

## ANALYTICAL STUDIES OF SOME CONTROLLED AND NONCONTROLLED DRUGS OF ABUSE\*

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### ABSTRACT

Separation and identification of some depressants and stimulants by GLC, combined GC-MS and HPLC techniques was attempted. The results obtained are successful, valuable and may be applied in routine forensic analysis.

### INTRODUCTION

In the last twenty years synthetic drugs in addition to other drugs of natural origin are widely abused in Egypt. Barbituric acid derivatives as sndopital, amytal and seconal are controlled and scheduled according to the Egyptian law, in schedule I. Non-barbiturate hypnotics, e.g., doriden, methaqualone and sosegon are also found in the illicit market. Methaqualone capsules are prepared by filling them with the drug and other adulterants and known in the illicit market by Fantom or skyhook.

Minor tranquilizers; benzodiazepines are abused by youth and patients who have been treated with this type of drugs. Normally they are used medically for long time and cause addiction. Due to their addicting properties they were controlled and scheduled under the convention on psychotropic substances, 1971.

Caffeine, theobromine and theophylline (Xanthine CNS stimulants) are well known and were isolated from coffee, cocoa, tea and cola (Somokin, 1973). Catha

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\*Dedicated to the memory of late Prof. Dr. M. O. Abdel-Rahman, Head of the Scientific and Applied Research Center, University of Qatar.

F. (controlled regionally) is abused in Yemen, Somalia, Ethiopia and other neighbour countries (Szendrei, 1980). The natives chewed the leaves of khat for stimulating effect to resist hunger and fatigue. In Saudi Arabia some of the foreign workers substitute khat (controlled) with cola acuminata nuts (non-controlled) for stimulating effect. They chew the nuts which enable them to do hard work.

Analytical data on the separation and identification of controlled and noncontrolled but commonly abused drugs are published by several authors using techniques as gas chromatography, gas chromatography-mass spectrometry and high performance liquid chromatography (Japp *et al.*, 1988; Scheutz and Westenberger 1979; Chiarotti *et al.*, 1986; Flanagan *et al.*, 1982; Nobuhare *et al.*, 1980; Smith, 1976; Hermann, 1976; Zaki, *et al.*, 1980; Mobarak, *et al.*, 1978; Hawks, 1984).

It was worthwhile to apply these techniques for separation and identification of abused drugs in routine forensic analysis.

## EXPERIMENTAL

Substances used: authentic samples of the drugs are dissolved in methanol. Concentrations for GLC, HPLC or GC-MS techniques are prepared as 1 mg/ml.

Gas liquid chromatography: gas chromatograph, Fractovap series 4200 Carlo Erba, attached with FID and programmer Model 400 was used.

Integrator: computerized C-R3A chromatopac Shimatzu.

Column temp: programmed temp.: 80-265°C, (9°C/min.) with 2 minutes initial delay and 10 minutes isothermal (after reaching 265°C).

Injection temp.: 270°C.

Detector temp.: 270°C.

Carrier gas: Nitrogen 4 ml/min.

Gas Chromatography-Mass spectrometry: Hewlet Packard HP 5985/B GC-MS apparatus was used.

High Performance Liquid Chromatography (HPLC): Reversed phase method was used.

Apparatus: Gynkotek Gradient Former Model 250 B  
Gynkotek constant flow pump model 600/200  
Degasser REC-3520  
Spectroflow monitor SF 770  
GM monochromator wave length drive SFA 339

Column: 250 mm (5 mm I.D.)  
Packing material: Hypersil 5 ODS  
Mobile phase (Methanol): (Methanol/H<sub>2</sub>O 1:1) 50:50 v/v.  
Flow rate: 0.8 ml/min.  
Detector: UV at 253 nm.  
Inj. volume: 20 ul.

## RESULTS AND DISCUSSION

In Table 1 the separation of some depressants using capillary column (30 m) was achieved. The retention time of each drug relative to that of phenobarbitone was calculated and listed in Tables 1, 2, 3 and 4. Meprobamate and chlordiazipoxide were degraded during separation (Japp *et al.*, 1988). Depressant drugs are well separated by this GLC conditions as shown in Fig 1.

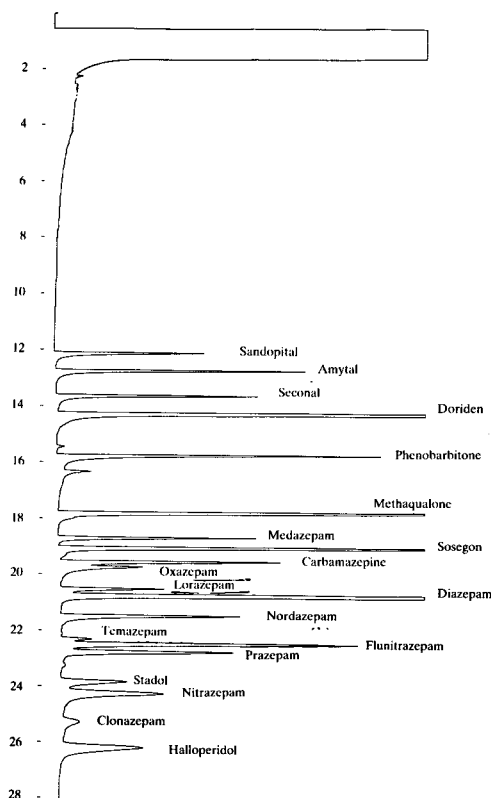


Fig. 1: Gas chromatogram of some depressants

The separation of some stimulants abused by students and athletes, using GLC technique, are also shown in Table 2. Regarding the results in Table 2, good separation of the stimulants applied for GLC are well detected and identified.

Cannabinoids were separated and identified since long time, using GLC and combined GC-MS techniques, by several authors. (Mobarak, *et al.*, 1978; Hawks, 1984). By capillary column, the isomers  $\Delta^8$ -THC and  $\Delta^9$ -THC were well separated and identified. The results are shown in Table 3 and Fig. 2.

Heroin, nowadays represents the most dangerous addicting drug. It is widely spread throughout the world. The detection of the drug and its metabolites;

**Table 1**  
GLC of some depressants abused in Egypt

Drug	Retention time of the substance	
	" " " " phenobarbitone	X100
Meprobamate	27.6 (58.7) (88.0)	
Sandopital	77.0	
Amytal	81.0	
Seconal	86.5	
Glutethimide	90.8	
Phenobarbitone	100.0	
Methaqualone	113.1	
Medazepam	118.7	
Pentazocine	121.0	
Carbazepine	124.0	
Oxazepam	125.4	
Lorazepam	130.3	
Diazepam	131.9	
Nordazepam	136.5	
Temazepam	141.7	
Flurazepam	142.9	
Flunitrazepam	142.9	
Prazepam	144.7	
Butorphanol (studol)	151.5	
Nitrazepam	154.1	
Clonazepam	160.6	
Chlordiazepoxide	160.7 (137.0) (141.0)	
Halloperidol	166.6	
Fluphenazine	176.6	

morphine was good achieved by the GLC conditions. The relative retention time of some opium alkaloids are shown in Table 4.

**Table 2**  
GLC of some stimulants abused in Egypt

Drug	Retention time of the substance				X100
	"	"	"	phenobarbitone	
Cyclopentamine					19.8
Amphetamine					26.2
Methamphetamine					27.0
Propyl hexedrine					27.7
Nylidrin					43.9
Norephedrine					44.6
1-Ephedrine					49.6
Phenmetrazine					56.6
Isoniazid					68.6
Iproniazid					68.6
Methylphenidate					81.6
Benzamphetamine					89.2
Caffeine					89.2
Theobromine					94.5
Phenylephrine					97.1
Theophylline					103.7
Cocaine					116.6

**Table 3**  
GLC of some Cannabinoids

Drug	Retention time of the substance				X100
	"	"	"	phenobarbitone	
Cannabidiol					127.8
$\Delta^8$ -THC					132.3
$\Delta^9$ -THC					133.7
Cannabinol					137.8

**Table 4**  
GLC of some opium alkaloids

Drug	Retention time of the substance				X100
	"	"	"	phenobarbitone	
Codeine					128.2
Morphine					131.6
Heroin					137.9
Papaverine					159.5
Narcein					223.7

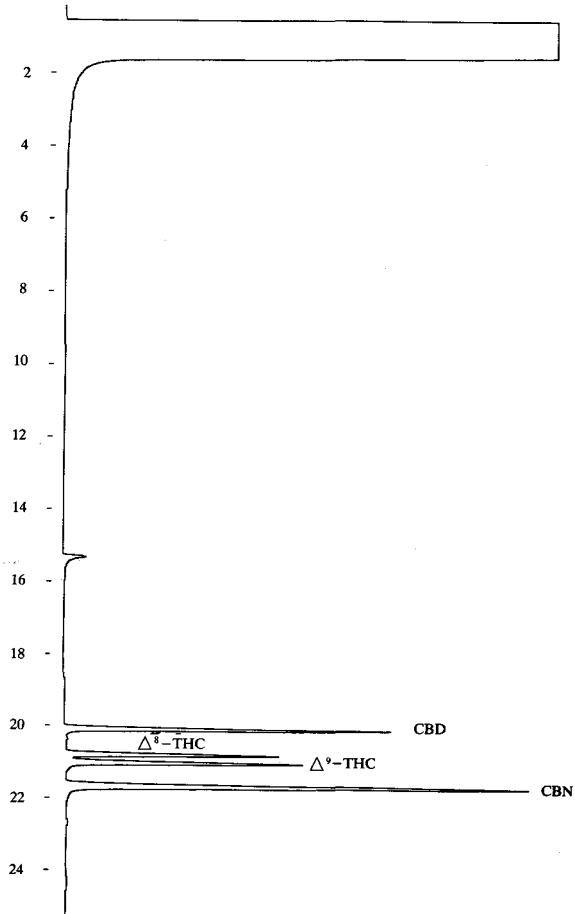


Fig. 2: Gas chromatogram of some cannabinoids

Combined gas chromatography-mass spectrometry technique was also applied for identification of some commonly abused drugs. The results obtained are shown in Table 5 and Fig. 3.

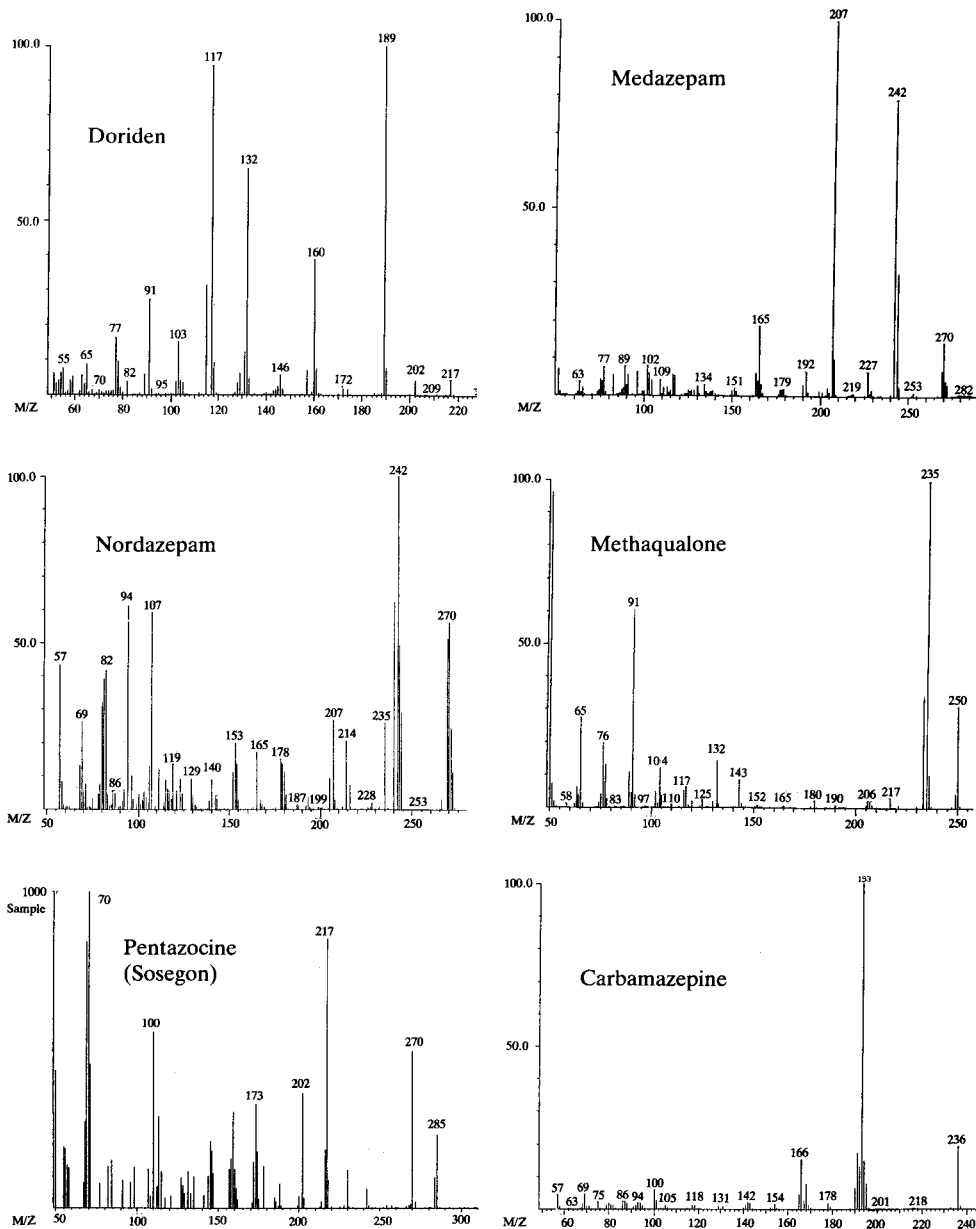


Fig. 3: Mass Spectra of some drugs of abuse

Analytical studies of some drugs of abuse

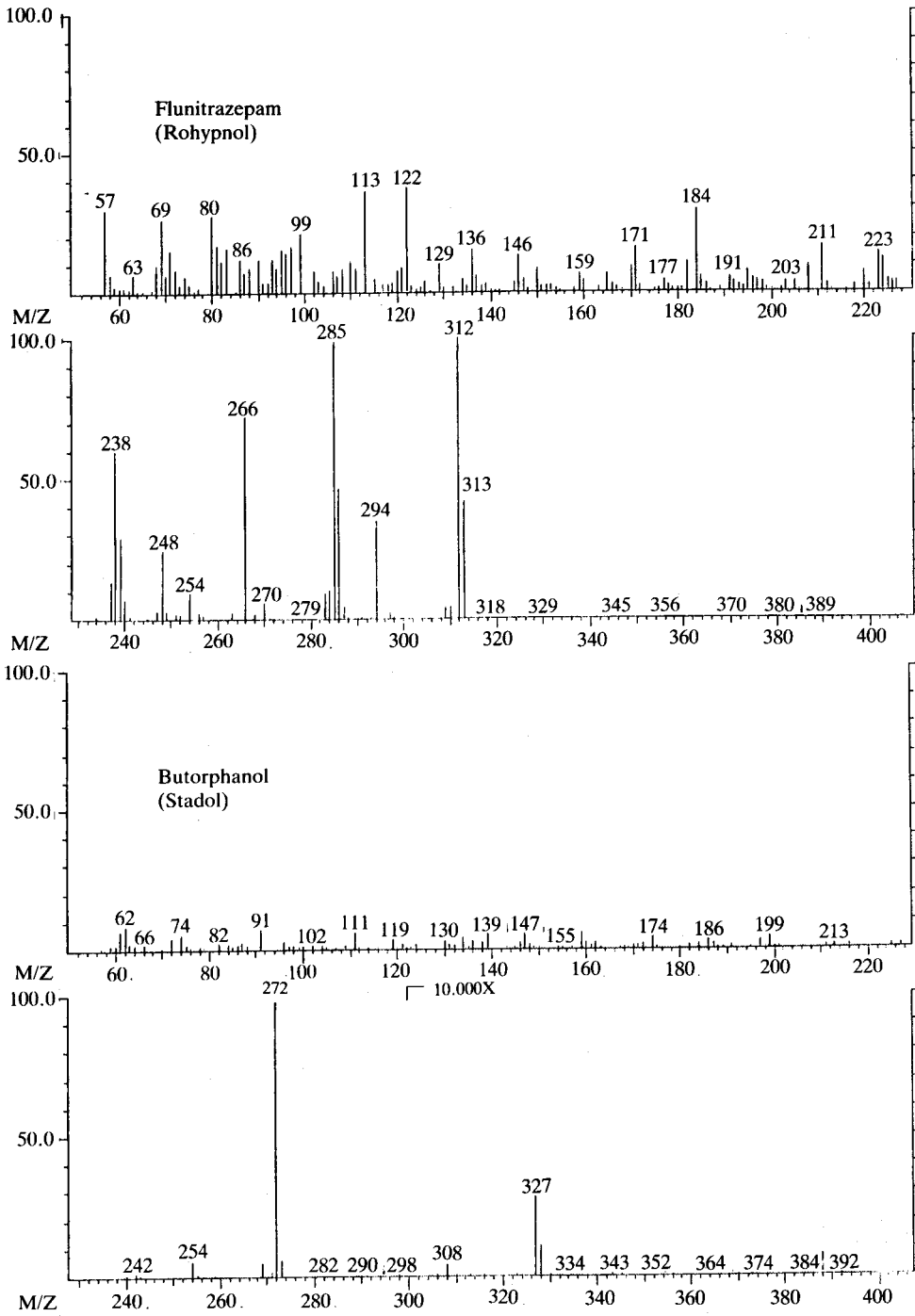


Fig. 3: Continued



**Table 5**  
Mass spectral data of some drugs of abuse

Drug	M <sup>+</sup>	M. Wt intensity	Base Peak M/Z intensity (100%)
Methaqualone	251	31%	235
Glutethimide	217	4%	189
Sosegon	285	22%	70
Medazepam	270	15%	207
Nordazepam	270	57%	242
Carbamazepine	236	20%	193
Butorphanol (stadol)	327	27%	272
Temazepam	300	12%	271
Flunitrazepam (Rohypnol)	313	42%	312

High performance liquid chromatography (HPLC) showed valuable, successful and sensitive method for separation and identification of some drugs of abuse. The retention time of each drug is shown in Table 6.

**Table 6**  
HPLC of some drugs abused in Egypt

Drugs	Retention time (minutes)	Drugs	Retention time (minutes)
Theobromine	3.17	Lorazepam	4.83
Benzamphetamine	3.33	Methaqualone	4.92
Isoniazid	3.33	Oxazepam	5.17
Theophylline	3.42	Temazepam	5.45
Caffeine	3.47	1-Ephedrine	5.48
Iproniazid	3.50	Norephedrine	5.67
Phenobarbital	3.68	Pentozocine	5.83
Glutethimide	3.92	Chlordiazepoxide	5.90
Clonazepam	4.93	Amphetamine	5.90
Flunitrazepam	4.37	Nordazepam	6.00
Flurazepam	4.42	Diazepam	6.53
Nitrazepam	4.42	Prazepam	9.30
Carbamazepine	4.45	Medazepam	13.93

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## دراسة كيميائية تحليلية على بعض العقاقير الخاضعة والغير خاضعة للرقابة

زين العابدين مبارك و ديتربينيك و فريد هلم كورت

تتضمن الدراسة استخدام الوسائل الفيزيوكيميائية مثل كروماتوجرافيا الغاز وكروماتوجرافيا الغاز المقترنة بمطياف الكتلة والكروماتوجرافيا تحت ضغط السائل . لقد تركزت الدراسة على العقاقير المخدرة مثل الهيروين ومركبات الافيون والمواد الفعالة في الحشيش والبنزوديايبينات والامفيتامينات والكوكايين ومواد أخرى . وأوضحت النتائج مدى تطبيقها في مجال الكيمياء التحليلية الشرعية .