

快速驗毒新技術

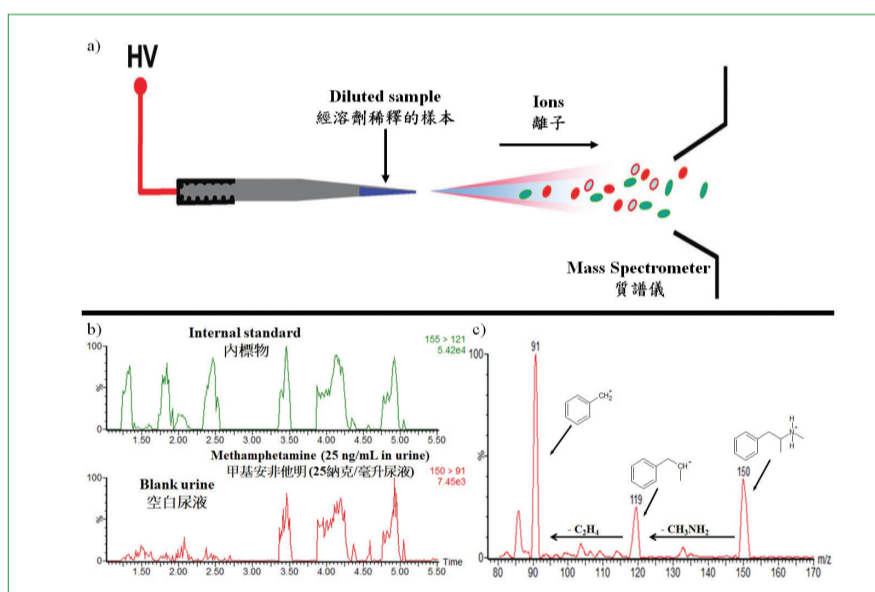
Novel Technology of Rapid Detection of Drugs of Abuse

利用先進質譜技術準確檢測尿液及唾液是否含有常被濫用的藥物

Accurate detection of drugs of abuse in urine and oral fluid using advanced mass spectrometry technology

常規驗毒方法繁複、費時，而現有的快速驗毒裝置，亦有出現假陽性和假陰性的問題。故此，我們研發了三種先進的質譜技術，以高電壓誘發經有機溶劑稀釋的樣本產生噴霧電離，從而獲取當中成分的質譜圖，用以準確及快速地檢測尿液及唾液中六種常被濫用的藥物，包括氯胺酮、甲基安非他明(冰)、可卡因、搖頭丸、大麻、海洛因及各藥物的代謝物。

由理大研發的質譜技術包括：1)簡單、經濟、用木牙籤進行的「木籤電噴霧電離質譜」；2)能提取及濃縮樣本內毒品成分，以提高測試靈敏度的「固相微萃取—電噴霧電離質譜聯用」；以及3)應用於現場驗毒的固相微萃取和便攜氣相質譜儀組合方法。



(a) 「木籤電噴霧電離質譜」方法的示意圖；(b) 以多反應監視模式檢測尿液中的甲基安非他明(25納克/毫升)；以及(c) 以串聯式質譜法驗證尿液中是否含有甲基安非他明(50納克/毫升)
(a) Schematic diagram of Wooden-tip Electro Spray Ionization Mass Spectrometry for drug analysis; (b) MRM detection of 25 ng/mL methamphetamine in urine; and (c) MS/MS spectrum obtained for confirmatory analysis of 50 ng/mL methamphetamine in urine

Conventional analytical methods for drug analysis are time-consuming, requiring tedious sample preparations. Rapid screening devices are currently available, but they may produce inaccurate results. Therefore, we have developed 3 advanced mass spectrometry technologies for rapid detection and quantitation of 6 common drugs of abuse, i.e. ketamine, methamphetamine, cocaine, ecstasy (MDMA), cannabis (THC) and heroin, and their metabolites in urine and oral fluids. It is achieved by applying a high voltage directly to sample loaded with organic solvent, inducing electrospray ionization and generating mass spectra.

The technologies developed by PolyU include: 1) Wooden-tip Electro spray Ionization Mass Spectrometry (WT-ESI-MS), which is a simple and economical method with the use of a wooden toothpick; 2) Solid Phase Microextraction Coupled to Electro spray Ionization Mass Spectrometry (SPME-ESI-MS), which is an extraction and enrichment technique for enhancing the sensitivity of chemical analysis, and 3) SPME coupled with commercially available portable gas chromatography mass spectrometer (GC-MS) for on-site analysis of drugs-of-abuse.

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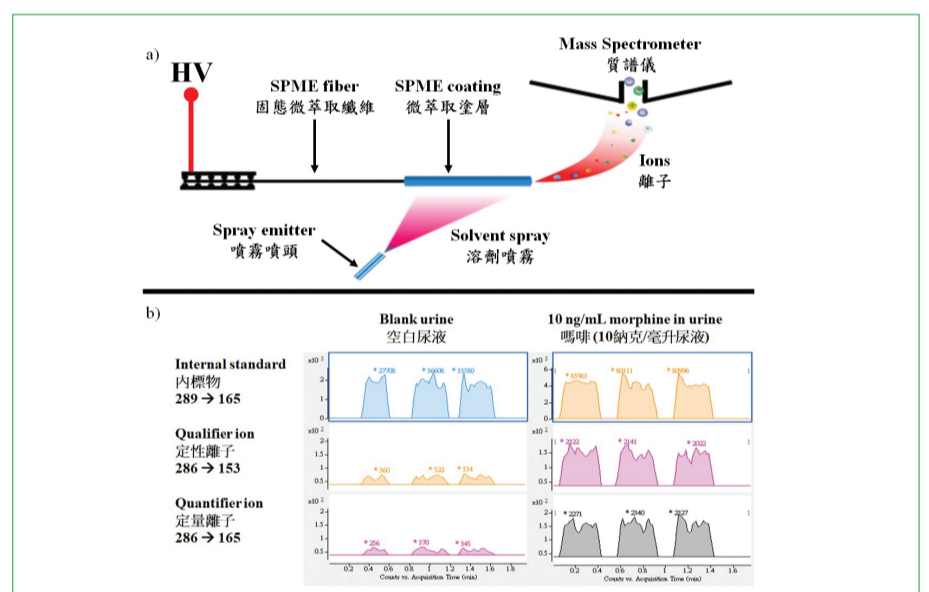
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特色與優點

- 「木籤電噴霧電離質譜」成本較低，易於安裝，兼容現有質譜儀，並能於幾分鐘內分析一個樣本
- 「固相微萃取—電噴霧電離質譜聯用」的靈敏度較高，能符合大部分國際濫用藥物檢測標準的要求
- 固相微萃取結合便攜氣相質譜儀方法適用於現場驗毒

應用

- 「木籤電噴霧電離質譜」適用於檢測尿液與唾液是否含有氯胺酮、甲基安非他明和搖頭丸，以及確定其含量
- 「固相微萃取—電噴霧電離質譜聯用」適用於檢測尿液和唾液中各種常被濫用的藥物(大麻除外)，以及確定其含量
- 現階段，固相微萃取結合便攜氣相質譜儀方法只能檢測氯胺酮和大麻，需進行進一步研究方能實現其所有潛在應用



(a) 「固相微萃取—電噴霧電離質譜聯用」方法的示意圖；以及 (b) 以多反應監視模式檢測尿液中的嗎啡(10納克/毫升)
a) Schematic diagram of Solid Phase Microextraction Coupled to Electro spray Ionization Mass Spectrometry and (b) MRM detection of 10 ng/mL morphine in urine

Special Features and Advantages

- WT-ESI-MS is relatively low cost, easy to set up, compatible with current instruments and only takes few minutes to analyze one sample
- SPME-ESI-MS is highly sensitive and can generally fulfill the detection requirements of international standards
- SPME coupled with portable GC-MS allows on-site drug detection

Applications

- WT-ESI-MS is suitable for the detection and quantitation of ketamine, methamphetamine and MDMA in urine and oral fluid
- SPME-ESI-MS is suitable for the detection and quantitation of the common drugs-of-abuse in urine and oral fluid, except for THC in oral fluid
- SPME coupled with portable GC-MS is currently able to detect ketamine and THC only. Further research is required to realize its full potential

