Enantioselective Analysis of N-Ethylhexedrone and its Phase-1 Metabolites using Supercritical Fluid Chromatography Tandem Mass Spectrometry (SFC-MS/MS)

Elene Marsagishvili

E-mail: elene.marsagishvili809@ens.tsu.edu.ge
Department of Chemistry, Faculty of Exact and Natural Sciences
Ivane Javakhishvili Tbilisi State University
3, I. Chavchavadze Avenue, Tbilisi, 0179, Georgia

N-Ethylhexedrone is a synthetic stimulant and part of the cathinone class of new psychoactive substance (NPS). It's structurally related to other cathinones like alpha- PVP and MDPV. Because N-ethylhexedrone is a designer drug, it often appears in illicit markets with little information about its purity or strength, increasing the danger for users. Detection in laboratories typically requires advanced analytical tools like Liquid Chromatography-Mass Spectrometry (LC-MS/MS) and Supercritical Fluid Chromatography-Mass Spectrometry (SFC MS/MS) due to its similarity to other substances. SFC-MS is an advanced analytical technique that combines SFC with MS to separate, identify, and quantify complex mixtures. It is particularly useful for chiral separations, lipid analysis, and pharmaceutical applications. Due to the rapid emergence and chemical variability of NPS, conventional methods may fall short in speed and resolution. SFC-MS/MS provides fast, efficient separation and highly sensitive detection, making it ideal for identifying structurally similar compounds like synthetic cathinones. The technique's ability to handle complex matrixes with minimal solvent use and rapid run times allows for high-throughout screening, which is critical given the urgent need for timely detection in clinical intoxication cases, law enforcement, and public health monitoring. This study presents, for the first time, the enantioselective analysis of Phase I metabolites of N-ethylhexedrone using SFC-MS/MS. Given the growing prevalence of NPS) advanced analytical approaches are essential to keep pace with the continuous emergence of new compounds. The application of SFC-MS/MS enables rapid, high-resolution separation of chiral metabolites, providing critical insight into their stereoselective metabolism and potential pharmacological or toxicological differences between enantiomers. This capability is particularly important for forensic and clinical toxicology, where accurate identification and understanding of metabolite profiles can support more precise detection, interpretation, and risk assessment.