The 2004 “Research on Drug Evidence” Report

[From the 14th ICPO / INTERPOL Forensic Science Symposium]

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ABSTRACT: A reprint of the 2004 “Research on Drug Evidence” Report (a review) is provided.

KEYWORDS: INTERPOL, Illicit Drugs, Controlled Substances, Forensic Chemistry.

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Citations in this report from the Journal of the Clandestine Laboratory Investigating Chemists Association and Microgram were (and remain) Law Enforcement Restricted. Microgram was split into Microgram Bulletin and Microgram Journal in 2002 and 2003, respectively; except for the 2002 Bulletins, both the Bulletin and Journal were (and are) unclassified.

The “General Overview” (Talking Paper) was removed from this reprint (Editor’s discretion).

This reprint is derived from the original electronic document, and is not an image of the best available hard copy (as was utilized for the 1995 and 1998 reports). For this reason, the pagination in the original document is not retained in this reprint, and some minor reformatting was done to eliminate deadspace.
Research On Drug Evidence

July 1, 2001 - June 30, 2004

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Fourteenth ICPO - INTERPOL
Forensic Sciences Symposium
October, 2004

Lyon, France
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Notes:
1. All categories are subdivided by topic or category, then alphabetically by the first author's name.
2. Where appropriate, a short explanatory note is added to the citation to provide additional detail concerning the reference.
3. Note that the following references are law enforcement restricted, and not available to the general public: Microgram and Microgram Bulletin prior to 2003, and the Journal of the Clandestine Laboratory Investigating Chemists Association (all years).
I) **Routine and Improved Analysis of Abused Substances**

**Issue:**

Improved methods of analysis, i.e., faster, more discriminatory, more sensitive, less costly, etc., are needed for all abused substances. Additionally, standard analytical data are required for previously unknown or rarely encountered substances and/or new homolog or analog (i.e., "designer"-type) drugs.

**Solution:**

Drug seizures and clandestine laboratory operations are continuously monitored to provide a comprehensive overview of new developments. Ongoing research in the forensic community, as well as in the general field of analytical chemistry, provide new and/or improved methods of analysis for both routine and specialized analyses of seized drugs. Reports providing standard analytical data for new drugs of abuse and/or improved analytical protocols for known drugs of abuse are generated for the forensic and enforcement communities.

**References:**

**Reviews:**


**Scientific Working Group for Forensic Analysis of Illicit Drugs:**


**Amphetamine, Methamphetamine, and Dimethylamphetamine (see also Substituted Amphetamines, Phenethylamines, and Methyleneoxyamphetamines):**

10) Brown H, Kirkbride KP, Pigou PE, Walker GS. New developments in SPME, Part 1: The use of vapor-phase deprotonation and on-fiber derivatization with alkylchloroformates in the analysis of preparations containing amphetamines. Journal of Forensic Sciences 2003;48(6):1231. [Presents a method for conversion of solid drug salts to their free bases, capture via SPME, and analysis by GC/MS. The technique can be used for noninvasive recovery from consumer items such as banknotes and garments. Use of on-fiber derivatization with alkylchloroformates improves chromatography and also allows for enantiomer determinations.]


15) Lua AC, Chou TY. Preparation of immunoaffinity columns for direct enantiomeric separation of amphetamine and/or methamphetamine. Journal of Chromatography A 2002;967(2):191. [For direct enantiomeric determination of amphetamine and methamphetamine in urine.]


**para-Substituted Amphetamines:**


Barbiturates:

20) Bartzatt R. Determination of barbituric acid, utilizing a rapid and simple colorimetric assay. Journal of Pharmaceutical and Biomedical Analysis 2002;29(5):909. [Presents three assay methods, which can be utilized on either aqueous or solid samples.]

21) Chang W-T, Smith J, Liu RH. Isotopic analogs as internal standards for quantitative GC/MS analysis - Molecular abundance and retention time differences as interference factors. Journal of Forensic Sciences 2002;47(4):873. [Isotopic analogues of five barbiturates were evaluated as internal standards for GC/MS analyses.]


Benzodiazepines:

25) Aebi B, Sturny-Jungo R, Bernhard W, Blanke R, Hirsch R. Quantitation using GC-TOF-MS: Example of bromazepam. Forensic Science International 2002;128(1-2):84. [Various methods are used to validate the use of GC-TOF-MS for analysis of bromazepam; diazepam and nordiazepam were also studied, but to a lesser extent.]

26) Bakavoli M, Kaykhaii M. Quantitative determination of diazepam, nitrazepam and flunitrazepam in tablets using thin-layer chromatography - densitometry technique. Journal of Pharmaceutical and Biomedical Analysis 2003;31(6):1185. [Also includes
and contrasts HPLC analyses; UV (254 nm) detection was used for both techniques.]


28) Cahours X, Cherkou S, Rozing G, Veuthey JL. Microemulsion electrokinetic chromatography versus capillary electrochromatography-UV-mass spectrometry for the analysis of flunitrazepam and its major metabolites. Electrophoresis 2002;23(14):2320. [Flunitrazepam and its three major metabolites (in biological fluids) were separated by the title technique.]

29) Ferreyra CF, Ortiz CS. Simultaneous spectrophotometric determination of phenylpropanolamine HCl, caffeine and diazepam in tablets. Journal of Pharmaceutical and Biomedical Analysis 2002;29(5):811. [UV spectrophotometry and LC methods were used.]

30) Kamande MW, Kapnissi CP, Zhu XF, Akbay C, Warner IM. Open-tubular capillary electrochromatography using a polymeric surfactant coating. Electrophoresis 2003;24(6):945. [The title technique was applied to the analysis of benzodiazepines (not specified in the abstract).]

31) Pirnay S, Ricordel I, Libong D, Bouchonnet S. Sensitive method for the detection of 22 benzodiazepines by gas chromatography - ion trap tandem mass spectrometry. Journal of Chromatography A 2002;954:235. [The title technique method was applied to biological samples.]


33) Suzuki Y, Arakawa H, Maeda M. The capillary electrophoresis separation of benzodiazepine drugs using dextran sulfate and SDS as running buffer. Biomedical Chromatography 2004;18(3):150. [Presents the EKC analysis of 10 benzodiazepines (not specified in abstract). The authors claim that the presented method may also be used for many other pharmaceuticals.]

**Dimethoxyphenethylamines:**

35) Curtis B, Kemp P, Harty L, Choi C, Christensen D. Postmortem identification and quantitation of 2,5-dimethoxy-4-n-propylthiophenethylamine using GC-MSD and GC-NPD. Journal of Analytical Toxicology 2003;27(7):493. [Primary focus is analysis of biological fluids and tissue samples; however, includes a small scale mass spectra (from GC/MS) of the title compound (i.e., 2C-T-7).]

**Chlordiazepoxide:**


**Clenbuterol:**


**Cocaine:**

41) Koulis CV, Reffner JA, Bibby AM. Comparison of transmission and internal reflection spectra of cocaine. Journal of Forensic Science 2001;46(4):822. [Study is on cocaine hydrochloride; includes cautionary notes on the use of ATR.]


**Ergot Alkaloids (see also LSD):**


**Fentanyl(s):**

45) DeBoer D, Goemans WPJ, Ghezavat VR, vanOoijen RD, Maes RAA. Seizure of illicitly produced para-fluorofentanyl: Quantitative analysis of the content of capsules and tablets. Journal of Pharmaceutical and Biomedical Analysis 2003;31(3):557. [Presents a GC/MS methodology for the title analysis; HPLC/UV was also used to quantify caffeine being used as an adulterant. The samples derived from an illicit laboratory in the Netherlands.]


47) Van Nimmen NFJ, Veulemans HAF. Development and validation of a highly sensitive
gas chromatographic - mass spectrometric screening method for the simultaneous determination of nanogram levels of fentanyl, sufentanil, and alfentanil in air and surface contamination wipes. Journal of Chromatography A 2004;1035(2):249. [Focus is on sampling for industrial occupational exposure. The technique uses SIM.]

**Flos daturae:**


**Fluoxetine (Prozac):**


**Heroin:**


51) Fitsev IM, Budnikov GK, Blokhin VK, Teslenko PG. Gas chromatographic determination of diacetylmorphine with mass spectrometric detection. Journal of Analytical Chemistry (English translation of Zhurnal Analiticheskoi Khimii) 2003;47(9-12):423. [Appears to be a GC/MS method for analysis of heroin in fluids (not clear in abstract).]

52) Kulikowska J, Celinski R, Soja A, Sybirksa H. Investigations on the quality of home-made poppy straw products ("Compote") at the forensic medicine department in Katowice. Proceedings, 39th Annual TIAFT Meeting, Prague, 2001. [Illicit production of morphine and heroin in Poland (from poppy straw) is reviewed, and the techniques used for analysis of these products are discussed.]


**gamma-Hydroxybutyric Acid (GHB), gamma-Butyrolactone (GBL) and 1,4-Butanediol (BD):**

55) Alston WC, Ng K. Rapid colorimetric screening test for gamma-hydroxybutyric acid (Liquid X) in human urine. Forensic Science International 2002;126(2):114. [Based on the ferric hydroxamate test for ester detection; takes 5 minutes and has a detection limit 0.1 mg/mL for 1 mL samples.]


57) Bravo DT, Harris DO, Parsons SM. Reliable, sensitive, rapid, and quantitative enzyme-based assay for gamma-hydroxybutyric acid (GHB). Journal of Forensic Sciences 2004;49(2):379. [Several assays are presented for detection of GHB in beverages and urine.]


59) Chappell JS, Meyn AW, Ngim KK. The extraction and infrared identification of gamma-hydroxybutyric acid (GHB) from aqueous solutions. Journal of Forensic Sciences 2004;49(1):52. [Presents a liquid-liquid extraction technique for isolating GHB free acid, with analysis by IR.]

60) Chew SL, Meyers JA. Identification and quantitation of gamma-hydroxybutyrate (NaGHB) by nuclear magnetic resonance spectroscopy. Journal of Forensic Sciences 2003;48(2):292. [Presents an NMR technique for identification and quantitation of GHB; the identification of GBL by NMR is also presented.]

61) Ciolino LA, Mesmer MZ, Satzger RD, Machal AC, McCauley HA, Mohrhaus AS. The chemical interconversion of GHB and GBL: Forensic issues and implications. Journal of

63) DeFrancesco JV. An NMR study of the stability of gamma-butyrolactone (GBL) in water. Proceedings of the American Academy of Forensic Sciences 2003;9:32. [Presents a study of the conversion of GBL to GHB over time, starting with different concentrations of GBL.]

64) Duer WC, Byers KL, Martin JV. Application of a convenient extraction procedure to analyze gamma-hydroxybutyric acid in fatalities involving gamma-hydroxybutyric acid, gamma-butyrolactone, and 1,4-butanediol. Journal of Analytical Toxicology 2001;25(7):576.

65) Garcia AD, Catterton AJ. 1,4-Butanediol (BD) - Forensic profile. Microgram Journal 2003;1(1-2):44.

66) Meyers JE, Garcia AD, Almirall JR. The analysis of gamma-hydroxybutyric acid (GHB) and gamma-butyrolactone (GBL) in forensic samples using GC/MS and H1-NMR. Proceedings of the American Academy of Forensic Sciences 2003;9:30. [Presents the referenced analyses, and also discusses the interconversion between the two substrates. SPME was utilized to recover the substrates for analysis.]

67) Meyers JE, Almirall JR. The analysis of gamma-hydroxybutyric acid (GHB) and gamma-butyrolactone (GBL) in forensic samples using gas chromatography/mass spectrometry (GC/MS) and proton nuclear magnetic resonance (H1-NMR). Proceedings of the American Academy of Forensic Sciences 2004;10:57. [Further investigates the interconversion between GHB and GBL, and presents a procedure for avoiding interconversion prior to analysis.]


70) Smith JV. Method for detection of 4-hydroxybutyric acid and its precursor(s) in fluids. U.S. US 6,617,123 (Cl. 435-19; C12Q1/44), 9 Sep 2003, Appl 607,026, 29 Jun 2000. [Appears to be a detection method for adulterated beverages (not biological fluids).]

71) Sabucedo AJ, Furton KG. Extractionless GC/MS analysis of gamma-hydroxybutyrate and gamma-butyrolactone with trifluoroacetic anhydride and heptafluoro-1-butanol from aqueous samples. Proceedings of the American Academy of Forensic Sciences 2004;10:109. [GHB can be derivatized directly in water solutions, without organic solvent extraction needed. GABA, diethylene glycol, BD, and GBL were analyzed under the same conditions (GBL gave a small response from conversion to GHB).]


74) Witkowski MR, Ciolino LA, DeFrancesco JV. GHB free acid: More on issues of interconversion with isolation and spectroscopic characterization of forensic analysis. Proceedings of the American Academy of Forensic Sciences 2003;9:30. [A forensic profile of the free acid (versus the more commonly encountered base form) is presented and discussed.]


**Ketamine:**


**Khat:**

77) Kite GC, Ismail M, Simmonds MSJ, Houghton PJ. Use of doubly protonated molecules

**LSD:**


**Marijuana and Related Cannabinoids:**


83) Fucci N. Growing cannabis with naphthalene in Rome. Forensic Science International 2003;138(1-3):91. [Presents the analysis of marijuana that was treated with naphthalene as a pesticide in a moderate sized home grow operation (80 plants); naphthalene was found in high concentration in the marijuana.]

85) Gambaro V, Dell'Acqua L, Fare F, Froldi R, Saligari E, Tassoni G. Determination of primary active constituents in cannabis preparations by high-resolution gas chromatography/flame ionization detection and high-performance liquid chromatography/UV detection. Analytica Chimica Acta 2002;468(2):245. [Presents a comparative study between the two title techniques for the complete, quantitative analysis of all the active constituents in cannabis. Validation studies were carried out on hashish.]

86) Gilmore S, Peakall R. Isolation of microsatellite markers in Cannabis sativa L. (marijuana). Molecular Ecology Notes 2003;3(1):105. [Fifteen markers were identified that can characterize genetic diversity in cultivated and natural marijuana populations.]

87) Gilmore S, Peakall R, Robertson J. Short tandem repeat (STR) DNA markers are hypervariable and informative in Cannabis sativa: Implications for forensic investigations. Forensic Science International 2003;131(1):65. [Presents a profiling study of 93 individual cannabis plants of widespread origin, using 5 STR markers. The authors claim that source determination is possible using the presented methods.]


90) Szabady B, Hidvegi E, Nyiredy S. Determination of neutral cannabinoids in hemp samples by overpressured-layer chromatography. Chromatographia 2002;56(Suppl. S):S165. [The overpressured-layer chromatographic separation of neutral cannabinoids (delta(9)-tetrahydrocannabinol, cannabidiol, cannabinol, cannabigerol and cannabichromene) was achieved on amino HPTLC plates, using dichloromethane as the mobile phase.]

91) Wojtasik E, Anyzewska M, Arent I. The optimization of the separation conditions for

**Mescaline/Peyote:**


**Methadone:**


**Methylenedioxyamphetamine and Related Compounds:**


97) Huang YS, Liu JT, Lin LC, Lin CH. Chiral separation of 3,4-methylenedioxymethylamphetamine and related compounds in clandestine tablets and urine by capillary electrophoresis/fluorescence spectroscopy. Electrophoresis 2003;24(6):1097. [MDA was also analyzed. Contrasts the title analysis with standard GC/MS methods.]

2002;49:99. [A study of Ecstasy tablets by TLC, UV, HPLC-DAD, and MS.]

99) Piette V, Parmentier F. Analysis of illicit amphetamine seizures by capillary zone electrophoresis. Journal of Chromatography A 2002;979:345. [Presents a CZE methodology for analysis of typical drugs found in Ecstasy tablets]


102) Schneider RC, Kovar KA. Analysis of ecstasy with a monolithic reverse-phase column. Chromatographia 2003;57(5-6):287. [Presents an HPLC method that analyzes for amphetamine, MDMA, MDEA, and N-methyl-1-(3,4-methylenedioxyphenyl)-2-butanamine in suspected ecstasy tablets.]

103) Schneider RC, Kovar K-A. Analysis of ecstasy tablets: Comparison of reflectance and transmittance near infrared spectroscopy. Forensic Science International 2003;134(2-3):187. [Presents analyses of mixed composition tablets by the title techniques; transmittance mode was found to be better than reflectance mode.]

**Methylphenidate:**


**Morphine, Codeine, and Related Opium Alkaloids:**

106) Baeyens WRG, VanderWeken G, Smet E, GarciaCampana AM, Remon JP. Comparison
of morphine and hydromorphone analysis on reversed phase columns with different diameters. Journal of Pharmaceutical and Biomedical Analysis 2003;32(4-5):913. [Presents the analysis of the title compounds by HPLC on 2, 3, and 4 mm i.d. RP columns with UV detection.]

107) Barnett NW, Hindson BJ, Lewis SW, Jones P, Worsfold PJ. Soluble manganese(IV); A new chemiluminescence reagent. Analyst 2001;126(10):1636. [Includes application for trace detection of morphine and codeine.]


111) Garrido JMPJ, Delerue-Matos C, Borges F, Macedo TRA, Olivera-Brett AM. Electroanalytical determination of codeine in pharmaceutical preparations. Analytical Letters 2002;35(15):2487. [Presents a square wave voltametric (SWV) method and a flow injection analysis system with electrochemical detection (FIA-EC) for determination of codeine in various pharmaceutical preparations. Limitations with certain co-ingredients (e.g., acetaminophen) are discussed.]


120) Sun GX, Wang Y, Sun YQ. The quantitative determinations of glycyrrhizic acid, glycyrrhetic acid, morphine, and sodium benzoate in compound liquorice tablets by HPCE. Journal of Liquid Chromatography and Related Technologies 2003;26(1):43. [Presents a CZE/UV method to perform the title analysis.]


**Opiate Alkaloids:**

122) Kuznetsov PE, Aparkin AM, Zlobin VA, Nazarov GV, Kosterin PV, Lyubun' EV,


**Opium (and Opium Poppies):**

124) Lurie IS, Panicker S, Hays PA, Garcia AD, Geer BL. Use of dynamically coated capillaries with added cyclodextrins for the analysis of opium using capillary electrophoresis. Journal of Chromatography A 2003;984(1):109. [Presents a rapid, precise, accurate, and robust method for analysis of the major opium alkaloids in either opium gum or latex. The same conditions may be utilized to analyze LSD exhibits.]

125) Reddy MM, Suresh V, Jayashanker G, Rao BS, Sarin RK. Application of capillary zone electrophoresis in the separation and determination of the principal gum opium alkaloids. Electrophoresis 2003;24(9):1437. [The presented method does not require sample purification or derivatization.]

126) Szucs Z, Szabady B, Szatmary M, Cimpan G, Nyiredy S. High-throughput analytical strategy with combined planar and column liquid chromatography for improvement of the poppy (Papaver somniferum L.) with a high alkaloid content. Chromatographia 2002;56(Suppl. S):S49. [Four different liquid chromatographic methods (multi-layer overpressured-layer chromatography (MLOPLC), normal-phase high-performance thin-layer chromatography (NPHPTLC), rapid reversed-phase high-performance liquid chromatography (RPHPLC), and a second, different RPHPLC method, were used for determination of alkaloid content of over 15,000 poppy capsule samples.]

**Overview/Polydrug:**

127) Peinhardt G. Identification of illegal drugs in pharmacy laboratories: Combination of thin layer chromatography and immunochemical quick tests. PZ Prisma 2002;9(2):99. [A combination of isolation and analytical methods are presented for detection and determination of cannabis, opiates, heroin, cocaine, amphetamines, designer drugs, and LSD.]
Pethidine:


Phenethylamines (including mixtures of Amphetamines, Methylenedioxy-amphetamines, and Related Compounds):

129) CampinsFalco P, VerduAndres J, HerraezHernandez R. Separation of the enantiomers of primary and secondary amphetamines by liquid chromatography after derivatization with (-)-1-(9-fluorenyl)ethyl chloroformate. Chromatographia 2003;57(5-6):309. [Analysis of amphetamine, methamphetamine, ephedrine, pseudoephedrine, MDA, MDMA, and MDE are reported. A variety of sample types (not specified in the abstract) were analyzed.]


132) Iwata YT, Kanamori T, Ohmae Y, Tsujikawa K, Inoue H, Kishi T. Chiral analysis of amphetamine-type stimulants using reversed-polarity capillary electrophoresis/positive ion electrospray ionization tandem mass spectrometry. Electrophoresis 2003;24(11):1770. [Presents the specialized CE/MS-MS analyses of a variety of ATS's, ranging from precursor ephedrines to methylenedioxy- substituted drugs.]


**Piperazines:**


136) Kercheval JC. GC/MS analysis of BZP and TFMPP. Mid-Atlantic Association of Forensic Sciences Newsletter 2004;32(2) (no page numbers). [Presents the GC/MS analyses of 1-benzylpiperazine and 1-(3-trifluoromethylphenyl)-piperazine.]


**Polydrug:**

138) Bazylak G, Nagels LJ. Simultaneous high-throughput determination of clenbuterol, ambroxol and bromhexine in pharmaceutical formulations by HPLC with potentiometric detection. Journal of Pharmaceutical and Biomedical Analysis 2003;32(4-5):887. [The title analysis was performed using six different isocratic systems.]

139) Benson AJ, Sabucedo A, Furton KG. Detection and identification of date rape drugs gamma-hydroxybutyrate (GHB), flunitrazepam (Rohypnol), lysergic acid diethylamide (LSD), scopolamine, diphenhydramine, and ketamine by refocused solid phase microextraction high performance liquid chromatography (SPME/HPLC) and solid phase microextraction high performance liquid chromatography mass spectrometry (SPME/HPLC/MS). Proceedings of the American Academy of Forensic Sciences 2003;9:29. [Presents a study of the SPME followed by HPLC and HPLC/MS for analysis of the referenced drugs.]


International 2004;141 (1):7. [The title analysis was applied for detection of GHB, GBL, and eight benzodiazepines (unspecified in abstract) in spiked beverages.]


144) Cherkaoui S, Veuthey JL. Use of negatively charged cyclodextrins for the simultaneous enantioseparation of selected anesthetic drugs by capillary electrophoresis-mass spectrometry. Journal of Pharmaceutical and Biomedical Analysis 2002; 27(3-4):615. [Presents the enantioseparation of bupivacaine, mepivacaine, ketamine, and prilocaine.]

145) Geraghty E, Wu C, McGann W. Effective screening for "Club Drugs" with dual mode ion trap mobility spectrometry. International Journal for Ion Mobility Spectrometry 2002;5(3):41. [Presents a study on the analysis of various "Rave" drugs by dual mode ITMS, including: Ketamine, GHB, ephedrine, flunitrazepam, methamphetamine, MDA, amphetamine, and MDMA.]


149) Lurie IS. Capillary electrophoresis analysis of a wide variety of seized drugs on the same dynamically coated capillary. Proceedings of the American Academy of Forensic Sciences 2004;10:107. [Drug types include phenethylamines, cocaine, heroin, oxycodone, morphine, LSD, psilocybin, opium, and GHB/GBL; both qualitative and quantitative results are achieved.]


151) Morehead RA. Optimizing HPLC separation of antidepressant drugs through stationary phase selection. Proceedings of the American Academy of Forensic Sciences 2003:9:304. [Includes a discussion of the primary separation mechanisms for 14 drugs; the referenced drugs were not identified.]

152) Pihlainen K, Kostiainen R. Effect of the eluant on enantiomer separation of controlled drugs by liquid chromatography - ultraviolet absorbance detection - electrospray ionisation tandem mass spectrometry using vancomycin and native beta-cyclodextrin chiral stationary phases. Journal of Chromatography A 2004;1033(1):91. [Presents the title study on nine amphetamine derivatives (not specified in abstract), methorphan, and propoxyphene. 14 seized drug samples (not specified in abstract) were analyzed using the optimized methodologies.]

**Propoxyphene:**

153) Magoon T, Ota K, Jakubowski J, Nerozzi M, Werner TC. The use of neutral cyclodextrins as additives in capillary electrophoresis for the separation and identification of propoxyphene enantiomers. Analytical and Bioanalytical Chemistry 2002;373(7):628. [Baseline separation was achieved in approximately 6 minutes.]

**Psilocybin Mushrooms, Psilocybin, and Psilocin:**

154) Linacre A, Cole M, Chun-I Lee J. Identifying the presence of "magic mushrooms" by DNA profiling. Science and Justice 2002;42(1):50. [Presents a minor review of DNA-based analyses of psilocybe and panaeolus mushrooms. The techniques are especially valuable for cases of dry, powdered material where microscopic
characterization is impossible."


**Psychotria viridis:**


**Salvia divinorum:**


**Steroids:**

compound has never been commercially marketed, and suggest that a clandestine source may therefore be in operation.]


163) Leinonen A, Kuuranne T, Kostiainen R. Liquid chromatography/mass spectrometry in anabolic steroid analysis-optimization and comparison of three ionization techniques: Electrospray ionization, atmospheric pressure chemical ionization and atmospheric pressure photoionization. Journal of Mass Spectrometry 2002;37(7):693. [The presented LC/MS/MS technique exhibited high sensitivity and specificity for the detection of various steroids, and may be a suitable technique for screening for the abuse of anabolic steroids.]


(Designer) Tryptamines (see also Psilocybin):


167) Meatherall R, Sharma P. Foxy, a designer tryptamine hallucinogen. Journal of Analytical Toxicology 2003;27(5):313. [Primary focus is analysis of biological fluids; however, includes a small scale mass spectra (from GC/MS) of "Foxy" (5-methoxy-N,N-diisopropyltryptamine).]

Zaleplon:


Zolpidem:

170) ElZeany BA, Moustafa AA, Farid NF. Determination of zolpidem hemitartrate by quantitative HPTLC and LC. Journal of Pharmaceutical and Biomedical Analysis 2003;33(3):393. [Presents the analyses of zolpidem in the presence of its degradation product by TLC-UV densitometry and by HPLC with UV detection.]

Zopiclone:


Miscellaneous:

172) Bartlett V. HPLC analysis of narcotic/acetaminophen admixtures. What to do if a compendium method doesn't work. The Restek Advantage 2002;3:6. [Discusses modifications to established methods for separating admixtures of compounds with similar structures.]
II) Synthesis and/or Cultivation of Abused Substances, their Precursors, and Essential Chemicals

Issue:
Forensic chemists must maintain familiarity with existing and new clandestine syntheses of abused substances, their precursors, and essential chemicals, and with the cultivation of abused natural products, in order to assist enforcement activities, to ensure safety and effectiveness during enforcement operations, and to provide expert testimony in legal proceedings.

Solution:
Illicit drug seizures, clandestine laboratory operations, and illicit grow operations, are continuously monitored to maintain a comprehensive overview of the field. In cases where new drugs are synthesized, or new methodologies are utilized, case reports are generated for the forensic and enforcement communities.

References:

Production of Abused Substances and/or their Precursors and Essential Chemicals:


of the common illicit syntheses of a variety of hallucinogens.]


III) Clandestine Laboratories - Appraisals and Safety

Issue:
Forensic chemists must maintain familiarity with clandestine laboratory procedures, setups, and techniques in order to assist enforcement activities, to ensure safety and effectiveness during enforcement operations, and in order to provide expert testimony in court proceedings.

Solution:
Clandestine laboratory operations are continuously reviewed to provide a comprehensive overview of the field. In cases where new methodologies are noted, or unusual safety concerns are salient, reports are generated for the forensic and enforcement communities.

References:

Clandestine Laboratory Appraisals and Safety:


dumpsites in Australia.]


Safety Issues - Case Reports:


Miscellaneous:


destruction).

IV) **Reference Drug Standards and Total Syntheses**

**Issue:**
Many reference drug standards or structurally related internal standards are either commercially unavailable, or if available are extremely expensive.

**Solution:**
Controlled substances and their structural or isotopically labelled analogs are synthesized as needed. Internal standards are also prepared as needed. Case reports are published for new or unusual standards or improved synthetic approaches.

**References:**


197) Klemenc S. 4-Dimethylaminopyridine as a catalyst in heroin synthesis. *Forensic Science International* 2002;129(3):194. [Presents a study on the acetylation of morphine using 4-dimethylaminopyridine (4-DMAP) as a catalyst.]


V) Source Determination of Drugs (Impurity Profiling) and Comparative Analyses

Issues:
Impurity profiling of drugs is important for comparative analysis protocols, geo-sourcing, and synthetic route determinations. However, although certain drugs have been well characterized with respect to their impurity profiles, most have not been properly investigated. Comparative analysis (i.e., the systematic application of impurity profiling for determination of commonality of origin) is complicated due to both the high complexity of the data and the large numbers of exhibits. Improved analytical and data handling techniques are needed.

Solution:
High sensitivity analytical techniques (primarily chromatographic) provide detailed profiles of trace-level impurities, ions, trace metals, and stable isotopes. Identification of individual impurities enhance origin identification and comparative analyses and also aid in development of internal standards for improved accuracy and precision of analysis.

In-depth analysis via improved instrumental methodologies help identify discriminatory components in impurity profiles. Computer databases, sorting programs, and pattern recognition/neural networks provide enhanced data handling and analysis, enabling and improving comparative analyses. Case reports are generated for the forensic and enforcement communities.

References:

Amphetamine(s):


209) Carter JF, Titterton EL, Grant H, Sleeman R. Isotopic changes during the synthesis of amphetamines. Chemical Communications 2002;21:2590. [Presents a study of the variations in C-13 and N-15 during various syntheses of amphetamine. The authors also claim that isotopic characterization can assist in identifying the synthetic origins of illicit MDMA and other amphetamines.]


**Cocaine:**


**Cocaine and Heroin:**

213) Galimov EM, Sevast'yanov VS, Kul'bachevskaya EV, Golyavin AA. Determination of isotopic compositions of carbon and nitrogen by the IRMS method: Implication for the source of narcotic substance origin. Doklady Earth Sciences 2003;393(8):1109. [Presents the title study on cocaine and heroin from different regions.]

**Dimethylamphetamine:**


**Heroin:**

215) Bora T, Merdivan M, Hamamci C. Levels of trace and major elements in illicit heroin. Journal of Forensic Sciences 2002;47(5):959. [Ten elements in 44 illicit heroin samples were determined using electrothermal atomic absorption spectrometry or inductively coupled plasma-atomic emission spectrometry.]


220) Hajdar M, Ruzdic E. Characterisation [sic] of heroin samples obtained in the area of the Federation of Bosnia and Herzegovina. Journal of Environmental Protection and Ecology 2003;4(4):873. [Presents the title survey, using GC/FID analysis to detect 8 opium alkaloids and 3 typical adulterants. The number of samples and the date range were not specified in the abstract.]


222) Zhang D, Shi X, Yuan Z, Ju H. Component analysis of illicit heroin samples with GC/MS and its application in source determination. Journal of Forensic Sciences 2004;49(1):81. [Presents a profiling analysis based on both GC and GC/MS. 500 samples were subclassified into nine groups using the presented techniques.]

Marijuana:


**Methamphetamine:**

225) Inoue H, Kanamori T, Iwata YT, Ohmae Y, Tsujikawa K, Saitoh S, Kishi T. Methamphetamine impurity profiling using a 0.32 mm i.d. nonpolar capillary column. Forensic Science International 2003;135(1):42. [The presented method allows for determination of 24 different characteristic starting materials and manufacturing byproducts.]


227) Koester CJ, Andresen BD, Grant PM. Optimum methamphetamine profiling with sample preparation by solid-phase microextraction. Journal of Forensic Sciences 2002;47(5):1002. [Volatile and semi-volatile components are recovered from illicit methamphetamine by SPME and analyzed by GC/MS. The method is claimed to be superior for profiling illicit methamphetamine.]

228) Kubicz-Loring E. Illicit methamphetamine profiling. Proceedings of the American Academy of Forensic Sciences 2003;9:30. [The impurity profiles of methamphetamine produced via the HI/red P reduction and Li/NH3 reductions are discussed and contrasted.]


4-Methoxyamphetamine and 4-Methoxymethamphetamine:


235) Waumans D, Bruneel N, Tytgat J. Anise oil as para-methoxyamphetamine (PMA) precursor. Forensic Science International 2003;133(1-2):159. [Presents a study of a large-scale PMA laboratory using anise oil as a precursor source. Includes impurity profiling studies that identified marker compounds for this synthesis.]

236) Waumans D, Bruneel N, Hermans B, Tytgat J. A rapid and simple GC/MS screening method for 4-methoxyphenol in illicitly prepared 4-methoxy-amphetamine (PMA). Microgram Journal 2003;1(3-4):184. [Confirms that 4-methoxyphenol is a marker compound for syntheses of PMA starting from anethole.]

Methylenedioxyamphetamine:

237) Armellin S, Brenna E, Fronza G, Fuganti C, Pinciroli M, Serra S. Establishing the synthetic origin of amphetamines by H-2 NMR spectroscopy. Analyst 2004;129(2):130. [The title study was applied to nine samples of N+acetyl-MDA.]

238) Bell SEJ, Barrett LJ, Burns DT, Dennis AC, Speers SJ. Tracking the distribution of "ecstasy" tablets by Raman composition profiling: A large scale feasibility study. Analyst 2003;128(11):1331. [Approximately 1500 tablets (all primarily MDMA) from different seizures in Northern Ireland were analyzed and found to have significant differences in their Raman spectra due to the presence of impurities and the degree of hydration of the MDMA. The results indicated that sample-sample comparisons could be
accomplished using Raman spectroscopy.]

239) Carter JF, Titterton EL, Murray M, Sleeman R. Isotopic characterization of 3,4-methylenedioxyamphetamine and 3,4-methylenedioxymethylamphetamine (Ecstasy). Analyst 2002;127(6):830. [Via analysis by IRMS and Deuterium NMR.]


242) Gimeno P, Besacier F, Chaudron-Thozet H. Optimization of extraction parameters for the chemical profiling of 3,4-methylenedioxyamphetamine (MDMA) tablets. Forensic Science International 2003;132(3):182. [Presents an optimized extraction procedure for recovery of impurities from MDMA tablets using diethyl ether extraction from a pH 11.5 buffered solution, followed by GC/MS analysis.]


244) Palhol F, Boyer S, Naulet N, Chabrillat M. Impurity profiling of seized MDMA tablets by capillary gas chromatography. Analytical and Bioanalytical Chemistry 2002;374(2):274. [Presents a study of MDMA tablets seized in France (total number not specified in the abstract). The authors claim that the results suggest that MDP2P is the most commonly used precursor, and that reductive amination is the most common synthetic route used to prepare the MDMA found in the tablets.]

245) Palhol F, Lamoureaux C, Naulet N. N-15 Isotopic analyses: A powerful tool to establish links between seized 3,4-methylenedioxyamphetamine (MDMA) tablets. Analytical and Bioanalytical Chemistry 2003;376(4):486. [Forty-three samples were analyzed by GC-Combustion-IRMS; the authors indicate that the technique can help establish common origins between samples.]
246) van der Peijl GJQ, van den Boom CPH, Bolck A, Dobney AM. XTC characterisation [sic] using ICPMS. Proceedings of the American Academy of Forensic Sciences 2004;10:53. [Presents the results of an ICPMS study of about 100 ecstasy samples.]

247) Titterton E, Carter J, Murray M, Sleeman R. Characterisation [sic] of ecstasy tablets by isotope ratio mass spectrometry. Proceedings of the 16th Meeting of the International Association of Forensic Sciences, Montpellier, France, September 2-7, 2002, pps 111-115. [MDA- and MDMA-based Ecstasy tablets were analyzed for deuterium, carbon-13, and nitrogen-15 to derive an isotopic fingerprint. Deuterium substitution was also determined via deuterium NMR.]

248) Vohlken BA, Layton SM. Instrumental separation of 3,4-methylenedioxy-amphetamine (MDA) from 1-(3,4-methylenedioxyphenyl)-2-propanol, a co-eluting compound. Microgram Journal 2003;1(1-2):32. [Presents a study of the referenced co-elution problem; includes the mass spectra for the title alcohol.]

249) Vu D-TT. Logo and headspace comparison for source determination of ecstasy seizures. Microgram 2001;34(9):244.

250) Waddell RJH, NicDaeid N, Littlejohn D. Classification of ecstasy tablets using trace metal analysis with the application of chemometric procedures and artificial neural network algorithms. Analyst 2004;129(3):235. [Presents a study of the practicality of ICP-MS for sample-sample comparisons. Several statistical analyses are evaluated.]

Opium and Opium Alkaloids:

251) Al-Amri AM, Smith RM, El-Haj BM, Juma'a MH. The GC-MS detection and characterization of reticuline as a marker of opium use. Forensic Science International 2004;140(2-3):175. [Reticuline was detected as its trimethylsilyl ethers, acetyl esters, and methyl ethers, in opium and in the urine of opium users. The results can be used to differentiate between opium and heroin users.]


253) Kelly SA, Glynn PM, Madden SJ, Grayson DH. Impurities in a morphine sulfate drug product identified as 5-(hydroxymethyl)-2-furfural, 10-hydroxymorphine and
10-oxomorphine. Journal of Pharmaceutical Sciences 2003;92(3):485. [The referenced impurities were isolated by semi-prep HPLC and identified via MS and NMR. The presence of sugars in the drug formulation was implicated in the formation of the impurities.]

**Occluded Solvent Analyses:**

254) Camarasu CC. Unknown residual solvents identification in drug products by headspace solid phase microextraction gas chromatography-mass spectrometry. Chromatographia 2002;56(Suppl. S):S131. [Presents a sensitive headspace SPME method for the extraction of residual solvents from pharmaceutical products (the specific products were not detailed in the abstract). The SPME method appears to be more sensitive than static headspace techniques.]

**Multi-Drug and Miscellaneous:**

255) Binder R, Machata G, Stead H. Analysis of potassium permanganate as a narcotic drug precursor. Archiv fur Kriminologie 2003;211:160. [Thirty-one samples were analyzed for 9 metallic elements using emission spectroscopy and ICP-OES. The results did not allow classification of the samples according to origin.]


258) Palhol F. Contribution of isotopic analyses to the fight against drug trafficking. Actualite Chimique 2003;(8-9):27. [Appears to be an overview of the topic (not clear from the abstract).]


260) Watanabe S, Shibata M, Kataoka K. Comparison of data obtained by various GC
methods for impurity profiling of stimulant drugs. Kanzei Chuo Bunsekishoho 2002;42:73. [Three different GC methods were used for impurity profiling of 10 typical impurities in 12 samples of stimulant drugs (not specified in abstract).]

VI) Analysis of Non-Controlled Pharmaceuticals, Pseudo-Drugs, Adulterants, Diluents, and Precursors

Issue:
Most "street-level" drugs are "cut" with various adulterants and diluents. Many of these cutting agents are pharmaceutical products or precursors. Others are "carry-through" compounds present in precursors (especially in cold remedy products). Separation and identification of these extraneous materials can be tedious, especially in exhibits which contain many components. In addition, new or unusual adulterants and/or diluents are occasionally identified in drug exhibits, and standard analytical data are required for these substances. Finally, improved methods of analysis, i.e., faster, more discriminatory, less costly, etc., are needed for all cutting agents.

Solution:
Reports providing standard analytical data and/or improved analytical protocols for non-controlled pharmaceuticals, pseudo-drugs, adulterants, diluents, and precursors are generated for the forensic and enforcement communities.

References:

Creatine:


263) Dash AK, Sawhney A. A simple LC method with UV detection for the analysis of creatine and creatinine and its application to several creatine formulations. Journal of Pharmaceutical and Biomedical Analysis 2002;29(5):939. [Presents a simple and sensitive LC method for the determination of creatine and creatinine in various creatine supplement formulations.]


265) Wagner SD, Kaufer SW, Sherma J. Quantification of creatine in nutrition supplements by thin layer chromatography-densitometry with thermochemical activation of fluorescence quenching. Journal of Liquid Chromatography and Related Technologies...
Ephedra, Ephedrine, and/or Pseudoephedrine and Related Compounds:


alkaloids by liquid chromatography/tandem mass spectrometry. JAOAC International 2003;86(3):471. [Presents an LC-MS/MS methodology for determination of six major ephedra alkaloids in various substrates, ranging from raw ephedra to a high-protein drink mix containing ephedra.]


278) Wedig M, Laug S, Christians T, Thunhorst M, Hozgrabe U. Do we know the mechanism of chiral recognition between cyclodextrins and analytes? Journal of Pharmaceutical and Biomedical Analysis 2002;27(3-4):531. [Chiral separation of ephedrine-type phenethylamines using various cyclodextrins is examined by CE and NMR.]

279) Ye NS, Gu XX, Zou H, Zhu RH. Separation and determination of ephedrine enantiomers by capillary electrophoresis using L-leucine as chiral selector. Chromatographia 2002;56(9-10):637. [The technique was applied to the analysis of ephedra plant extracts.]


281) Zhang JY, Xie JP, Chen XG, Hu ZD. Sensitive determination of ephedrine and pseudoephedrine by capillary electrophoresis with laser-induced fluorescence detection. Analyst 2003;128(4):369. [The title technique was applied to the analysis of ephedra and ephedra preparations.]

282) Zhang JY, Xie JP, Liu JQ, Tian JN, Chen XG, Hu ZD. Microemulsion electrophoretic chromatography with laser-induced fluorescence detection for sensitive determination of
ephedrine and pseudoephedrine. Electrophoresis 2004;25(1):74. [The two substrates were derivatized with 4-chloro-7-nitrobenzo-2-oxa-1,3-diazol prior to analysis. The technique was applied to Chinese traditional herbal preparations.]

**Phenylpropanolamine:**


**Other Adulterants/Diluents (including mixtures containing Ephedrine and/or Pseudoephedrine):**


285) Garcia A, Ruperez FJ, Marin A, delaMaza A, Barbas C. Poly(ethyleneglycol) column for the determination of acetaminophen, phenylephrine and chlorpheniramine in pharmaceutical formulations. Journal of Chromatography B - Analytical Technologies in the Biomedical and Life Sciences 2003;785(2):237. [Presents a rapid, isocratic HPLC method for determination of the three title compounds in cold medications. UV detection at 215 nm and 310 nm was used.]

286) Geer LC, Hays PA. Letrozole (Femara®) Microgram Journal 2003;1(3-4):190. [Presents analytical data (GC/MS, FTIR, and NMR) for the title compound.]


289) Marin A, Garcia E, Garcia A, Barbas C. Validation of a HPLC quantification of acetaminophen, phenylephrine and chlorpheniramine in pharmaceutical formulations: Capsules and sachets. Journal of Pharmaceutical and Biomedical Analysis 2002;29(4):701. [Presents the simultaneous determination and quantitation of the title compounds (and also phenylpropanolamine) in various pharmaceutical formulations.]


292) Qi ML, Wang P, Zhou L, Gu JL, Fu RN. Simultaneous determination of acetaminophen, dextromethorphan [sic] and pseudoephedrine hydrochloride in a new drug formulation for cold treatment by HPLC. Chromatographia 2003;57(3-4):139. [Presents a validated method for the referenced analysis, which is completed in less than 10 minutes per run.]

293) Rothchild R. Identification of a heroin diluent: One- and two-dimensional proton and carbon-13 NMR studies of procaine hydrochloride: Computational studies of procaine and its conjugate acid. Spectroscopy Letters 2003;36(1&2):35. [Presents the isolation (from a street sample of heroin) and identification of the title compound, and also presents ab initio molecular modeling calculations.]


Theophylline:

296) Huan L, Kan Q, Wang X, Lui X, Bi K. Simultaneous determination of the contents of...
five components in compound theophyllini [sic] tablets by statistical-simulation spectrometry. Huaxue Fenxi Jiliang 2002;11(4):11. [Compounds determined included amidopyrine [sic], phenacetine [sic], theophylline, theobromine, and caffeine.]

VII) New and/or Improved Instrumental Techniques

Issue:
Forensic Chemists must maintain familiarity with updates in current instrumental techniques and become versant in new, improved methods of analysis.

Solution:
Improved/existing and new technologies are reviewed and applied to both routine and specialized analyses of drugs. In cases where improved performance is observed, case reports are generated for the forensic community.

References:

Capillary Electrophoresis (and Related Techniques, including Tandem Techniques):


Gas Chromatography (and Tandem GC Techniques):


310) Dallabetta-Keller T. Trace analysis by GC/MS using pulsed splitless injections. Proceedings - NOBCChE 2001;28:4. [A pressure pulsed injection technique for GC/MS allows for enhanced detection of trace level controlled substances.]

311) Gorecki T, Harynuk J, Panic O. Comprehensive two-dimensional gas chromatography (GC x GC). New Horizons and Challenges in Environmental Analysis and Monitoring [Workshop], Gdansk, Poland, Aug. 18-29, 2003, pps 61-83. [Presented examples include (unspecified) forensic samples.]

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**High-Performance Liquid Chromatography (and tandem HPLC techniques):**

313) Conemans JMH, Van Der Burgt AAM, Van Rooij JML, Pijnenburg CC. The simultaneous determination of illicit drugs with HPLC-DAD. Bull TIAFT 2004;34(1):11. [The presented method is applied to drug powders, various dosage forms, and various biological matrices, in a clinical setting.]


317) Perrin C, Matthijs N, Mangelings D, GranierLoyaux C, Maftouh M, Massart DL, VanderHeyden Y. Screening approach for chiral separation of pharmaceuticals; Part II. Reversed-phase liquid chromatography. Journal of Chromatography A 2002;966(1-2):119. [A screening strategy for the rapid separation of drug enantiomers by reversed-phase liquid chromatography is presented. Results for 37 diverse chiral pharmaceuticals are presented (the specific products were not detailed in the abstract).]


321) Sychev KS, Sychev SN. Application of universal mobile phases in high-effective liquid chromatography for analysis of the objects of food industry, criminology and pharmaceutical chemistry. Zavodskaya Laboratoriya, Diagnostika Materialov 2003;69(9):8. [Various diethylammonium based run buffers are examined for RP-HPLC.]


**Inductive Coupled Plasma- Mass Spectrometry (ICP-MS):**


**Infrared and Raman Spectroscopy:**


tables (for forensic purposes).]

329) Jarman JL, Seerley SI, Todebush RA, de Haseth JA. Semiautomated depositor for infrared microspectrometry. Applied Spectroscopy 2003;57(9):1078. [Presents a novel method for depositing minute samples for IR microspectrometry (the authors suggest applicability to forensic analyses).]


**Ion Spectroscopy:**


**Mass Spectrometry:**


334) Libong D, Pirmay S, Bruneau C, Rogalewicz F, Ricordel I, Bouchonnet S. Adsorption-desorption effects in ion trap mass spectrometry using in situ ionization. Journal of Chromatography A 2003;1010(1):123. [Quadrupole mass spectrometers were compared for the GC/MS analyses of diazepam, alprazolam, triazolam, LSD, trimethylsilylated LSD, and trimethylsilylated buprenorphine.]


**Microchip Technology:**


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Belder D, Deege A, Maass M, Ludwig M. Design and performance of a microchip electrophoresis instrument with sensitive variable-wavelength fluorescence detection. Electrophoresis 2002;23(14):2355. [A modular instrument for high-speed microchip electrophoresis equipped with a sensitive variable-wavelength fluorescence detection system was developed and evaluated using fluorescein isothiocyanate (FITC)-labelled amines, including amphetamine.]

Felton MJ. Lab on a chip: Poised on the brink. Analytical Chemistry 2003;75(23):505A. [A review of the topic, and an overview of the available instrumentation in the field.]

Harris CM. Shrinking the LC landscape. Analytical Chemistry 2003;75(3):65A. [A conversational overview of recent developments in chip-based technologies.]


**Nuclear Magnetic Resonance Spectroscopy:**


**Osmolality:**

Wesley JF. Osmolality - A novel and sensitive tool for detection of tampering of adulterated with ethanol, gamma-butyrolactone, and 1,4-butanediol, and for detection of dilution-tampered demerol syringes. Microgram Journal 2003;1(1-2):8. [Presents the title technique and various real-world applications.]

**Solid Phase Micro-Extraction:**


Thin Layer Chromatography:


X-Ray based Techniques:


Rendle DF. Use of X-rays in the United Kingdom Forensic Science Service. Advances in X-ray Analysis 2003;46:17. [Presents four case studies, including the use of XRD in the analysis of "street drug seizures" (not specified in the abstract)]
VIII) Portable Detection and Analytical Instrumentation

Issue:
"Free Trade" agreements and the easing of formally restrictive national and international borders have resulted in dramatic increases in cargo transshipments and personal travel, thereby complicating drug inspection and interdiction efforts at POEs. Discovery and confirmational analysis of suspected drugs in cargo or on individuals is severely hampered by the lack of on-site detection and/or analytical equipment.

Solution:
Development of portable and highly sensitive detectors for drug detection and analyses allows law enforcement personnel and/or forensic chemists to perform screening type analyses on-site. In those cases where new methodologies have proven effective, case reports are generated for the forensic and enforcement communities.

References:


352) Bannister WW, Chen C-C, Curby WA, Chen EB, Damour PL, Morales A. Thermal analysis for detection and identification of explosives and other controlled substances. U.S. US 6406918 B1 18 June 2002. [Includes identification of illicit drugs (i.e., in addition to explosives).]


355) Buryakov IA, Kolomiets YN. Rapid determination of explosives and narcotics using a
multicapillary-column gas chromatograph and an ion-mobility spectrometer. Journal of Analytical Chemistry - Russia (translation of Zhurnal Analiticheskoj Khimii) 2003;58(10):944. [The title technique was applied to detection of heroin, cocaine HCl and cocaine base (crack).]

356) Buryakov IA. Express analysis of explosives, chemical warfare agents, and drugs with multicapillary column gas chromatography and ion mobility increment spectrometry. Journal of Chromatography B - Analytical Technologies in the Biomedical and Life Sciences 2004;800(1-2):75. [The title technique was applied to analysis of heroin, cocaine hydrochloride, and cocaine base.]


361) Harris CM. Raman on the run. Analytical Chemistry 2003;75(3):75A. [A conversational overview of recent developments in portable Raman, including a comparative listing of five commercially available instruments.]

362) Kiraly B, Sanami T, Doczi R, Csikai J. Detection of explosives and illicit drugs using neutrons. Nuclear Instruments & Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms 2003;213:452. [Presents a Thermal Neutron Activation technique for the title analyses. The “illicit drugs” were not specified in the abstract.]


367) Smith WD. SAW chip sniffs out cocaine. Analytical Chemistry 2003;75(23):492A. [Presents an overview of the use of surface acoustic wave based devices for detecting cocaine vapor or particulates.]


IX) Miscellaneous

References:

Analytical Artifacts:

371) Varshney K-M. HPTLC study of the stability of heroin in methanol. Journal of Planar Chromatography 2002;15(1):46. [Presents the results of a degradation study of heroin in methanol (at room temperature). The results indicate degradation is measurable on Day 2, and is complete in around 38 weeks.]

Chemometrics:


Cocaine:

373) Brachet A, Rudaz S, Mateus L, Christen P, Veuthey J-L. Optimisation [sic] of accelerated solvent extraction of cocaine and benzoylecgonine from coca leaves. Journal of Separation Science 2001;24(10-11):865. [A variety of extraction parameters were varied to achieve the optimal results. Analysis was conducted by GC/FID and CE with UV detection.]


Counterfeit Drugs:


**Dragon's Blood:**

377) Edwards HGM, de Oliveira LFC, Prendergast HDV. Raman spectroscopic analysis of Dragon's Blood resins - Basis for distinguishing between Dracaena (Convallariaceae), Daemonorops (Palmae), and Croton (Euphorbiaceae). Analyst 2004;129(2):134.


**Drugs on Currency:**


**Heroin:**

383) Brazier JS, Morris TE, Duerden BI. Heat and acid tolerance of Clostridium novyi Type A spores and their survival prior to preparation of heroin for injection. Anaerobe 2003;9(3):141. [Presents the title study. This study was in followup to the outbreak of clostridium illnesses and deaths in the United Kingdom as a result of the use of contaminated heroin. The results indicate that typical heroin preparation procedures (by abusers) are not adequate to kill the spores.]

**Khat:**

history, cultivation, and constituents of khat; however, the primary focus is pharmacological.]

**Methamphetamine:**


**Qualitative Tests:**


389) Makarov SA, Simonov EA, Makarov VG, Kozlov AS. Method for determination of narcotic, psychotropic and offensive substances of plant and synthetic origin. Russ. RU 2,205,385 (Cl. G01N21/78) 27 May 2003, Appl. 2,002,103,845, 18 Feb 2002. [Appears to present a narcotics test kit (abstract is not clear).]


Quality Assurance:


394) Chang W-T, Smith J, Liu RH. Isotopic analogs as internal standards for quantitative GC/MS analysis - Molecular abundance and retention time differences as interference factors. Journal of Forensic Sciences 2002;47(4):873. [Isotopic analogues of five barbiturates were evaluated as internal standards.]


397) Hibbert DB. Scientist vs the law. Accreditation and quality assurance. 2003;8(5):179. [Presents an analysis of an Australian court case where convicted clandestine laboratory operators were acquitted on appeal due to alleged shortcomings in the laboratory's standard operating procedures.]


399) Moeller MR. Forensic conclusiveness and quality assurance of toxicological results. Research in Legal Medicine 2003;30:55. [An overview of the legal consequences of toxicological analyses.]

Sampling Plans:


Surveys and Overviews:


404) Briellmann TA, Dussy FE, Bovens MG. Forensic analysis of heroin and cocaine seizures. Chimia 2002;56:74. [Presents a survey and overview of seizures in Switzerland (date range not specified in abstract).]


416) Myers S. Forensic science. Nature  2003;421(6925):872. [A minor overview of the development of forensic DNA laboratories; includes some general comments of interest on the "real-life value" of forensic laboratories.]


419) Poon NL, Chong WC. Ecstasy in Hong Kong. Proceedings of the American Academy of
Forensic Sciences 2002;8:60. [An overview of the trends in ecstasy seizures in Hong Kong, including a review of tablet characteristics that might be valuable in source determinations.]


424) van Zundert M. Travel-pills, ecstasy pills, or Grandma's heart-rhythm pills? Pharmaceutisch Weekblad 2002;137(51/52):1825. [Appears to be a conversational overview presenting the use of TLC and GC for the identification of unknowns at a Dutch emergency pill identification lab.]


Other:


428) Bilia AR, Bergonzi MC, Lazari D, Vincieri FF. Characterization of commercial kava-kava herbal drug and herbal drug preparations by means of nuclear magnetic resonance spectroscopy. Journal of Agricultural and Food Chemistry 2002;50(18):5016. [NMR was used to determine the kavalactones in both a finely powdered herbal drug and a commercial extract.]


432) Harris HA, Newman MS, Montreuil RS, Goodrich JT. Comparison of extraction in a drop and solid phase microextraction. Proceedings of the American Academy of Forensic Sciences 2003;9:33. [Explains and compares the two referenced extraction techniques. Drugs utilized include cocaine, phenylpropanolamine, brompheniramine, and dextromethorphan.]


434) Mausolf N. The name of the test. Microgram 2001;34(9):235. [On the Duquenois and related tests for cannabis.]

436) Pitts SJ, Thomson CI. Analysis and classification of common vegetable oils. Journal of Forensic Sciences 2003;48(6):1293. [Presents methods of analysis for canola, corn, olive, peanut, safflower, soybean, and sunflower oils. (Although not stated, this study may also have value in the analysis of preparations of steroids in oils.)]

437) Puschel K, Stein S, Stobbe S, Heinemann A. Analysis of 683 drug packages seized from "body stuffers". Forensic Science International 2004;140(1):109. [Presents a short overview of the practice of internal carrying of controlled substances, with a discussion of packaging and drug types, as observed in Hamburg, Germany.]
