Editorial

Isomerism in Forensic Drug Chemistry

The first three papers in this issue describe some of our continuing efforts in developing methods for the differentiation of regioisomeric and isobaric phenethylamines of importance in forensic drug chemistry. This work is also designed to test and challenge the specificity of methods used in forensic drug sample evaluation and identification. The papers included in this issue are specifically related to the methylenedioxy-methamphetamines and the appropriate precursor substances. The methylenedioxy-phenethylamine group of compounds has been the focus of a significant amount of designer drug attention in recent years.

Designer drugs have been described as substances created by clandestine synthesis to get around existing drug laws by various degrees of molecular modification. Some countries have dealt with the legal issues of designer drugs by placing controls on individual molecular species while others such as the US have developed a controlled substance analog law attempting to proactively control many substances before they appear as clandestine drugs. In either case, the forensic chemist is left with the need to specifically identify any new substance encountered in a drug sample.

Regioisomeric relationships are the result of different positions of attachment of functional groups in compounds that possess the same molecular formula (elemental composition). Isobaric substances are of the same nominal mass but different elemental compositions. Regioisomeric and isobaric substances are considered a significant challenge for the analytical techniques used to identify specific substances. This is extremely important when some of these molecules are legally controlled drugs of abuse or controlled precursor substances. Gas chromatography–mass spectrometry is the mandated method of confirming drug identity in a number of forensic and regulatory situations.

While the mass spectrum is often considered a specific "fingerprint" for an individual compound, there are other substances which may produce very similar or almost identical mass spectra. Such compounds having mass spectral equivalency and similar elution properties, perhaps co-elution represent a serious analytical challenge. When the number of mass spectral equivalent isomeric substances is relatively small, chromatographic separation and reference standard availability is not a major concern. However, the continued designer exploration of some drug categories will likely produce even greater numbers of regioisomeric and isobaric substances especially among the phenethylamines. As the number of compounds having mass spectral equivalence increases, so will the challenge of specific identification via chromatographic resolution and other analytical methods.

The substituted phenethylamines show major fragments in their electron impact ionization mass spectra from cleavage of the bond between the two carbons connecting the aromatic ring and the nitrogen atom of the amine functional group. Those regioisomeric and isobaric relationships occurring within the major mass spectral fragmentation sites not only have the same molecular weight but can also yield EI decomposition ions at equal mass, equivalent mass spectra.

The following three individual studies are part of our overall efforts to provide for greater analytical specificity in the identification of individual drug species via evaluation of the most likely imposter molecules.

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