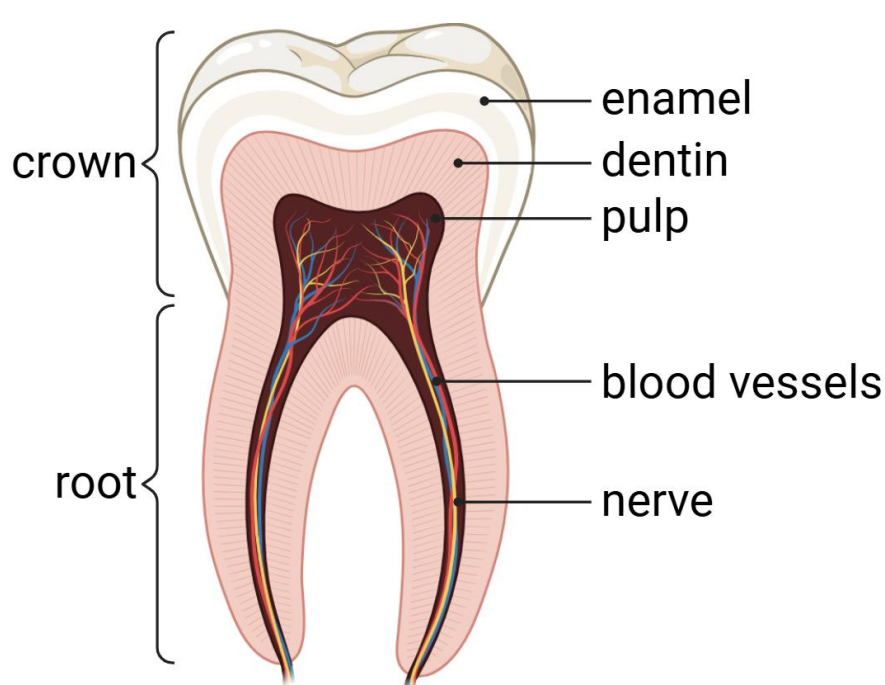


Detection of synthetic cannabinoids in dental hard tissue after single exposure: a promising approach for postmortem toxicology



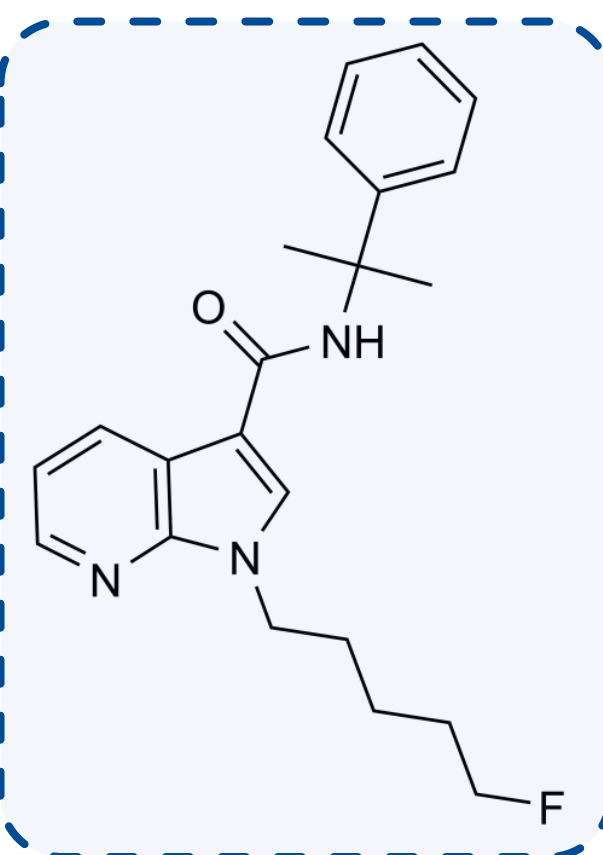
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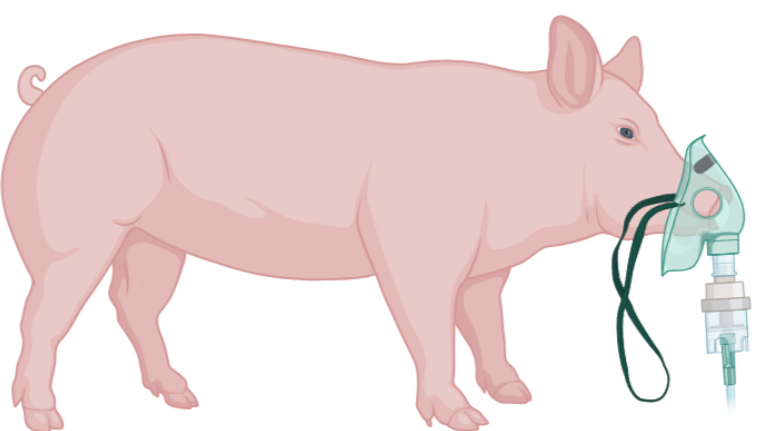
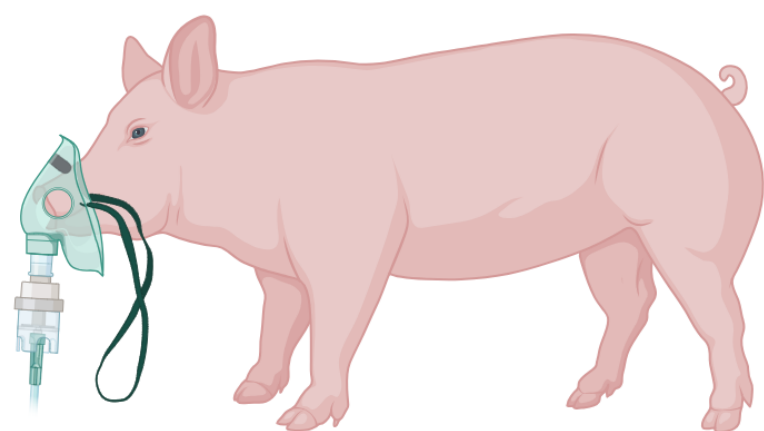
Introduction

- Dental hard tissues are a promising matrix in forensic toxicology with a possible longer detection window.
- Teeth resist postmortem changes better than blood or urine.
- Drug deposition in teeth occurs through blood flow and oral exposure.
- It is unclear, if a single exposure of drugs is detectable in postmortem teeth.
- At the time of treatment, the pigs were at an age of three months.
- They were euthanized eight hours after the inhalation of the synthetic cannabinoids.

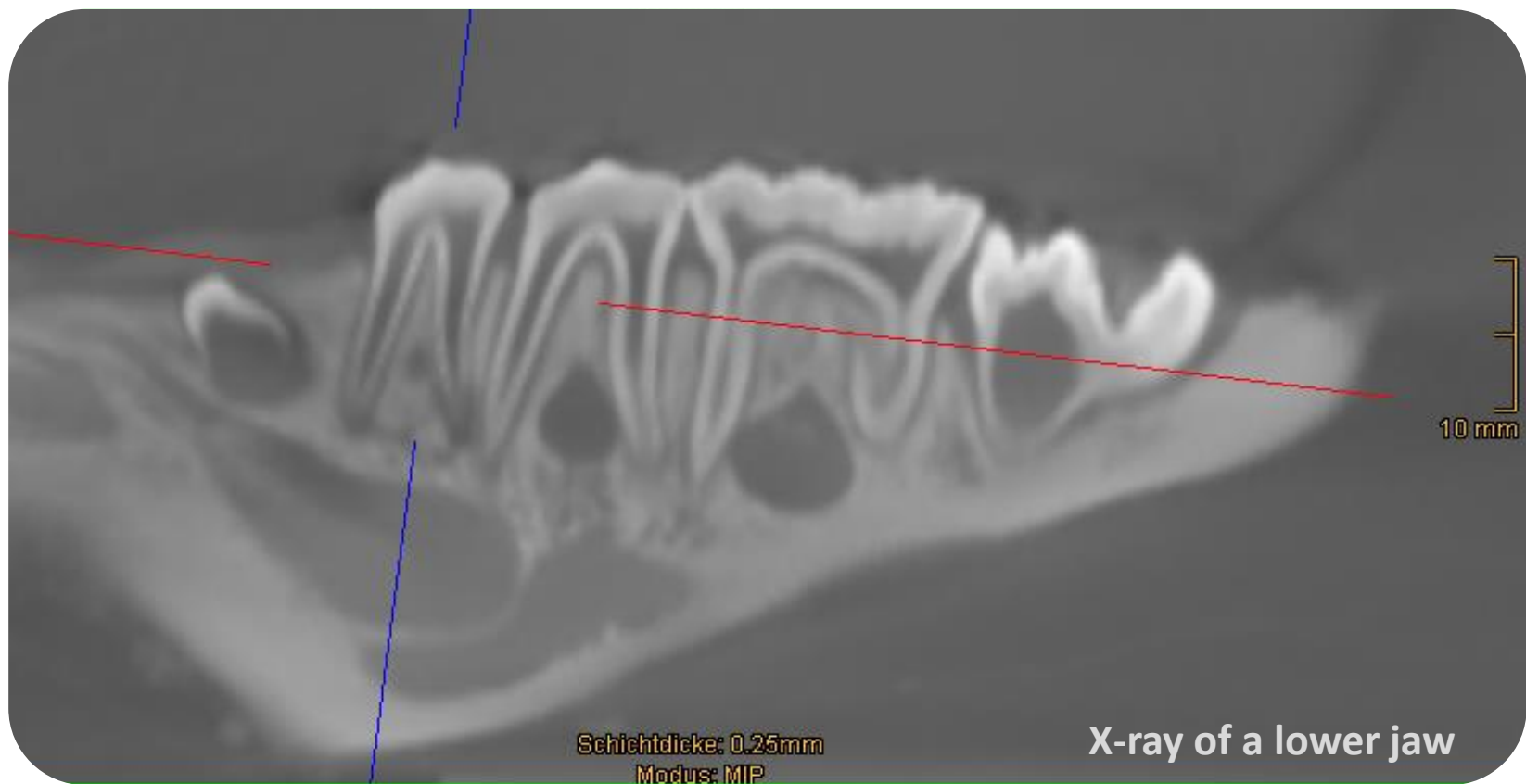
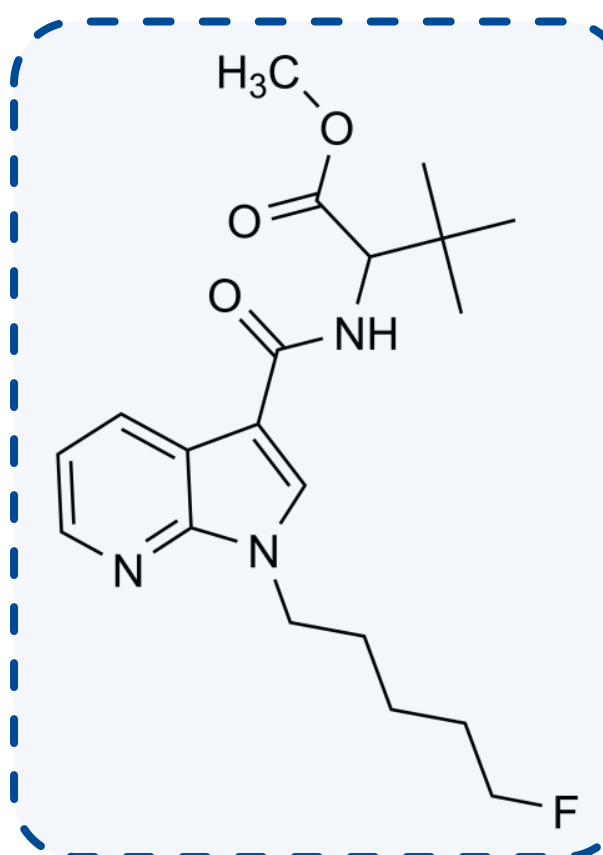


200 µg/kg
5F-Cumyl-P7AICA
8 min

Study at Homburg
(Saarland University)

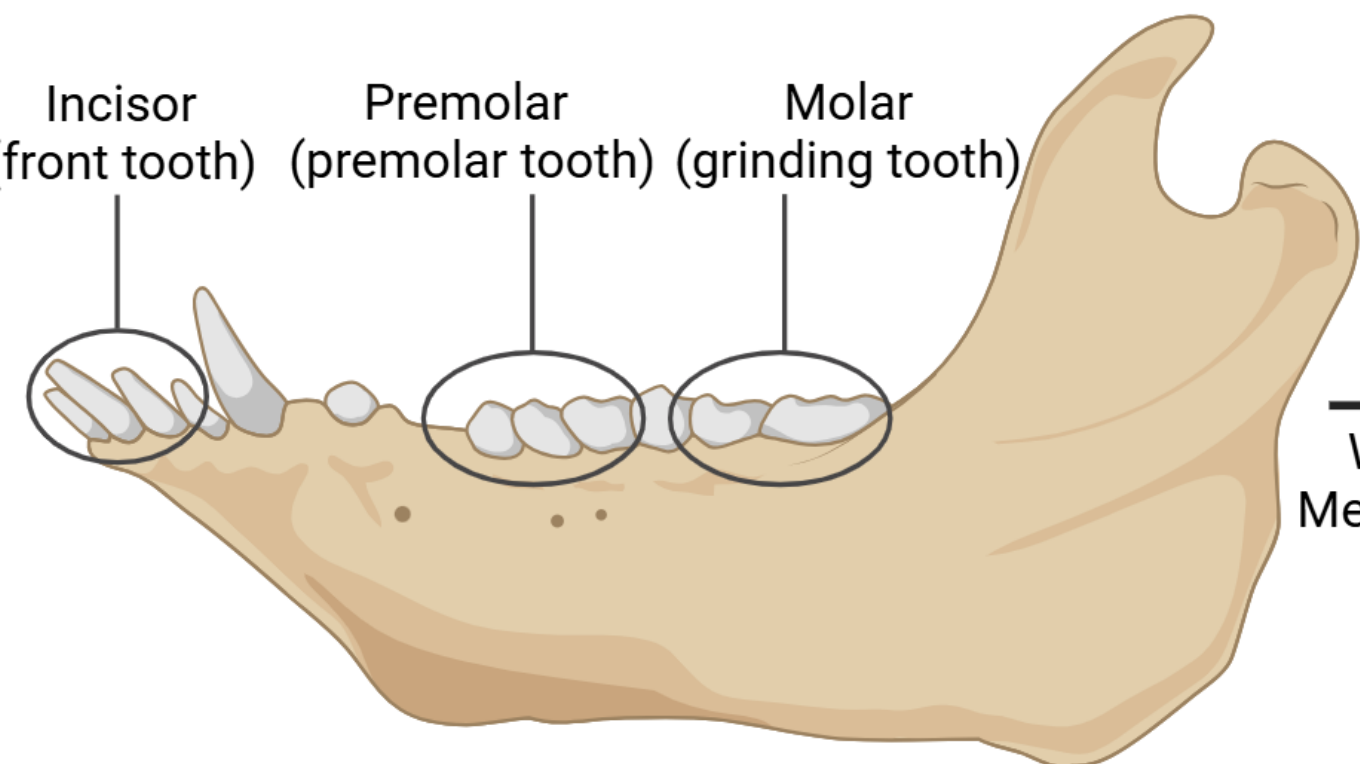


200 µg/kg
5F-MDMB-P7AICA
8 min

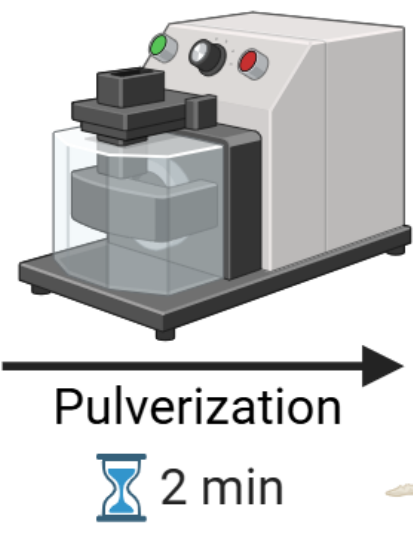


Methods

Porcine teeth were extracted from the jaws and soft tissues (gum and pulp) were removed. Blank porcine dental samples were obtained from a local slaughterhouse and were spiked for calibration in a range of 0.05 – 5.0 pg/mg.



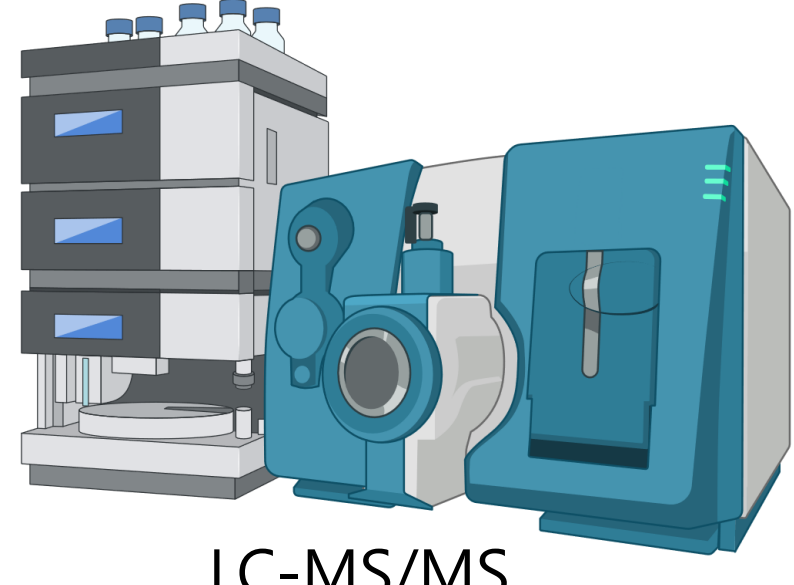
Washing with
MeOH/H₂O [50:50]
10 min



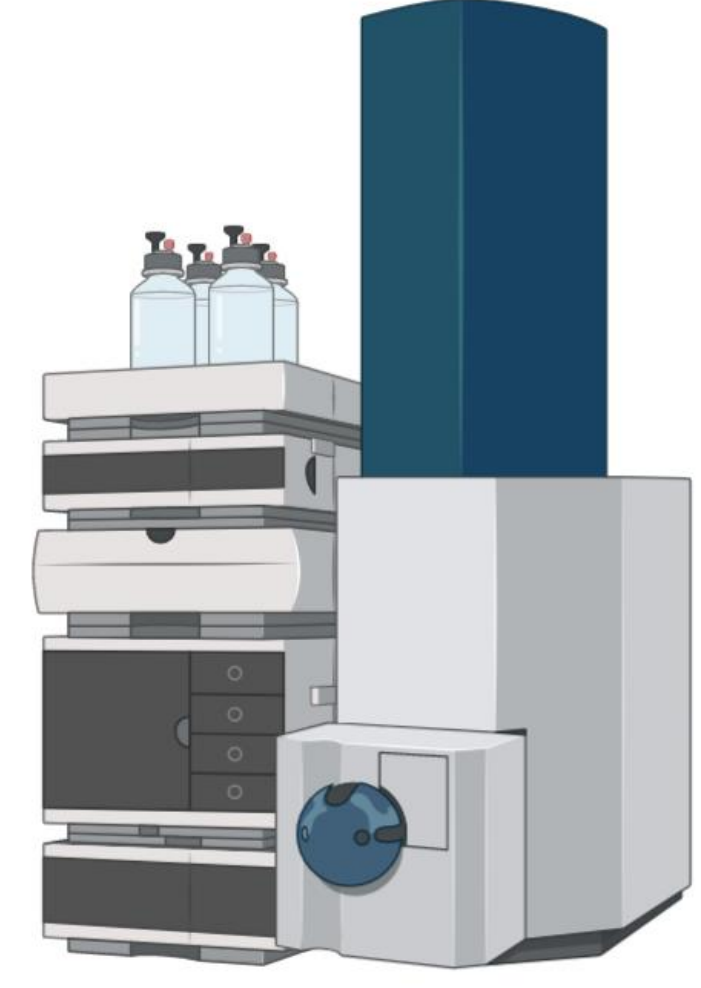
Pulverization
2 min



Extraction



LC-MS/MS

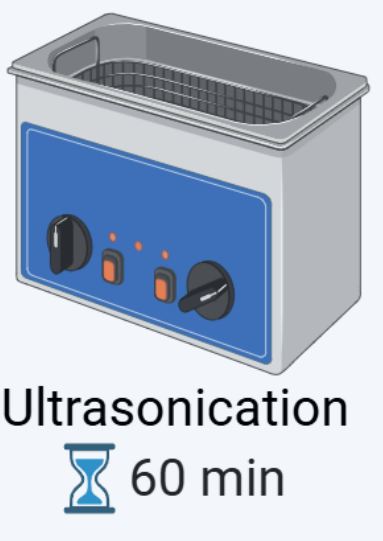


LC-QToF/MS

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Extraction Procedure

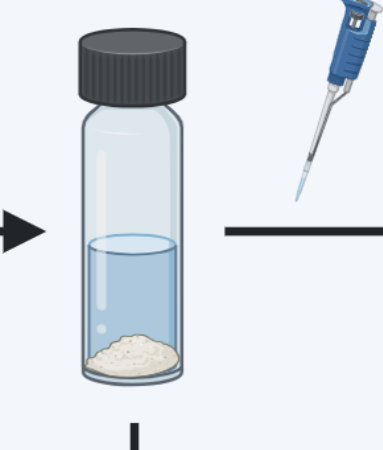
1st: 500 µL MeOH
2nd: 500 µL ACN
3rd: 500 µL ACN



Ultrasonication
60 min



Centrifugation



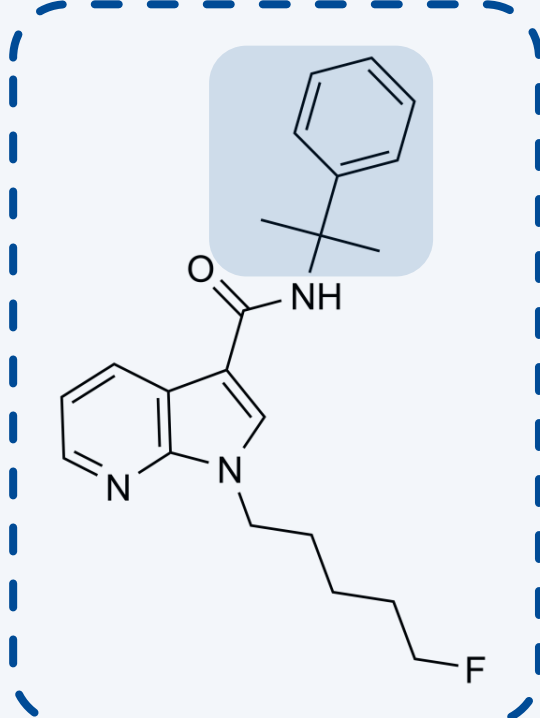
Evaporation



Reconstitution
in mobile
phase

Results & Discussion

5F-Cumyl-P7AICA



Tooth	Concentration in dental hard tissue [pg/mg]
Molar	ca. 1.3
Premolar	ca. 0.95
Incisor	ca. 0.01*

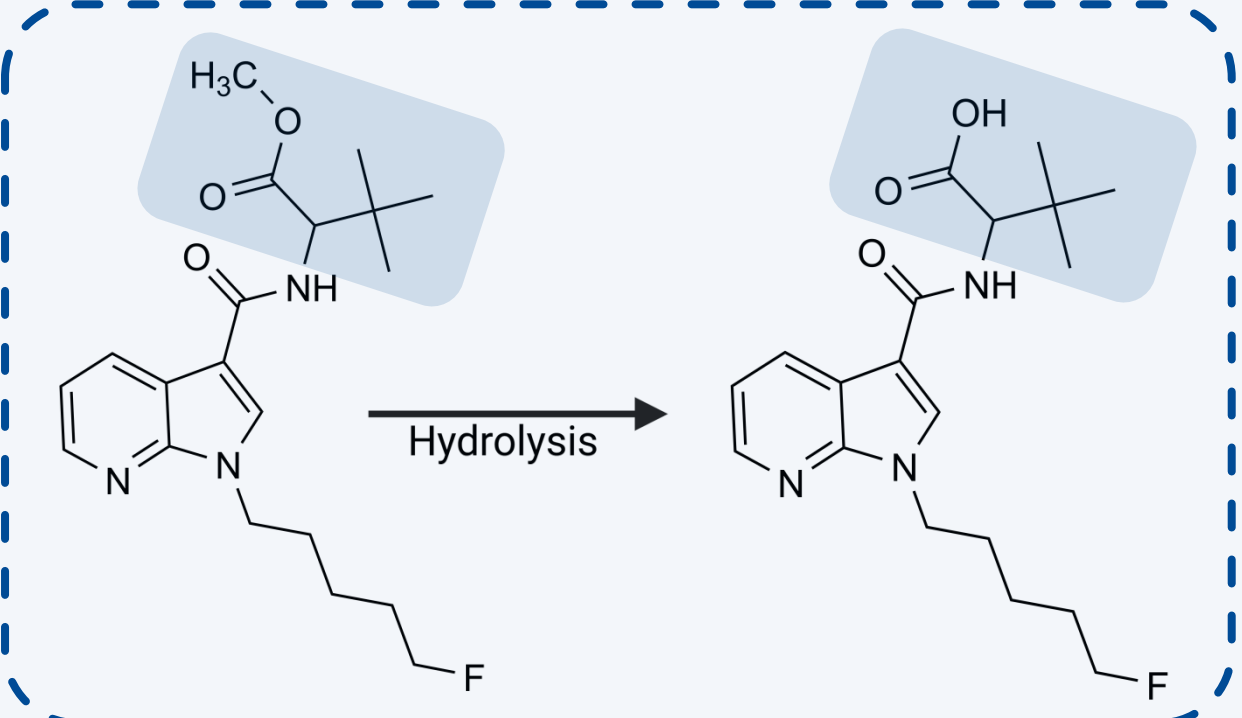
*Value is below the lowest calibrator and was extrapolated.

The different concentrations seem to depend on tooth location within the oral cavity.

Explanation:

- Possible larger contact area between the soft tissue of the pulp and the dentine

5F-MDMB-P7AICA



- Traces of the hydrolysis product of 5F-MDMB-P7AICA were detected (Signal-to-noise-Ratio ≤ 3)
- 5F-MDMB-P7AICA itself was not detected → likely due to the instability of ester-containing synthetic cannabinoids

Other Drugs

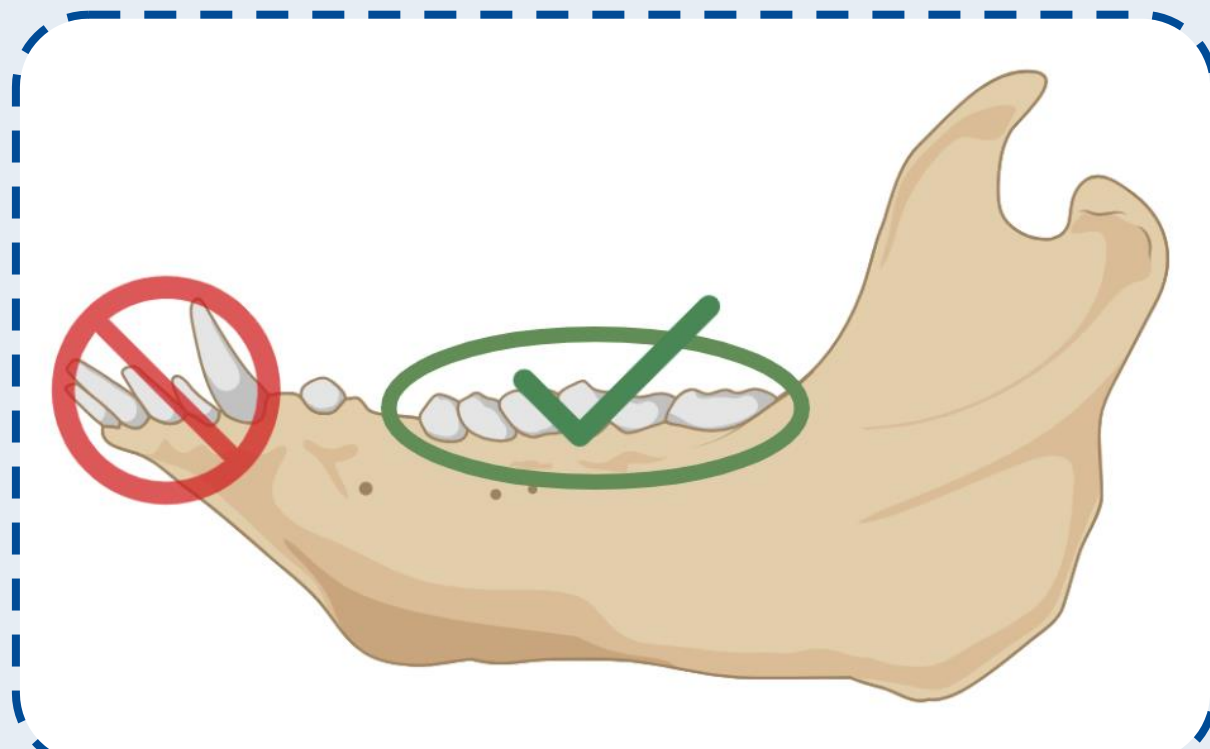
The generated extracts were subjected to liquid chromatography-time-of-flight mass spectrometry for high-resolution mass screening (LC-QToF/MS) and the drugs were identified using a library search (Target Screener HR4.0 and in-house databases). The following drugs were given to the pigs during the treatment. Embutramide was given for euthanasia. Some of the drugs and their metabolites could be detected:

Drug	Pig with 5F-Cumyl-P7AICA	Pig with 5F-MDMB-P7AICA	Blank-Tooth
Embutramide	✓	✓	✗
Ketamine	✓	✓	✗
Norketamine	✓	✓	✗
Atropine	✗	✗	✗
Isoflurane	✗	✗	✗
Xylazine	✓	✓	✗

- Atropine may no longer be detectable due to hydrolytic transformation or instability.
- Isoflurane is probably only detectable in negative ionization mode and was not included into in-house and commercial databases.

Take Home Message

- Synthetic cannabinoids of the 7-azaindole type are detectable in postmortem teeth after single exposure.
- Molar and premolar teeth seem to incorporate higher concentrations of presumably incorporated drugs and their metabolites.
- Other drugs used as sedatives and for euthanasia could be identified after single exposure as well.



Contact

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References

Schaefer, N., Kroell, A.-K., Laschke, M.W., Menger, M.D., Maurer, H.H., Meyer, M.R., Schmidt, P.H., 2018. Development of an in-vitro drug delivery efficiency test for a pulmonary toxicokinetic pig study. Curr. Drug Deliv. 15, 1167–1171.
Doerr, A. A.; Nordmeier, F.; Walle, N.; Laschke, M. W.; Menger, M. D.; Meyer, M. R.; Schmidt, P. H.; Schaefer, N. Does a Postmortem Redistribution Affect the Concentrations of the 7 Azaindole-Derived Synthetic Cannabinoid 5F-MDMB-P7AICA in Tissues and Body Fluids Following Pulmonary Administration to Pigs? Arch Toxicol 2024, 98 (10), 3289–3298
Klima, M.; Altenburger, M. J.; Kempf, J.; Auwärter, V.; Neukamm, M. A. Determination of Medicinal and Illicit Drugs in Post Mortem Dental Hard Tissues and Comparison with Analytical Results for Body Fluids and Hair Samples. Forensic Science International 2016, 265, 166–171.