Reprint from

RECENT ADVANCES IN DOPING ANALYSIS (6)

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INVESTIGATION ON A "BLACK MARKET'S DRUG - CARPHEDONE"

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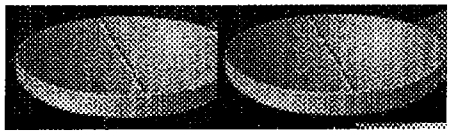
INTRODUCTION

During the past years "the black market" supports to the athletes drug with name "Carphedone". We are not found appropriate literature data on this drug. The investigation was carried out by the drug "Carphedone" bought from "the black market" and the active substance was isolated by HPLC. The chemical, spectroscopic (UV, IR, MS, ^{1}H and ^{13}C NMR) and chromatographic (CG, GPC and HPLC) properties of the substance were studied. The urine samples of volunteer after administration of one tablet "Carphedone" were analysed too.

EXPERIMENTAL



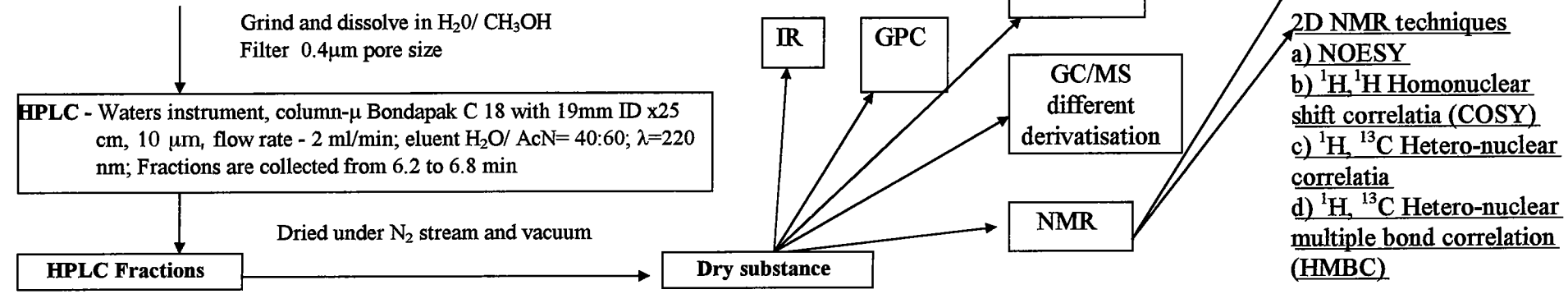


Figure 1. Used methods and techniques for isolation and identification of the substance from tablet

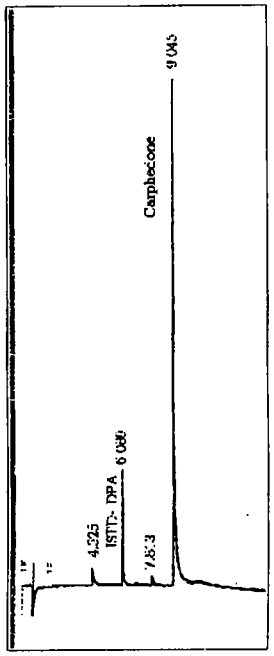


Figure 2. GC/NPD chromatogram of Carphedone (HP 5890 II instrument extraction with diethyl ether pH=14)

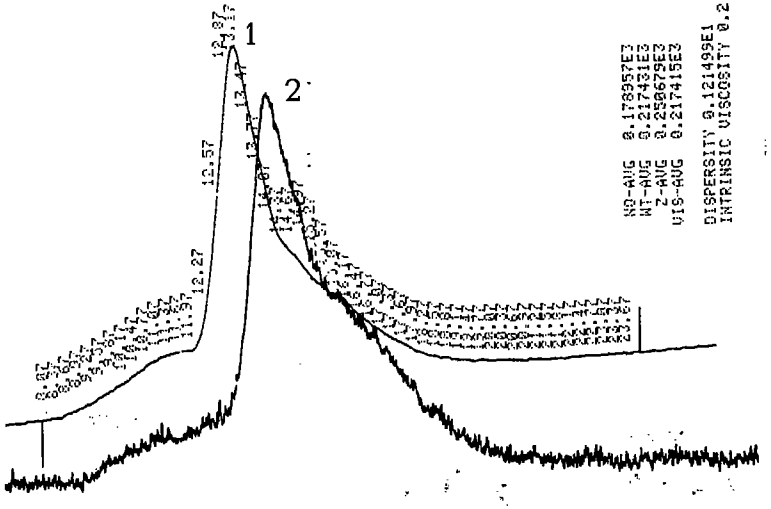


Figure 3. GPC chromatogram of Carphedone. Detection -refractive index (1), UV - λ=254 nm. (2) Waters instrument; two "UltraStyragel" columns 30 x 6.9 cm with pore size 50 Å, eluent - THF with flow rate 1 ml/min, temperature - 30°C, calibration - low molecular standards of p-cresol oligomers.

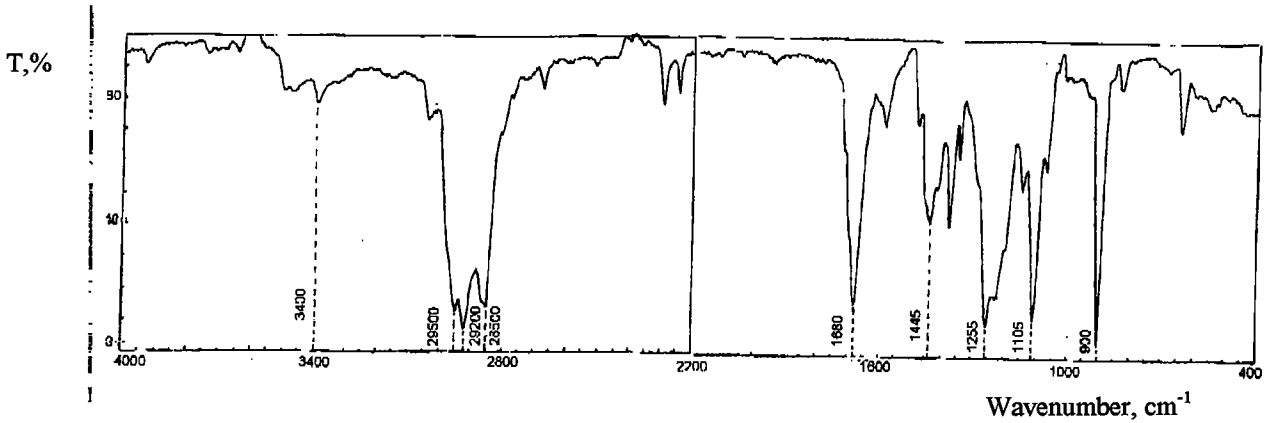
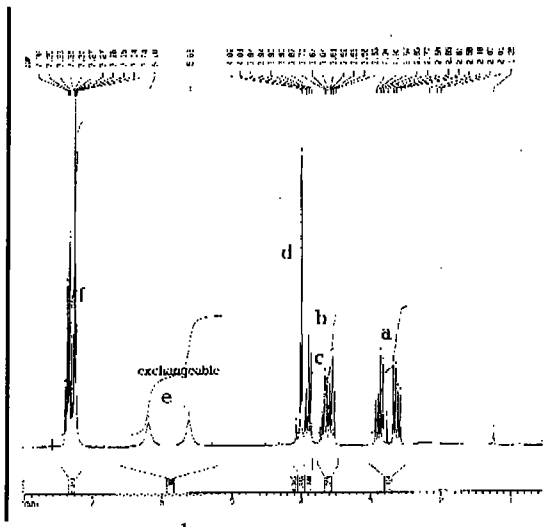
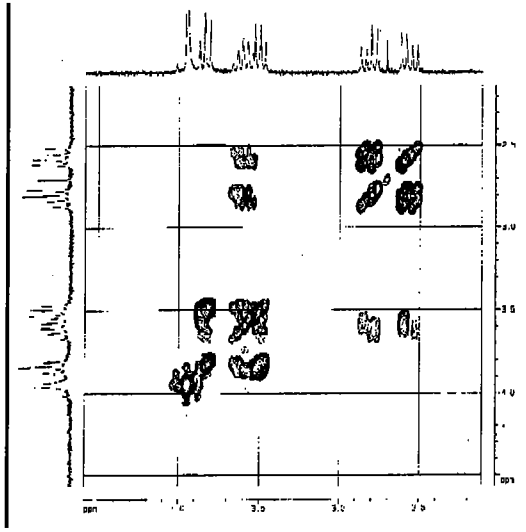


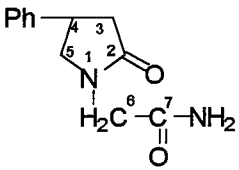
Figure 4. IR spectrum of Carphedone in $CHCl_3$ when: 3400 cm^{-1}- N-H *str* of primary amide; 2890 - 2950 cm^{-1} - C-H *str* of aliphatic chain; 1680 and 1445 cm^{-1} - C=O *str*/ N-H *def* of primary and tertiary amide; 1255 and 1105 cm^{-1} - C-O *str* of keto group; 900 cm^{-1} - C-H *def* of monosubst. Ar ring.



a -CH_2
b -CH-CH_2
c -CH-CH_2
d -CH_2
e - NH_2
f - C_6H_5

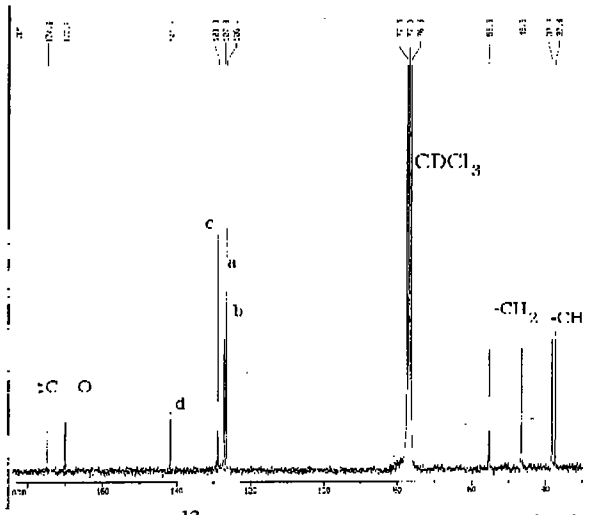
Figure 5. 250 MHz ^{1}H NMR spectrum of Carphedone in $CDCl_3$





Crosspeaks
H-3/ H-4
H-4/ H-5

Figure 6. 250 MHz proton correlated 2D NMR spectrum (COSY) of Carphedone in $CDCl_3$.



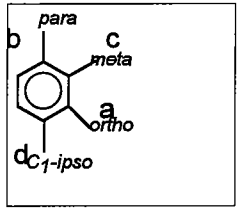
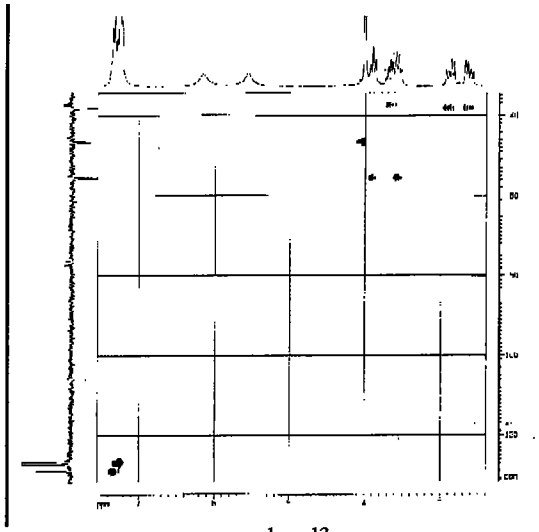


Figure 7. 250 MHz ^{13}C NMR spectrum of Carphedone in $CDCl_3$



Crosspeaks
2.769 and
2.677/ 38.3

3.696/ 37.4
3.696/ 141.7

3.590 and
3.902/ 55.5

4.021/ 46.6

Figure 8. 250 MHz ^{1}H-^{13}C 2D NMR spectrum of Carphedone

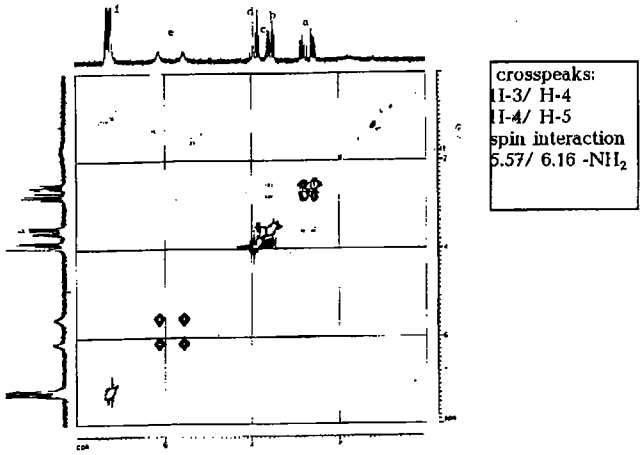


Figure 9. 250 MHz NOESY spectrum of Carphedone .
All NMR spectra were recorded by "Bruker- DRX 250" in $CDCL_3$.

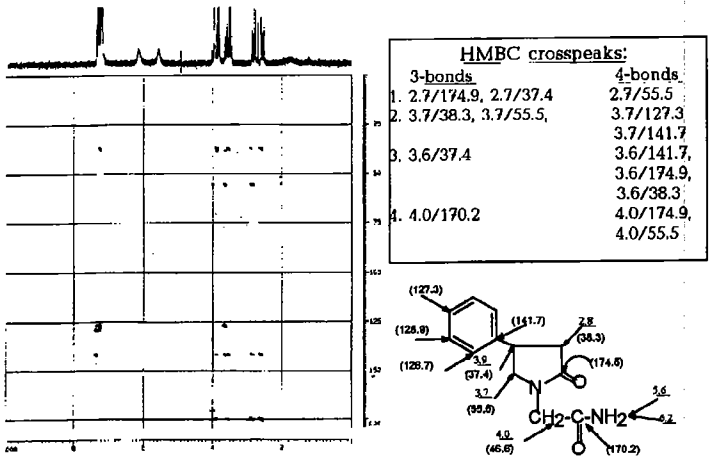
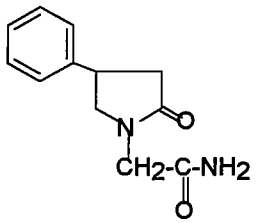


Figure 10. 250 MHz ^1H-^{13}C multiple bond correlated spectrum (HMBC) of Carphedone.

CHEMICAL STRUCTURE OF CARPHEDONE

The obtained results of spectroscopic and chromatographic analyses confirmed the next formula of Carphedone



2-oxo-4-phenyl-1-pyrrolidineacetamide.

This formula is very similar to the well-known nootropic drug Piracetam (2-oxo-1-pyrrolidineacetamide). For this reason the mass spectroscopic analyses were carried out with both substances.

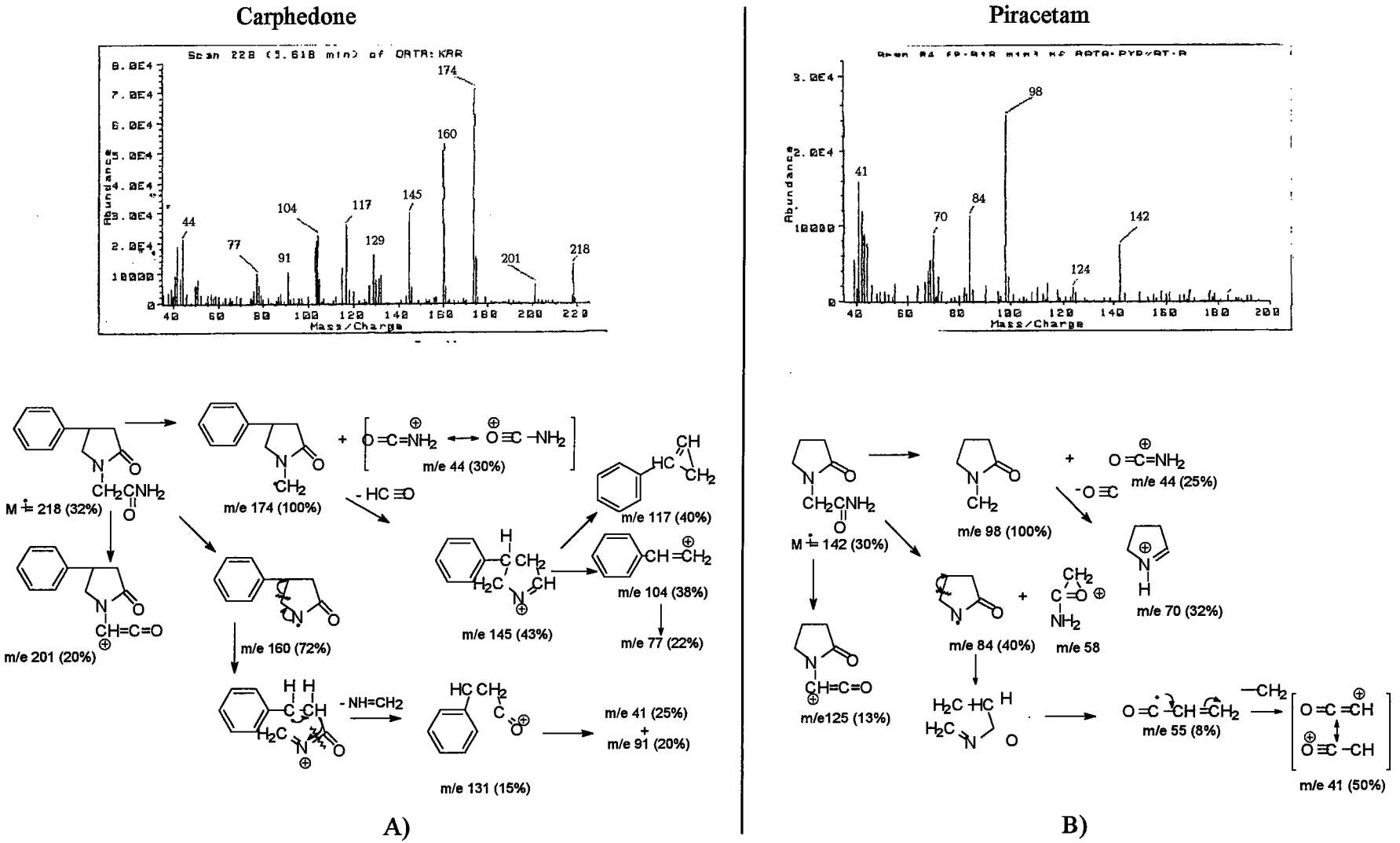


Figure 11. EI mass specra and fragmentation of Carphedone (A) and Piracetam (B)

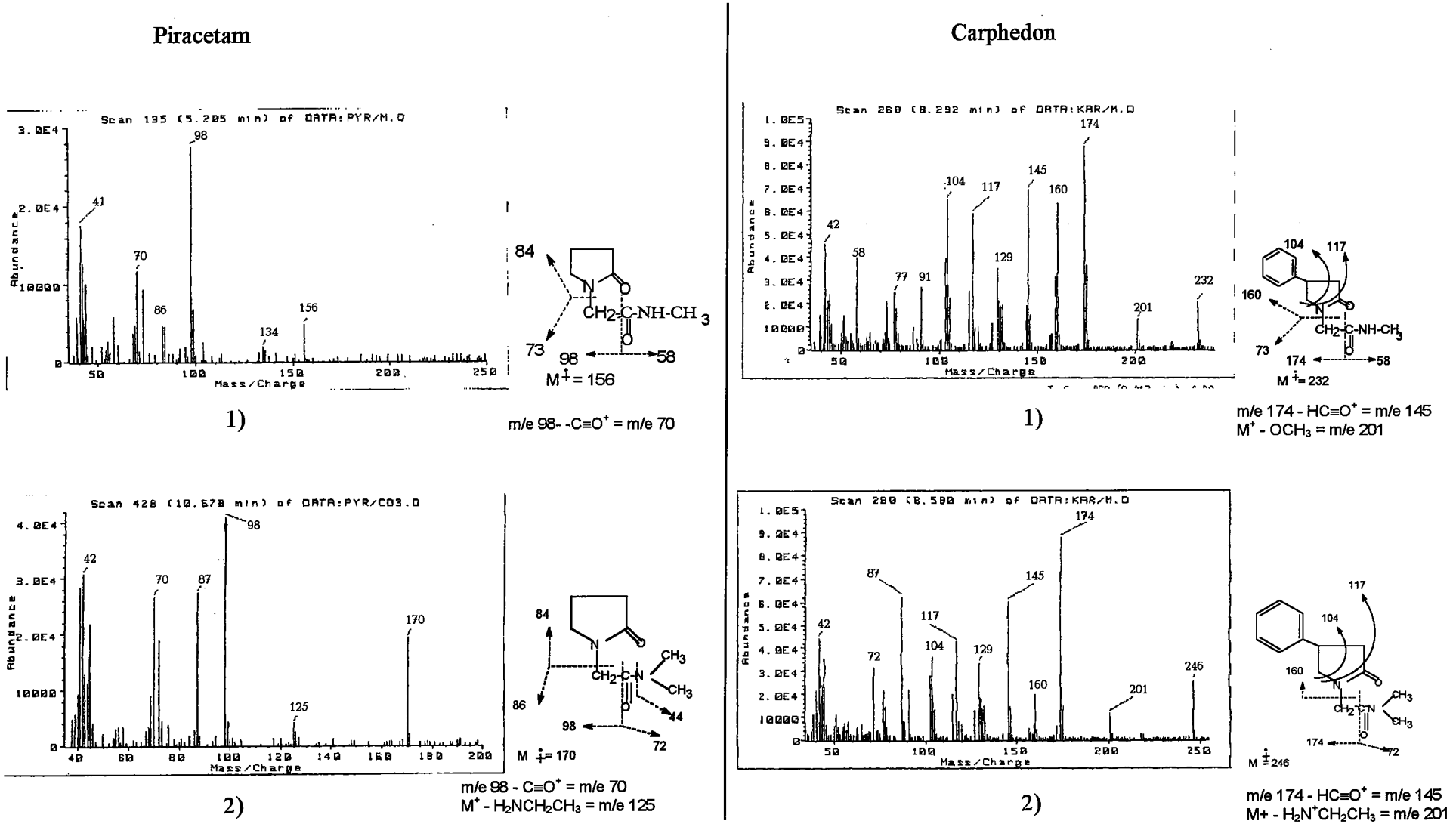


Figure 12. EI mass spectra and fragmentation of methylated with CH_3J Carphedone and Piracetam. Under condition of methylation mono-(1) and dimethylated (2) derivatives are formed from both substances.

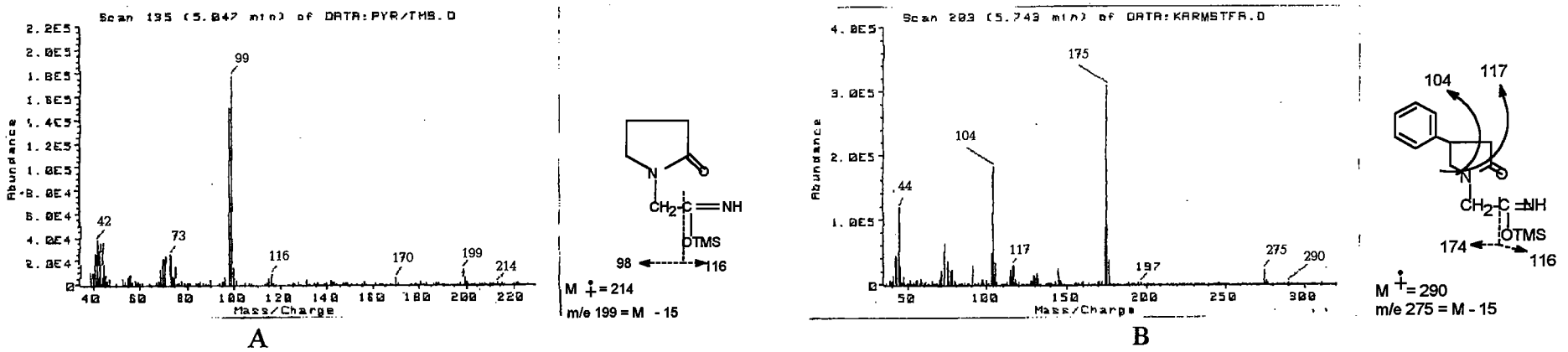
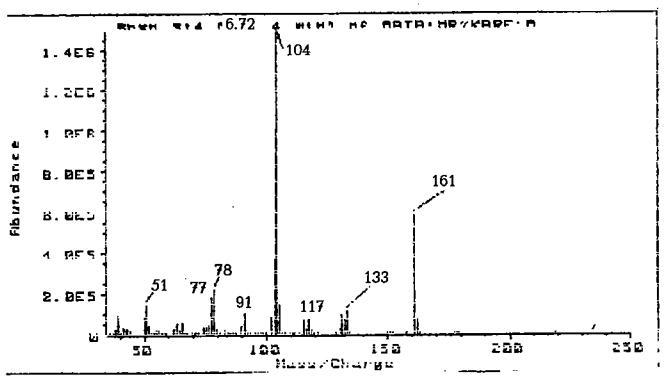


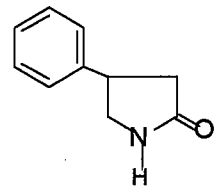
Figure 13. EI mass spectra of silyllated with N-Methyl-N-trimethylsilyl-trifluoroacetamide (MSTFA) Piracetam (A) and Carphedone (B).

ANALYSES OF URINE SAMPLES AFTER ADMINISTRATION OF CARPHEDONE

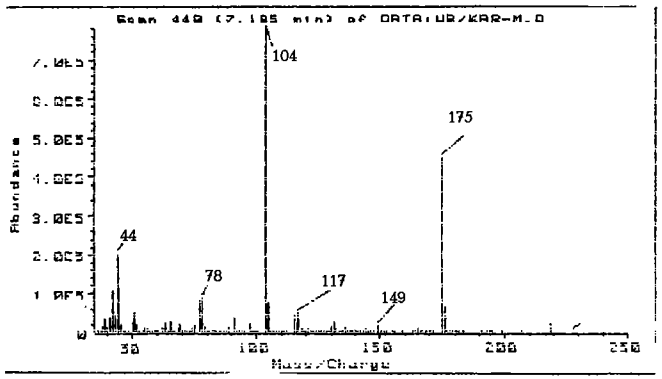
The urine samples are collected up to 16 hours after administration of 1 tablet Carphedone from health volunteer. The samples were analysed by GC/NPD and GC/MSD after carrying out a procedure for free stimulants (extraction at pH=14). Unchanged Carphedone and its Metabolite was detected and identified by GC/MSD in analysed urine samples after application of Carphedone.

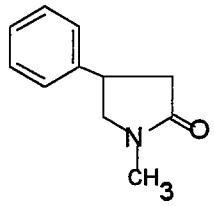
Analytical parameters:	GC analyses	GC/MSD analyses
Analytical instrument	GC/NPD HP 5890 II	HP GC 5890/ MSD 5970
Carrier gas:	Nitrogen (1 ml/min flow)	Helium (1 ml/min flow)
Split ratio:	1:15	1:10
Analytical column:	HP Ultra-2 16m, 0.25 mm i.D., 0.20 μm film thickness	HP - 5, 20 m, 0.25 mm i.D. 0.20 μm film thickness
Temperature program:	70°C, 20°C/min till 300°C	120°C, 15°C/min till 300°C
Injection:	2 μl	1 μl





M^+= 161





A B

Figure 14. EI mass spectra of Metabolite of Carphedone- underivatized (A) and after methylation (B)

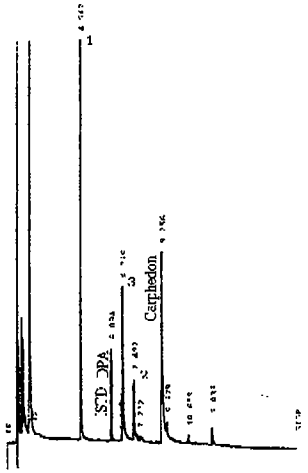


Figure 15. GC chromatogram of urine sample after administration of Carphedone: nicotine -1; caffeine-2; Metabolite of Carphedone-3

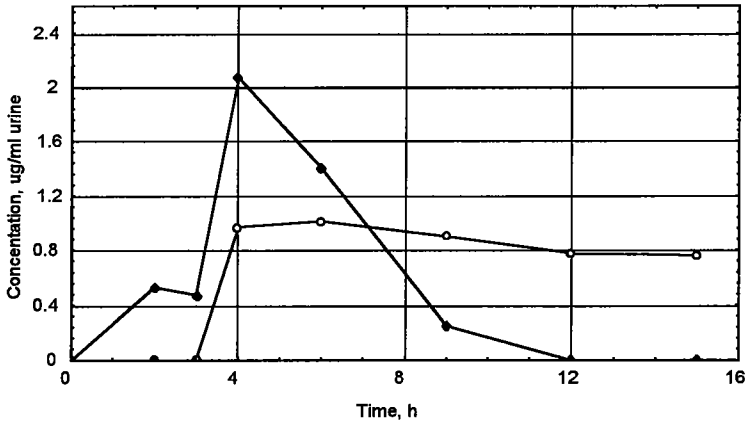


Figure 16. Excretion curves of Carphedone (◆) and Metabolite (O).