Abstract

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Title of diploma thesis: *Electromembrane extraction of amphetamines and cathinones from meconium*

Drug use is one of the long-term problems worldwide. Amphetamines (especially methamphetamine) belong among the most used hard drugs in the Czech Republic. Amphetamines and their structurally similar substances synthetic cathinones are psychostimulants and have a stimulating effect on the central nervous system. They increase the level of dopamine, norepinephrine, and serotonin at the synapses through their reduced reuptake.

Drug use during pregnancy does not harm only the mother, but also the fetus and can lead to abnormalities that may occur malformations of fetal organs, delayed fetal development, low birth weight of the newborn, premature birth, or risk of hypoxia. There is also a risk that a newborn will have neonatal abstinence syndrome (NAS).

Prenatal drug exposure not only risks complications during pregnancy and childbirth, but also later consequences. Most children have developmental disorders, cognitive problems, and behavioral problems until school age. Therefore, the determination of fetal exposure to drugs is very important for the future development of the newborn.

Meconium analysis is the gold standard of alternative biological matrix for testing drugs and medications in prenatal exposure. It starts to form at the beginning of the second trimester (between the 12th and 14th week). Drugs used by the mother during pregnancy pass through the placenta by passive diffusion and are subsequently accumulated through a deposit in the meconium. The advantages of meconium analysis include easy non-invasive collection, long detection window and relatively large amount of sample.

Meconium is a complex biological matrix and requires sample preparation before analysis itself. The goal of sample preparation is to purify the sample and to remove interfering substances in a complex matrix. In this project we use electromembrane extraction (EME), which is hybrid microextraction laying between liquid-liquid extraction and electrophoreses. Here, the transfer of the ionized analytes from the donor to the acceptor solution, through the supported liquid membrane (SLM) is mediated by an applied voltage which create an electric field in the system. This extraction was performed in a miniaturized 96-well plate.

The optimization of this method included several steps – choice of organic solvent for SLM, optimization of donor and acceptor solution, amount of meconium for extraction, length of extraction time, and amount of applied voltage.

The optimized conditions of our extraction method: the donor and acceptor solution were 1% formic acid, the organic solvent for SLM was ENB with 1-undecanol in a ratio of 1:1 (V/V), amount of meconium 45-50 mg / well, vortex intensity 1050 rpm, length of extraction 20 minutes, and the size of the applied voltage 15 V, after 1 minute increased to 30 V.

The samples were analyzed using UHPLC-MS/MS. The optimized method was validated using the FDA guideline and verified by analyzing a real sample of meconium that was positive.