K78 Stability of Synthetic Cathinones (Bath Salts) in Toxicology Specimens

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After attending this presentation, attendees will learn about the *in vitro* degradation of synthetic cathinones, often referred to as bath salts. Based on the hypothesis that beta-keto amphetamines are inherently unstable in biological matrices, a preliminary study using several cathinones spiked in blood and urine samples stored at ambient and refrigerated temperatures was evaluated by Liquid Chromatography with Tandem Mass Spectrometry (LC/MS/MS)
and Liquid Chromatography/Time-Of-Flight/Mass Spectrometry (LC/TOF/MS) over a five-week time period. This model system revealed temperature-dependent and compound-specific decay rates among the commonly known cathinones.

This presentation will impact the forensic science community by emphasizing the effects of storage conditions and type of biological sample used to perform analysis. Data reflected a rapid signal degradation, which was accelerated in ambient storage conditions and urine specimens. The values extrapolated from each experiment yielded putative rate constants, which were compared to previous actual cases with confirmed cathinones. The limited data analyzed from the five-week trial with sampling each week produced a broad generalization that could aid interpretation of results, especially when intoxication was observed yet there is an absence of confirmatory signal.

The most stable cathinone in this study was methylenedioxypyrovalerone (MDPV), which retained as much as 29% in blood stored at room temperature. In distinction, naphyrone and mephedrone showed a complete loss of response. Compared to room temperature, refrigerated blood had an overall average increase in stability by 34%. Urine samples at room temperature demonstrated the most dramatic effect between sample and temperature. All cathinones, excluding MDPV, fell sharply at day 8, followed by an even greater drop below 5% or complete loss of signal by day 29. In comparison, refrigerated urine had an overall average increase in stability by 45%. The differences show that biological specimen and temperature significantly affect synthetic cathinone stability. Both specimens produced more stability in refrigerated temperature (4°C) compared to ambient temperature (21°C). The complete or significant loss in signal occurred earliest in urine samples at ambient temperatures.

The lessons learned from this pilot study were applied to actual postmortem and DUI forensic toxicology cases. For postmortem samples collected at autopsy, the urine specimens were stored frozen at -20°C without preservative, while decomposition fluid was stored at 4°C in grey top blood tubes preserved with sodium fluoride. For DUI samples collected, the urine contained no preservative and was refrigerated at 4°C. These specimens were re-analyzed and the rate constant and half-life calculated from the stability experiment were applied and compared to previous cases. The degradation of each cathinone followed a first order rate of decay. MDPV was the compound confirmed in all cases. The rate constant determined from the pilot study agreed fairly well with actual case results.

This study indicates that it is possible for a specimen to generate a false negative result if the specimen was stored at room temperature or analyzed after a significant time delay. Refrigeration proved to lengthen stability for both types of specimens, with refrigerated urine producing the greatest stability. The stability of cathinones in biological samples is extremely important due to its increasing use among drug abusers and lack of experience in toxicology laboratories. Factors that may influence drug stability in stored samples include: storage temperature, storage time, addition of preservatives, and initial condition of the collected sample. Furthermore, LC/TOF/MS analysis revealed that as cathinone levels diminished, their corresponding “reduced” forms became more prevalent. This development may signal the need for reduced derivatives of cathinone standards for use in forensic toxicology confirmations.

Bath Salts, Stability, Toxicology

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