使用液相層析串聯質譜法開發污水中濫用藥物之定量分析方法

Development of quantitative analysis method using liquid chromatography-tandem mass spectrometry for abuse drugs in wastewater

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Abstract

Over the past decade, drug-related crimes have inflicted an enormous impact on society. To be more effective in the fight against drug-related crimes, retrieving the spatial and temporal distribution patterns in drug abuse is required. Compared to collecting drug users' samples, analyzing drug abuse in wastewater is more effective in estimating population usage. This study aims to develop a quantitative analysis method using liquid chromatography-tandem mass spectrometry for 15 abused drugs in wastewater. The wastewater samples were collected at the inlet of wastewater treatment plants (WWTPs) in Southern Taiwan. All samples were maintained at 4℃ until sample pretreatment and analysis. After filtering through 0.22 μm glass microfiber filters, solid-phase extraction (SPE) was used to extract and concentrate analytes of interest in the wastewater samples. We chose the HLB (hydrophilic-lipophilic balance) cartridge used in this study for sample preparation. The extraction methods are as follows： First, four cartridges were conditioned with 6 mL methanol and 3 mL water to equilibrate. Then, 240 mL wastewater samples spiked with internal standards were loaded into the cartridges, respectively. Finally, the cartridges were eluted with 4 mL of 5% acetonitrile in four tubes. The nitrogen blowdown evaporators were used to dry the eluate, and the residue was dissolved in 5% acetonitrile for mass spectrometry analysis. All the analytes showed recoveries ranging from 70% to 110%. The limits of quantification of 15 drugs were all lower than 90 ng/L. Calibration curves of all targets in wastewater sample show good linearity with correlation(R) above 0.99. The carry-over parameter measured concentration due to residual analysis from a preceding sample that remains in the analytical instrument. Carry-over of all targeted drugs was generally lower than 2%. In conclusion, we developed a quantitative analysis method for detecting abused drugs in wastewater using liquid chromatography-tandem mass spectrometry.

關鍵字：污水、濫用藥物、方法開發、液相層析串聯質譜法

Keyword：Wastewater、Illicit drugs、Method Development、liquid chromatography-tandem mass spectrometry