用於檢測濫用藥物的視覺化奈米材料感測陣列暨深度學習平台

提案人： 張煥宗 教授
單　位： 國立臺灣大學　化學系/研究所
簡　歷： 參照連結
http://www.ch.ntu.edu.tw/faculty_ch/htchang-c.html

市場及需求:
濫用藥物防制是全世界重要議題，常見的毒品包括海洛因、古柯鹼、甲基安非他命、愷他命及合成卡西酮等。目前市場上雖已有一些用於毒品檢測的化學呈色方法及免疫分析法，但囿於化學呈色試劑選擇性較差及免疫試劑成本高等不利因素，犯罪現場執行初篩上仍有許多限制，另需要有經驗的查緝人員判檢測結果。因此，迫切需要開發靈敏的現場感測系統，以檢測海洛因、古柯鹼、甲基安非他命、愷他命和合成卡西酮等濫用藥物；其中使用手機拍攝感測圖像並通過雲中的人工智能自動識別濫用藥物。

技術摘要(含成果):
本發明揭示五種不同類型的奈米材料用以構成感測海洛因、古柯鹼、甲基安非他命、愷他命及合成卡西酮感測之陣列系統。使用手機拍攝陣列圖像，然後將其發送到具有捲積神經網絡的深度學習人工工作站，以自動識別濫用藥物。檢測原理係利用濫用毒品造成新穎奈米材料螢光淬息或增強等特性。

優勢:
本發明之具 5 種感測材料之陣列可同時檢測海洛因、古柯鹼、甲基安非他命、愷他命及合成卡西酮等五大類常見毒品，具靈敏、廣篩、穩定、低成本等優勢，並搭配人工智慧辨識減少人為誤判，極具濫用藥物檢測未來性及吸引力。

競爭產品:
目前市面上毒品檢測試劑（紙）係以化學呈色法及免疫法檢測為主，但分別囿於選擇性較差及成本高等不利因素所限制。此外，近年愈來越多合成毒品流行，包括合成卡西酮、合成大麻及合成鴉片等，免疫法對於具有多種類緣物結構之毒品快篩技術上暴露本質上技術缺點。再者，目前市場尚未有可同時廣篩多種毒品及進行自動化辨識的相關產品。

專利現況:
本發明目前已進入中華民國及美國專利案件的申請階段。本研究團隊具有數十年研究經驗，著力於開發新穎且綠色的奈米材料合成方法，特別是在金、銀奈米團簇及碳量子點的領域。本團隊研究成果具體表現，包含於國際期刊發表超過 362 篇論文和積極參與許多國際合作案等。另，本實驗室前期所開發之卡西酮類毒品碳量子點毒品檢測試劑和試紙、液相萃取式碳量子點苯二氮平類安眠藥檢測試劑等皆已於正式取得美國專利(Patent No: 10041962, Aug. 07, 2018; 20200225216, Jul. 16, 2020)。

聯絡方式(請不用填):
臺大產學合作總中心
Tel: 02-3366-9945,　E-mail: ntuciac@ntu.edu.tw

A Visually Nanomaterial-based Sensor Array in Conjunction with A Deep Learning Platform for Analysis of Abused Drugs

PI： Prof. Huan-Tsung Chang

Department of Chemistry, National Taiwan University.

Experience:

http://www.ch.ntu.edu.tw/faculty_ch/htchang-c.html

Market Needs:

Prevention of drug abuse is an important issue all around the world. Popular abused drugs include heroin, cocaine, methamphetamine, ketamine, and synthetic cathinone. Although chemical approaches and immunoassays have been used for the detection of these popular drugs, their uses for preliminary screening at crime scenes are limited, mainly due to poor selectivity of chemical sensors and high cost of the immunoassays. In addition, it requires experienced law enforcement officers to judge the test results. It is thus highly demanded to develop sensitive and on-field array systems for sensing of abused drugs, including heroin, cocaine, methamphetamine, ketamine and synthetic cathinone, at the crime scene, in which a mobile phone is used to take the images that allow identification of the abused drugs through artificial intelligence in cloud.

Our Technology:

In this invention, we disclose use of five different types of nanomaterials to fabricate an array system for sensing of heroin, cocaine, methamphetamine, ketamine, and synthetic cathinone. A mobile phone is used to take the array images, which are then sent to a deep-learning artificial workstation with a convolutional neural network for identification of the abused drugs automatically. The sensing mechanism of the array system is based on the abused drugs induced fluorescence quenching or enhancement of the nanomaterials.

Strength:

The disclosed array with five nanomaterials can simultaneously detect five types of common drugs, including heroin, cocaine, methamphetamine, ketamine, and synthetic cathinone, with the advantages of sensitivity, wide screening ranges, stability, and low cost. The array images taken with a smartphone are further analyzed with artificial intelligence to reduce human misjudgment. The sensing and analysis system holds great potential for the analysis of abused drugs at crime scenes.

Competing Products:

Although commercially chemical approaches and immunoassay have been used for sensing of abused drugs, they are limited with the disadvantages of poor selectivity and/or high cost. In addition, their uses for sensing of synthetic drugs, including synthetic cathinone, synthetic cannabis, and synthetic opioids, that have become more and more popular in recent years are not ready. Furthermore, there are currently no products for simultaneous screening of multiple drugs and automated identification of them.

Intellectual Properties:

This invention is under the patent application in ROC and US now. The Chang's group has developed many novel and green approaches to preparation of nanomaterials, especially gold/silver nanoclusters, and carbon dots, for more than a decade. The Chang's group has strong connection with several international research teams and has published more than 362 papers in international journals. In addition, the Chang's group had obtained two U.S patents for abused drug detection systems (Patent No: 10041962, Aug. 07, 2018; 20200225216, Jul. 16, 2020).

Contact (do not need to fill out):

Center for Industry-Academia Cooperation, NTU

Tel: 02-3366-9945, E-mail: ntuciac@ntu.edu.tw