K28 An Analysis of Ethanol in Blood and Oral Fluid Samples From Dosed Individuals by Headspace Gas Chromatography

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After attending this presentation, attendees will better understand the application of headspace gas chromatography to the determination of ethanol in blood and oral fluid. Attendees will also understand the relationship between ethanol concentrations in blood, oral fluid, and breath samples during a human dosing study.

This presentation will impact the forensic science community by providing evidence of a validated method for the analysis of both blood and oral fluid. The validated method was utilized in the analysis of samples from individuals dosed with ethanol in order to assess the viability of oral fluid as a matrix in Driving Under the Influence (DUI) applications. The use of headspace gas chromatography for this toxicological analysis allows for minimal sample preparation and little devaluation of the column with repeated usage.

Oral fluid has become a matrix of interest for forensic toxicological analysis, mainly for the qualitative and quantitative analysis of various drugs of abuse. Oral fluid is an ideal matrix for forensic analysis due to its lack of invasive collection procedure and ease of collection and monitoring, making the sample difficult to adulterate.[1-3] The findings of this study have the potential to impact current policy and forensic sample collection in suspected DUI cases. The use of oral fluid as a forensic specimen that is collected carside after probable cause of driving while impaired has been determined to have the potential to improve the quality and accuracy of the forensic toxicological analysis. The ability to collect oral fluid at the scene can potentially reduce the lag time between the traffic stop and obtaining the toxicological sample.

A method for the analysis of ethanol in blood and oral fluid was developed. In this study, a Perkin Elmer® HS-Clarus® 580 headspace gas chromatograph with two flame ionization detectors and a TurboMatrix™ 40 autosampler was utilized. A single headspace injection was split between two columns, Elite-BAC1 (30m x 0.32mm x 1.8µm) and Elite-BAC2 columns (30m x 0.32mm x 1.2µm). Helium carrier gas at a flow rate of 12.30mL/min was utilized, and the column temperature was set to 70°C. The method was validated using aqueous solutions, bovine blood, human blood, and human oral fluid with Lower Limit of Detection (LLOD) and Lower Limit of Quantification (LLOQ) values of 0.01% for ethanol. Calibration curves demonstrated good linearity for the BAC1 and BAC2 column where the r^2 values exceeded 0.999.

A controlled dosing study was performed utilizing subjects who consumed a pre-determined amount of wine (11.5%) to reach a target blood alcohol concentration of 0.05g/dL. Blood, breath, and oral fluid samples were collected from subjects prior to the consumption alcohol. Blood and breath samples were collected every 15 minutes over 3 hours; oral fluid samples were collected every 5 minutes for the first 30 minutes post-consumption and every 15 minutes following for 3 hours. Blood and oral fluid samples were prepared using 3mL of internal standard (0.016% *n*-propanol), 300µL of sample, and ¼ teaspoon of NaF/NaCl salt mix. Breath samples were measured with a portable breath-testing device. Results revealed the ethanol concentration profiles correlated well between blood and oral fluid. The Pearson correlation values between samples of oral fluid and blood were 0.92–0.97.

In conclusion, the validated method for the analysis of ethanol in blood and oral fluid samples illustrates the utility of oral fluid samples as a matrix in DUI investigations. The ease of collection of oral fluid and the fast and simple sample preparation for analysis makes this method viable for implementation in a forensic toxicology laboratory for analysis of DUI samples.

Reference(s):

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