

使用新穎快速萃取技術結合 UHPLC-MS/MS 對人體尿液中常見食品毒素丙烯醯胺及其代謝物進行生物監測

Biomonitoring of common food toxin acrylamide and their metabolites in human urine using novel fast extraction technique coupled with UHPLC-MS/MS

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Abstract

Acrylamide (AA) is a toxicant in high-temperature processed foods and it is classified as a group 2B carcinogen by IARC. Upon absorption, AA is metabolized to glycidamide (GA) as well as it conjugates with glutathione (AA-GSH) and is excreted majorly in urine as N-acetyl-S-(2-carbamoyl-ethyl)- L-cysteine (AAMA), N-acetyl-S-(2-carbamoyl-2-hydroxyethyl)- L-cysteine (GAMA) with the help of CYP 450 - 2E1 enzyme activation. The persistent biometabolites of AA in urine must be monitored to comprehend short-term exposure fully. Therefore, developing a fast, sensitive, and simultaneous biomonitoring method need to be developed, for quantifying the AA biometabolite levels in human urine samples. Therefore, in the present study, we developed Fast Acrylamide and its Metabolites Extraction (Fa-AAMs-Ex) technique and coupled it to UHPLC-MS/MS for the identification of acrylamide and its metabolites in the human urine samples. In the Fa-AAMs-Ex technique, two syringes were coupled for liquid-liquid microextraction and micro-solid phase extraction. The fully optimized and validated Fa-AAMs-Ex pre-treatment technique yielded higher enrichment factor (4.2 – 4.6) and higher detection and quantification levels (LOD of 0.20, 0.15, 0.05, and 0.02 ng/mL, and LOQ of 0.60, 0.90, 0.70, and 0.10 ng/mL for AA, GA, AAMA, and GAMA). The inter and intra-day analysis shows >12% RSD with recovery ranging from 87.32-112.2 %. Moreover, matrix effect ranged from -10.88 to 9.72%, respectively, showing the high selectivity towards extracting acrylamide and its metabolites from the urine samples with less matrix effect. Finally, the Fa-AAMs-Ex technique coupled with UHPLC-MS/MS was developed with various advantages, such as lower detection and quantification limits, higher enrichment, and fewer matrix interferences. Therefore, we strongly suggest that today's difficulties associated with sample pre-treatment for acrylamide and its metabolites can be quickly addressed with the Fa-AAMs-Ex sample pre-treatment technique.

Keywords: Food toxin; Acrylamide and their metabolites, Fast extraction technique; Liquid chromatography mass spectrometry; Human urine, Exposure assessment;