

使用多反應監測-質譜法定量台灣南部污水中之非法藥物
Quantification of illicit drugs in wastewater in southern Taiwan using
Multiple Reaction Monitoring-Mass spectrometry

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Abstract

The use of illicit drugs has become a public issue in Taiwan, with over 2,500 kilograms of drugs seized every year from 2012 to 2021. Wastewater-based epidemiology (WBE) has been developed to provide a better understanding of the drug abuse situation in each region through the analysis of wastewater concentration. However, very few studies have investigated illicit drugs in the wastewater of Taiwan. Here, we established an analytical method to monitor the concentration levels of 15 illicit drugs in the wastewater using liquid chromatography multiple reaction monitoring-mass spectrometry (LC-MRM-MS). The influent wastewater sample was collected from wastewater treatment plants (WWTPs) which treated water volume is larger than 50,000 m³/day in the south of Taiwan. The wastewater samples were filtered by a 0.5 µm glass microfiber. The 240 mL wastewater sample was spiked with 14 stable isotopically labeled internal standards at 10 ppm, and then the 15 illicit drugs were extracted by solid phase extraction with a loading of 60 mL per cartridge. The wastewater extracts were analyzed by LC-MRM-MS operated with an electrospray ionization source (ESI) in positive ion mode. The quantitation limit (QL) of methamphetamine, amphetamine, ketamine, norketamine, morphine, codeine, THC, THC-COOH, MDMA, mephedrone, flunitrazepam, 7-aminoflunitrazepam, nimetazepam, and 7-aminonimetazepam, zopiclone were 26.7 ng/L, 32.5 ng/L, 9.5 ng/L, 7.2 ng/L, 3.4 ng/L, 21.0 ng/L, 90.3 ng/L, 78.0 ng/L, 7.0 ng/L, 13.7 ng/L, 8.9 ng/L, 19.0 ng/L, 11.1 ng/L, 3.8 ng/L, and 61.7 ng/L, respectively. As a result, the wastewater concentrations of methamphetamine, amphetamine, ketamine, norketamine, morphine, codeine, mephedrone, and 7-aminonimetazepam were 426.64 ng/L, 52.93 ng/L, 188.68 ng/L, 92.72 ng/L, 97.22 ng/L, 78.88 ng/L, 65.62 ng/L, and 6.83 ng/L, respectively. THC, THC-COOH, MDMA, Flunitrazepam, 7-Aminoflunitrazepam, Nimetazepam, and Zopiclone were not detected in wastewater in south Taiwan. The results of our investigation matched with the statistics of drug seizure table in 2022 by the Ministry of the Interior. We have developed a fast and efficient way to assess illicit drugs in regions. Thus, this approach will also be used for wider screening in Taiwan and other countries.

關鍵字：非法藥物、污水流行病學、定量、液相層析/多反應監測串聯質譜儀

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