

# Inhomogeneities in 'legal highs': Playing russian roulette with your health

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## Introduction

A 'bath salt' product ('9/11') containing 4-methylethcathinone (4-MEC) as the active ingredient and a 'herbal mixture' ('ACME', active ingredient JWH-210) were involved in the death of a 29 year old male. To evaluate if an unintended dosing error could have contributed to the fatal outcome, a study was conducted to determine the distribution of the 4-MEC and JWH-210 content in a single package and between several packages.

## Materials and methods

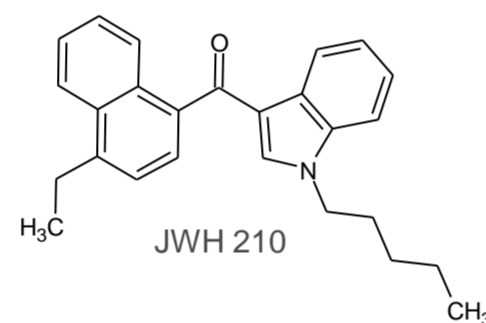
### Sample preparation

36 packages of the 'bath salt' and 19 packages of the herbal mixture were analyzed. 100 mg portions of the 'bath salt' and 200 mg portions of the herbal mixture were exactly weighted in a test tube and extracted with methanol and ultrasonication for 15 minutes. 5 µl of the extract were spiked with internal standard and diluted in mobile phase B. The analysis was then accomplished on a HPLC-DAD-System. [1][2]



ACME

Column: Kinetex 1.7 µ C18, 100 x 2.1 mm (Phenomenex)  
Eluents: A: 1.0 % ACN, 2 mM/L NH<sub>4</sub><sup>+</sup>HCOO<sup>-</sup>  
B: ACN + 0.1 % HCOOH, 2 mM/L NH<sub>4</sub><sup>+</sup>HCOO<sup>-</sup>  
Wavelength: 209 nm, 217 nm



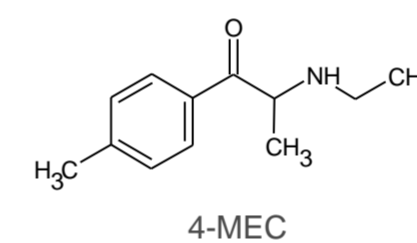
### LC-Settings

LC-System: Dionex UltiMate 3000 RSLC LC-System  
Detector: DAD-3000RS diode array detector

9/11



Synergi Polar RP, 2.5 µm, 100 Å, 100 x 2 mm (Phenomenex)  
A: 0.1 % HCOOH, 1 % ACN, 2 mM/L NH<sub>4</sub><sup>+</sup>HCOO<sup>-</sup>  
B: ACN + 0.1 % HCOOH, 2 mM/L NH<sub>4</sub><sup>+</sup>HCOO<sup>-</sup>  
262 nm [3]



## Results

### Inter-package distribution

Table 1: Distribution of the active ingredient concentrations between different packages

Product	Active ingredient	Packages analyzed	Mean content [% w/w]	Range [% w/w]	SD [%]
ACME	JWH-210	14	9.58	8.75 - 11.3	0.819
9/11	4-MEC	30	40.9	7.30 - 81.5	20.2

### Intra-package distribution

Table 2: Distribution of the active ingredient concentrations in a single package

Product	Active ingredient	Aliquots per package	Mean content [% w/w]	Range [% w/w]	SD [%]
ACME	JWH-210	10	9.77	7.34 - 12.7	1.51
		10	9.68	8.91 - 11.1	0.653
		9	9.26	8.30 - 10.7	0.771
		10	12.3	9.07 - 16.5	2.01
		10	10.2	8.73 - 12.1	1.02
9/11	4-MEC	11	11.6	5.16 - 31.8	7.30
		10	69.2	55.7 - 89.2	9.42
		10	80.1	63.0 - 102	13.4
		11	57.8	29.5 - 79.1	18.0
		7	64.8	39.4 - 103	22.6
		8	84.4	70.2 - 102	11.5

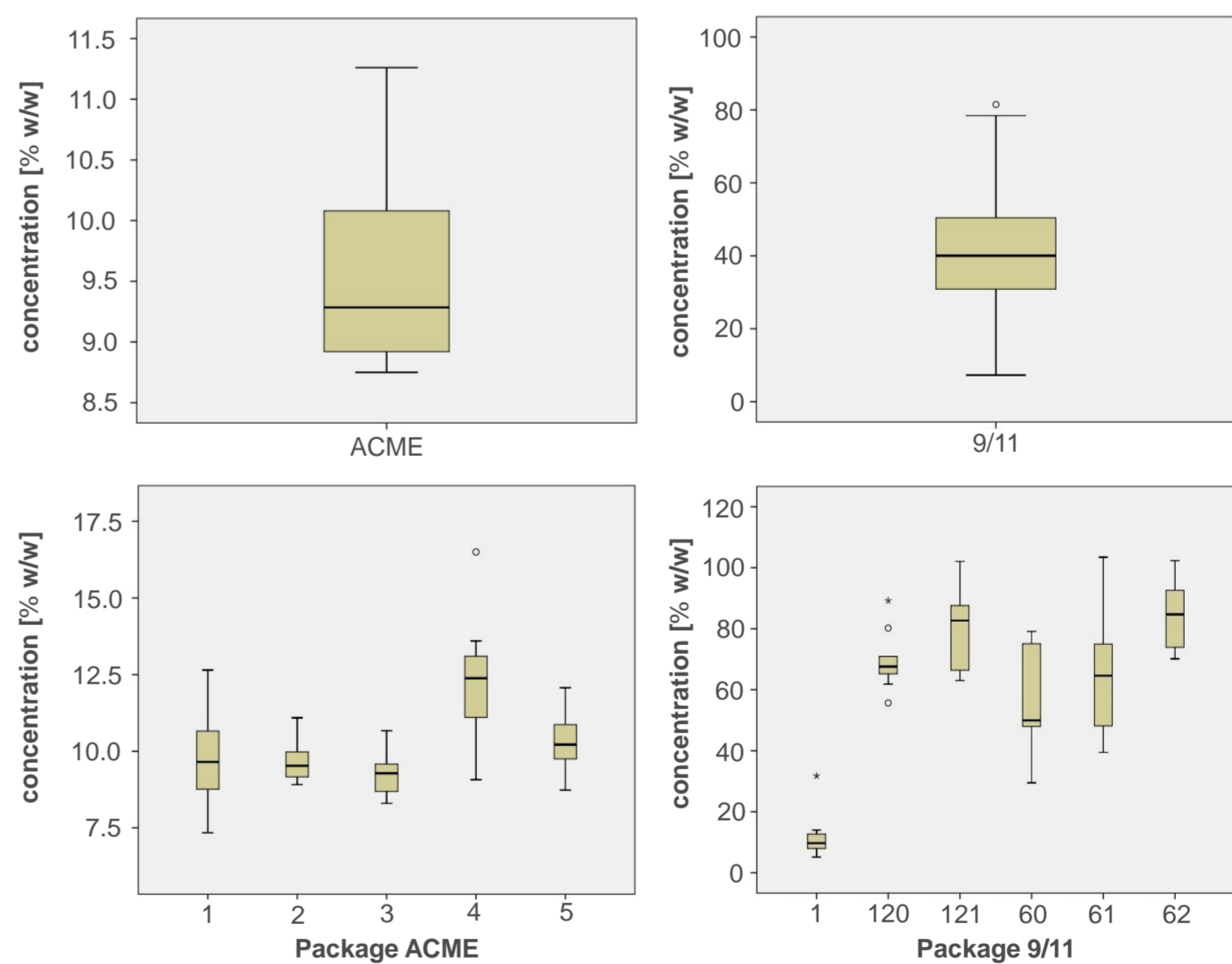


Fig. 1: Boxplots of the inter-package distribution

Fig. 2: Boxplots of the intra-package distribution

The content of the analyzed samples ranged from 7.30 to 81.5 % (w/w; median 40.0 %, SD ± 20.2 %) for 4-MEC and from 8.75 to 11.3 % (w/w; median 9.29 %, SD ± 0.819 %) for JWH-210, respectively. Examining the intra-package distribution regarding all analyzed samples the 4-MEC content ranged from 5.16 to 103 % (w/w; median 66.4 %, SD ± 28.6 %) and from 7.34 to 16.5 % (w/w; median 9.93 %, SD ± 1.64 %) for JWH-210, respectively. [1][2]

## Conclusions

Large inhomogeneities were detected in the distribution of the 4-MEC and the JWH-210 content. This makes it very difficult for consumers to properly dose these drugs and enhances the risk of an unintentional overdose resulting in major health problems and even death as shown in the above mentioned case, where a combined intoxication was regarded as a plausible explanation for the lethal outcome.

## References

- [1] Huppertz et al.: A comprehensive library-based, automated screening procedure for 46 synthetic cannabinoids in serum employing liquid chromatography-quadrupole ion trap mass spectrometry with high-temperature electrospray ionization. *J. Mass Spectrom.* 49 (2):117-127
  - [2] Moosmann et al.: Inhomogeneities in herbal mixtures: a serious risk for consumers. *Forensic Toxicol.* (accepted for publication)
  - [3] Mayer et al.: Simultaneous Determination of 4-Substituted Cathinones (4-MMC, 4-MEC and 4-FMC) in Human Urine by HPLC-DAD. *J. Chromatogr. Sci.* 51 (9): 861-866.
- Picture Sources: [http://img.webme.com/pic/j/joker-fun/kiffer\\_joe.jpg](http://img.webme.com/pic/j/joker-fun/kiffer_joe.jpg) and <http://www.trendcenter-24.de/ed/1481b2.jpg>

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