Developmental neurotoxicants: The advancement of multi-residue screening for analytical determination and their occurrence in human matrices

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Abstract:

Owing to the increasing number of children suffering from neurodevelopmental disorders there is a growing concern of studium of effects of the neurotoxic compounds to the child health.

The main aim of the thesis was to develop and validate the multi-analyte method for the determination of 97 (potential) developmental neurotoxicants in human milk. These compounds included persistent organochlorine pesticides and pyrethroid insecticides, halogenated legacy and alternative flame retardants (FRs) and polychlorinated biphenyls (PCBs) and their selected metabolites. The low limits of detection of the developed method enabled us to detect even current-use compounds (pyrethroids and alternative FRs) in the trace levels and they presented the novel data regarding alternative FR in human matrices in Europe.

The method was subsequently used for an analysis of more than 550 milk samples from three European countries, Norway, the Netherlands and Slovakia. Comparison of the levels and human risk assessment has been performed with the main groups of developmental neurotoxicants. Legacy compounds such as pesticides or PCBs have been shown to be present in human milk at high concentrations despite the ban more than 30 years ago. Flame retardant analysis included both persistent compounds (polybrominated diphenyl ethers, PBDEs) and alternative FRs, which started to be used after the PBDE restrictions. ΣPBDEs was shown to decrease since their ban in EU in 2004, but the levels of some congeners, such as BDE 153, were still stable. The most often detected alternative halogenated FRs, bromobenzenes (hexabromobenzene , HBB, pentabromobenzene, PBBz, pentabromotoluene, PBT) occurred in more than in a half of the samples in all countries. Since the data regarding presence of AFR in humans could not be compared with older data or with many of the papers, there is a need to continue with the analyses of these compounds for the assessment of their toxic potential which is still mostly unknown.

Dutch exposure data was subsequently used for the epidemiological evaluation of the presence of the developmental neurotoxicants to the child health and sex-specific significant associations were found between early life exposure to organochlorine compounds and behavioural development at the age of 18 months.