Introduction

Cigarette smoke is a highly complex aerosol composed of several thousand chemical substances distributed between the gas and particulate phases. Numerous chemical classes are represented in cigarette smoke including saturated and unsaturated hydrocarbons, alcohols, ketones, carboxylic acids, esters, phenols, nitriles, terpenoids, and alkaloids. The enormous complexity of cigarette smoke is a consequence of multiple thermolytic processes (e.g., distillation, pyrolysis, and combustion).

Hydrogen cyanide is known to be present in cigarette smoke, and is thought to be generated by the pyrolysis or pyrosynthesis of tobacco leaves’ components.

A method was developed to quantify cigarette mainstream smoke cyanide by LC-(ESI)-MS/MS, with the purpose of obtaining a selective, robust and reliable method. This method is based on a previous report of quantitation of blood cyanide by LC-MS after derivatisation1.

Results & Discussion

The derivatisation reaction was found to be very quick, less than 5 minutes, for the standard as well as the samples. However, an excess of derivatising agents was necessary for the samples. A 7-point calibration curve with a concentration range of 1.99 to 398.5 μg/cig was established with a correlation coefficient of r²=0.9995.

The limit of quantitation was calculated as 0.013 μg/cig and the limit of detection as 0.004 μg/cig. The average yield of HCN in the University of Kentucky reference cigarettes 1R5F and 2R4F was of 28.95 μg/cig (SD: 2.32, RSD: 8.32%, n=4) and 103.90 μg/cig (SD: 3.75, RSD: 3.6% n=4) respectively.

One of the causes of variability with the results was the smoking process. To obtain a better repeatability, the internal diameter of the shimmer of the wash bottles used for smoke collection was narrowed from 5 to 2 mm. Thus, smaller bubbles were generated, which increased the contact surface with the solution and resulted in a three-fold decrease in the standard deviation for the 2R4F cigarette.

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Conclusion

A new, simple, fast, sensitive and reliable method for quantification of cyanide in cigarette mainstream smoke by LC-MS/MS was developed and validated.

This method requires the derivatisation of cyanide and uses K⁵⁰⁴⁵⁵ as an internal standard. The reaction time is quick, less than 5 minutes, and the LC run under 4 min.

References:

