

Spectroscopy Focus

THE METH MYSTIQUE (D vs L)

Don Harris

Have you ever used methamphetamines? Has your child ever used them? Are you absolutely certain? You may be surprised to learn that perhaps you BOTH may, unknowingly, have used methamphetamines (for years) through routine self-medication.

Typically if someone mentions methamphetamines what comes to mind is the street drug "crystal meth" and all of the negative connotations of a hyped-up, paranoid, often violent individual who uses it. However, what most people do not know is that there are TWO forms of methamphetamine: An illegal drug, Dextro-methamphetamine (D), commonly known as "crystal meth", and the legal drug, Levo-methamphetamine (L), which is a common therapeutic pharmaceutical. Until recently, it was difficult to scientifically distinguish between these two forms.

“MASS SPECTRAL ANALYSIS RELIES ON SHATTERING THE MOLECULES INTO FRAGMENTS, MUCH LIKE A HAMMER SHATTERS A PIECE OF GLASS”

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Analytical Solutions and Providers, LLC, (ASAP Analytical) has developed an improved analysis to determine the specific form of Methamphetamine using the ASAP GC.IRD system. The GC.IRD system combines the separating power of the GC with the structural identification of the IRD. The ASAP GC.IRD is a common instrument found in Forensic, Petrochemical and Pharmaceutical laboratories for the identification of routine to complex samples and is very complementary to GC/MS.

In the diagram below of the Infrared Detector (IRD) the infrared light is created by an IR source. The light from the source passes through the interferometer and then through a flow cell. Any light that reaches the end of the flow cell is collected and focused on a detector. The detector converts the intensity of the beam into an electrical signal. Appropriate electronics then convert the signal to digital numbers that the computer can process. While infrared light is streaming through the flow cell, the gas chromatograph (GC) is separating the components of the sample. The end of the GC column extends from the GC oven to the flow cell through a heated interface that maintains thermal uniformity. As each component elutes from the column, it passes through the flow cell. Since IRD is nondestructive, each component is returned to the GC oven via a second heated interface.

The IRD measures, repeatedly and as fast as possible, the infrared spectrum of the component in the flow cell. When only carrier gas is present, there is no detectable absorption. But when a component of the unknown mixture elutes, you get a spectrum. The wavelengths absorbed depend on the identity of the compound and the amount of radiation depends on the amount of the compound present.

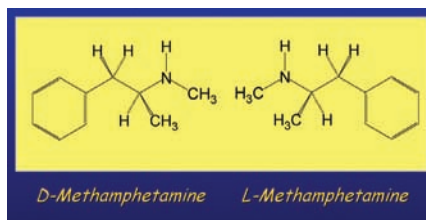


Figure 1. Methamphetamine Structures

Don Harris, President of ASAP, describes the problem in differentiating the two forms of methamphetamine as follows: "Imagine that the legal form of methamphetamine looks like your left hand. The drug of abuse form looks like your right hand. The forms are mirror images of each other, and the right-handed one is a very powerful narcotic. As an example, the therapeutic form is the active ingredient in an over-the-counter inhaler and other over-the-counter medicines, and is extremely effective for the treatment of cold symptoms."

Now this comparison of D vs L with methamphetamine use has an interesting and controversial story attached to it. Mr. Harris adds, "The identification of these isomers of methamphetamine is an important issue. In the 2002 Winter Olympics, a British skier was stripped of his Bronze medal after he tested positive for methamphetamine use. The banned substance as defined by the World Anti-Doping Agency and adopted by the International Olympic Committee is specifically the right-hand isomer – the illegal street drug. However, the GC/MS analysis typically performed on these drugs does not provide unique, spectral identification. The GC.IRD analysis does."

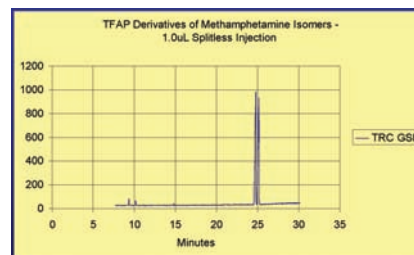


Figure 2. DB-1301 Column

Alain Baxter, the British skier in question, has authorised a biography entitled Unfinished Business. [1] Baxter describes his struggles and legal battles with the International Olympic Committee over an apparent mistake in his drug test in the Salt Lake City Olympics. Baxter tested positive for "methamphetamine", but claims not to have used the banned form. He admits to having used an inhaler though.

Eventually Baxter was cleared and re-instated as an Olympic athlete. He competed in the 2006 Turin Olympics, but he remains stripped of his 2002 Bronze medal. The IOC considers Baxter's case closed, and is steadfast in its position.

"The problem in analysing methamphetamines," comments Dr. Charles C. Johnson, PhD, Former Technical Support Manager of ASAP, "is that the conventional testing is done by GC.MSD.

The GC, or Gas Chromatography is intended to separate the components. In this case, the GC does not separate the Dextro from the Levo form. Compounding the problem is that the Mass Spectral, or MS, analysis gives identical spectroscopic results as well.

In other words, the assumption is that if a testing lab finds any methamphetamine, it must be the drug-of-abuse form. This bias is unscientific."

Mass Spectral analysis relies on shattering the molecules into fragments, much like a hammer shatters a piece of glass. Each molecule will break in a predictable way based on its structure. The problem is that the fragments produced from MS analysis of methamphetamine, regardless of the isomer, gives the same, identical fragments.

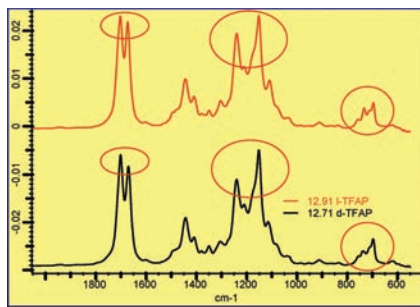


Figure 3. L & D IRD Spectra

"The GC.IRD analysis relies on reacting the methamphetamine isomer with a compound that will allow the GC to separate the isomers.

Then the separated isomers are identified using Vapor-Phase Infrared Spectroscopy in the IRD. We can measure the vibrations of the individual molecules, and a unique fingerprint pattern is established for each form of the methamphetamine.

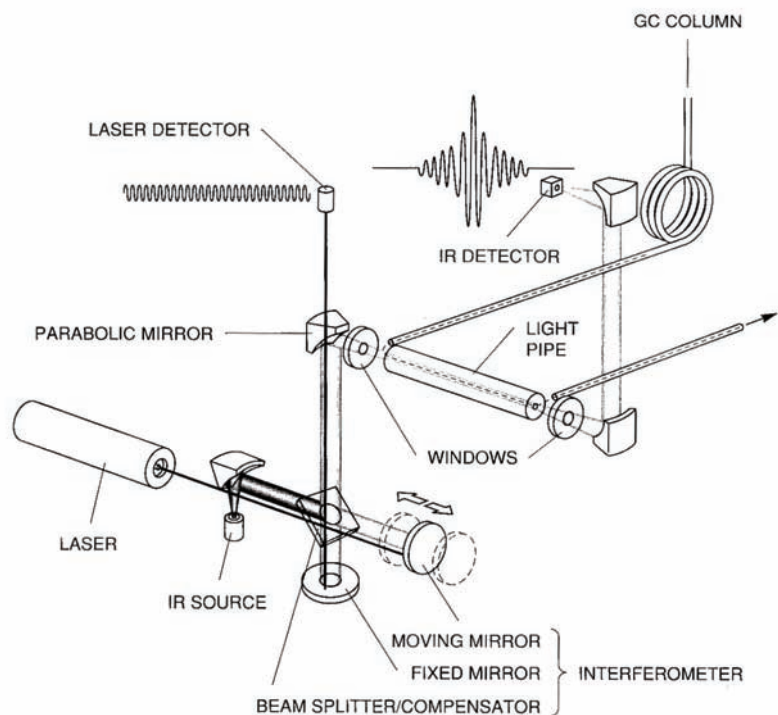
The same procedure used on a GC.MSD system still provides no significant spectroscopic differentiation" adds Johnson.

ASAP has worked closely with police labs around the country with this Vapor Phase Infrared technology. This procedure, which was developed in collaboration with the Oklahoma State Bureau of Investigation, has been independently confirmed at the New Jersey State Police. Further refinements to the procedure are expected in the future.

The GC.IRD system from ASAP was being exhibited at Pittcon 2007 in Chicago at the McCormick Place. Don Harris commented, "I have never had the opportunity to meet Alain Baxter but, hopefully, now more testing will be done to make this a viable method since there are good and bad drugs in society."



Schematic Diagram of IRD



References:

1. Unfinished Business, http://www.dewilewismedia.com/PAGES/ALAIN_BAXTER.html
2. The World Anti-Doping Code: The 2006 Prohibited List, International Standard, effective 1 January 2006.
3. IOC Anti-Doping Rules – 10.11.2005(F)
4. Methamphetamine and Drug Tests, The Vaults of Erowid, http://www.erowid.org/chemicals/meth/meth_testing

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