Microextraction as sample preparation for new psychoactive substances (NPS) – a greener alternative

Schüller, M.[1], Fabris, A.L. [2], Pedersen-Bjergaard, S[1] & Øiestad, E.L.[1,3*],

rmeloi@ous-hf.no,

1 University of Oslo, Department of Pharmacy, Norway,

2 University of São Paulo, School of Pharmaceutical Sciences, Brasil

3 Oslo university Hospital, Department of Forensic Sciences, Norway

New psychoactive substances continue to appear in the drug market due to the possibility of circumventing legal consequences and generating profit. Consequently the development of new methods is necessary to be able to identify use and quantify the concentrations in biological media. During the last decade an increase in environmental consciousness has led to a wish to reduce the environmental impact of analytical procedures. The term "green chemistry" is used for a set of principles constructed to reduce or eliminate the use or generation of hazardous substances [1]. Sample preparation is a parts of the analytical workflow where the possibility for "greener analysis" is evident [2].

We present three examples of sample preparation for NPS in whole blood using microextraction methods. Analytes were extracted from an aqueous donor phase through a supported liquid membrane (3-4 µl organic solvent) into an aqueous acceptor phase compatible with LC-MS/MS. Nitazenes were extracted using 96-well liquid phase membrane extraction, LPME, while tryptamines and synthetic cathinones were extracted using electromembrane extraction, EME. In EME an electric field is the driving force of extraction.

Validation was performed in line with forensic toxicology guidelines, and the methods were evaluated using the AGREEprep tool, developed by Wojnowski et al. [3]. The program gives a score between 0 and 1 for method "greenness". The nitazene method had an intraday precision of ≤10%, interday precision of ≤21%, accuracy ≤ |8%|, recovery 10– 98% and received a greenness score of 0.71. The tryptamine method had intraday precision of ≤16%, interday precision of ≤13%, accuracy ≤ |6%|, recovery 81–102% and received a greenness score of 0.76. For the synthetic cathinones intraday precision of ≤18%, interday precision of ≤19%, accuracy ≤ |15%|, and recovery 63– 117% were achieved as well as a greenness score of 0.77.

The methods were in line with common requirements for forensic methods, but received very good greenness scores. In comparison a standard method could typically have a greenness score of 0.52 [4].

1. Anastas, P.T. and J.C. Warner, Green Chemistry: Theory and Practice. 1998, New York: Oxford University Presss.
2. Armenta, S., S. Garrigues, and M. de la Guardia, The role of green extraction techniques in Green Analytical Chemistry. TrAC Trends in Analytical Chemistry, 2015. 71: p. 2-8.
3. Wojnowski, W., et al., AGREEprep - Analytical greenness metric for sample preparation. Trac-Trends in Analytical Chemistry, 2022. 149.
4. Kristoffersen, L., et al., Determination of 12 commonly found compounds in DUID cases in whole blood using fully automated supported liquid extraction and UHPLC-MS/MS. J Chromatogr B Analyt Technol Biomed Life Sci, 2018. 1093-1094: p. 8-23.