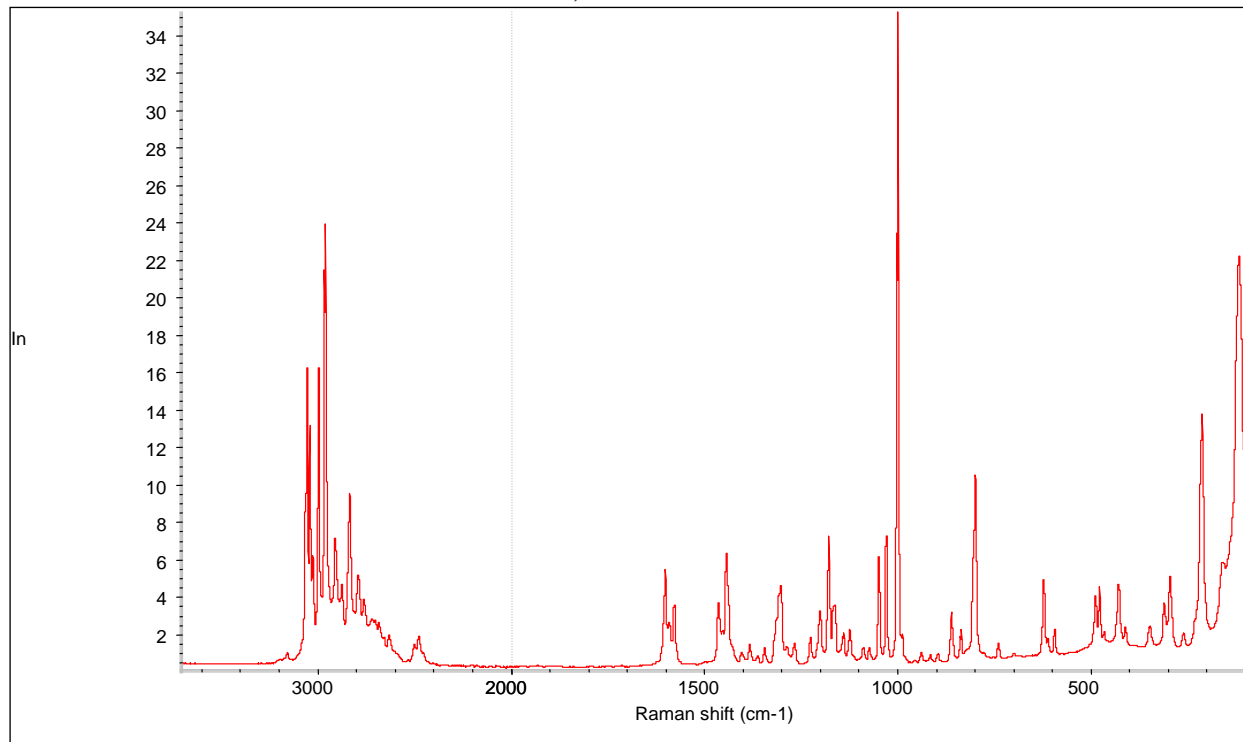
FTIR (ATR): Benzylpiperazine HCl  
16 scans, 4 cm<sup>-1</sup> resolution



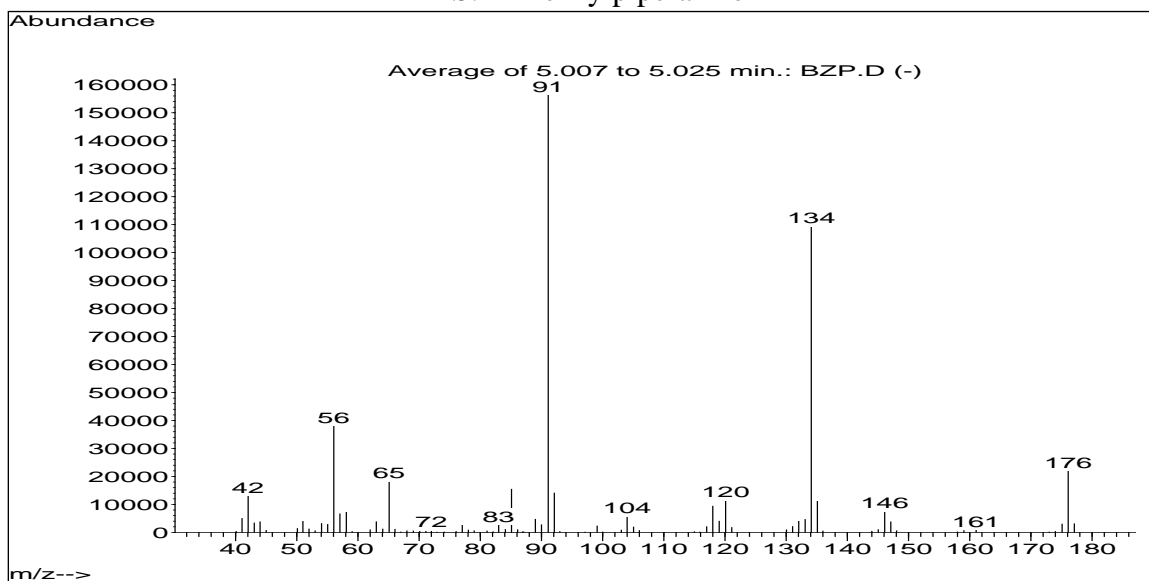
RAMAN: Benzylpiperazine base  
256 scans; 4.0 nm resolution



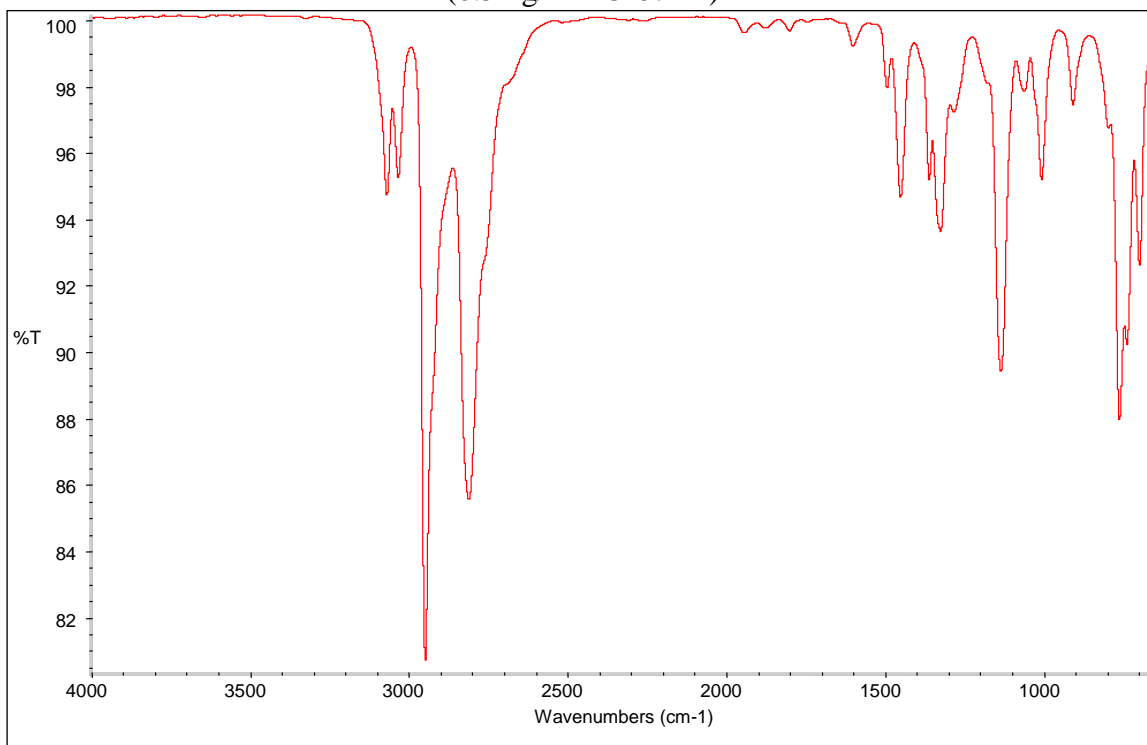
RAMAN: Benzylpiperazine HCl  
256 scans; 4.0 nm resolution



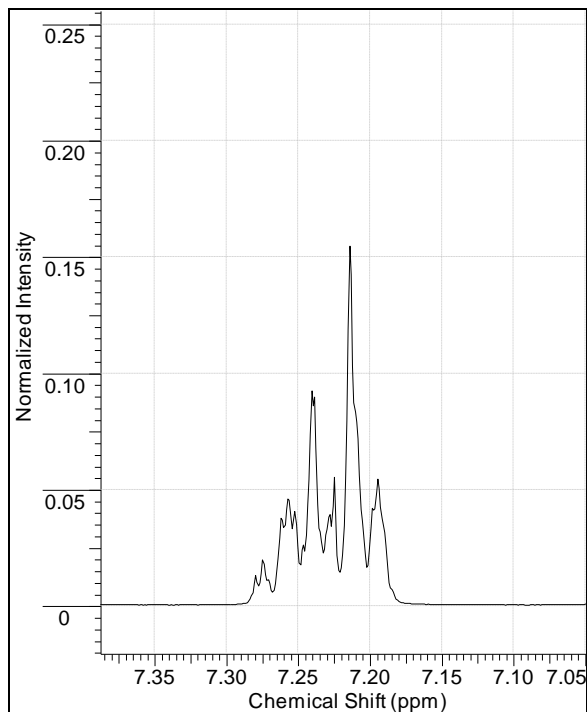
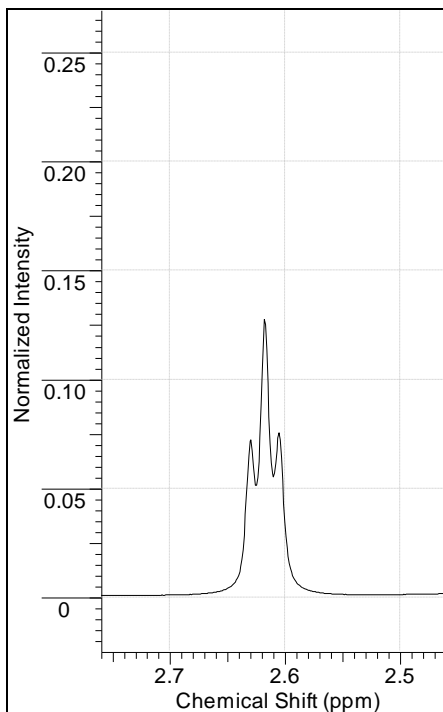
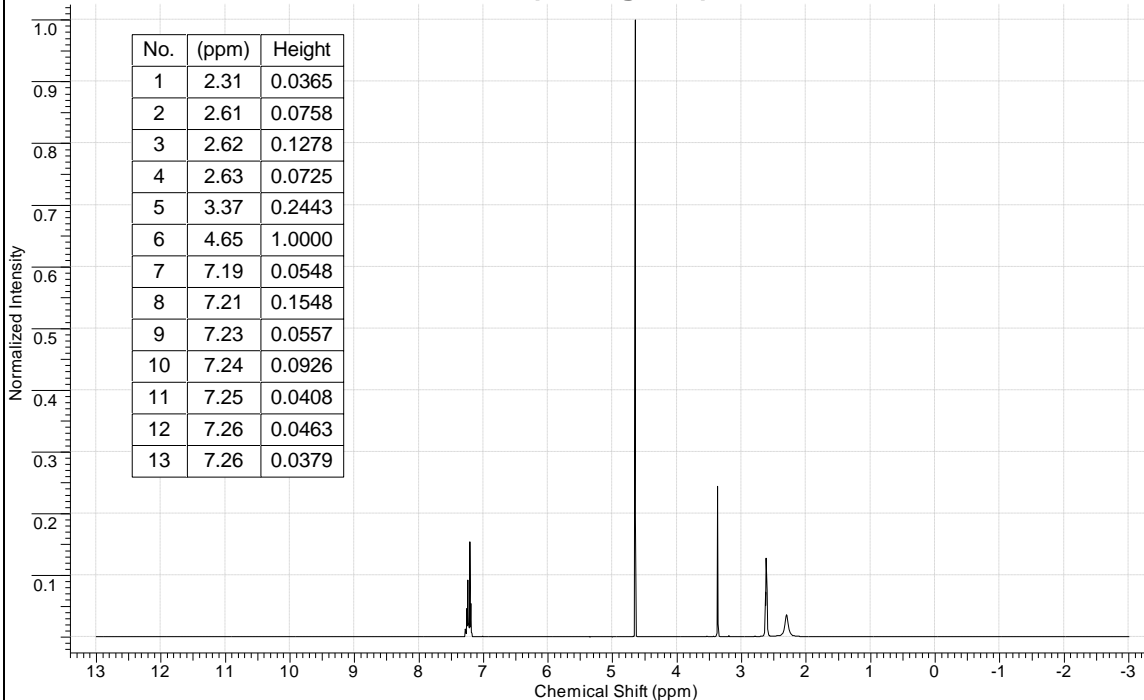
### MS: 1-Benzylpiperazine



### Vapor Phase IR: Benzylpiperazine (0.5mg/mL @ 8cm<sup>-1</sup>)



**FT-NMR 400 MHz Proton  
Benzylpiperazine HCl in D2O  
(60 mg/mL)**



**FT-NMR 400 MHz Carbon  
Benzylpiperazine HCl in D2O  
(60 mg/mL)**

