

POINT-OF-CARE COMMUNITY DRUG CHECKING TECHNOLOGIES: AN INSIDER LOOK AT THE SCIENTIFIC PRINCIPLES AND PRACTICAL CONSIDERATIONS

L. GOZDZIALSKI, B. WALLACE, D. HORE. 2023

[HTTPS://DOI.ORG/10.1186/S12954-023-00764-3](https://doi.org/10.1186/s12954-023-00764-3)

BACKGROUND

Many instruments have been proposed and explored for the purpose of drug checking, however there is often a trade-off between accuracy, cost, portability, speed, and ease-of-use.

This paper discusses tools used as part of the Vancouver Island Drug Checking Project in Victoria, Canada.

IMMUNOASSAY TEST STRIPS

"IMMUNOASSAYS OFFER A CONVENIENT, FAST, AND LOW-COST TESTING METHOD, USEFUL FOR OUTREACH AND AT-HOME USE."

Immunoassays use the principles of competitive binding between the antigen (target drug such as fentanyl) and antibodies of the test strip pad.

They offer reliability and low limit of detection (LOD), however are largely qualitative and prone to either false positives with structurally similar compounds or false negatives due to the diversity of drugs within a class.

ATR-IR SPECTROSCOPY

"ULTIMATELY, AN IR SPECTRUM IS A PLOT OF THE DEGREE TO WHICH THE LIGHT HAS BEEN ABSORBED (THE ABSORBANCE) AS A FUNCTION OF THE IR FREQUENCY."

IR spectroscopy is one of the most widely used instrumental methods for drug checking on account of its relatively low cost, ease of operation, speed, minimal sample preparation, and availability of libraries with a wide range of drugs and cutting agents. Limitations are an LOD of around 5%, difficulty distinguishing between similar IR fingerprints, and a shallow penetration depth that contributes to uncertainty for poorly mixed samples.

GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS)

GC-MS is useful as a point-of-care drug checking instrument as it offers trace-level identification.

However, it has a relatively high instrumental and operational complexity.

Mass spectrometry data enables us to benchmark the performance of portable instruments and pursue further method development.

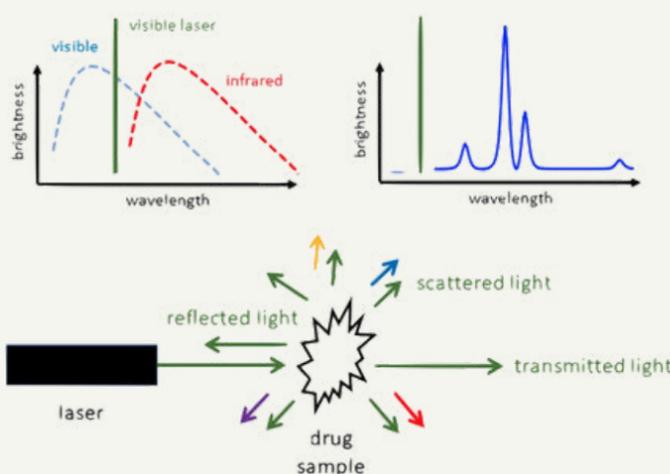
MULTI-INSTRUMENT APPROACH TO DRUG CHECKING

"IN THE CONTEXT OF INCREASINGLY COMPLEX SUBSTANCES AND UNPRECEDENTED LEVELS OF ILLICIT DRUG OVERDOSE, THERE ARE SIGNIFICANT ADVANTAGES TO A MULTI-INSTRUMENT APPROACH TO DRUG CHECKING."

Out-of-the-box technology is not currently meeting the needs of service providers and a multi-instrument approach may be required to respond to expectations of drug checking services. Recognizing limitations, consideration of different instrument demands and contexts, and integrating instrument knowledge will establish trustworthy and effective service.

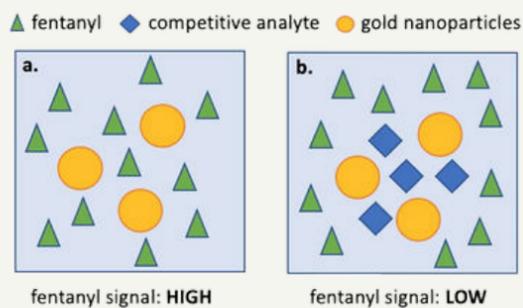
RAMAN SPECTROSCOPY

With Raman Spectroscopy, a laser in the visible light region is focused on a sample which scatters some of the light. This light shifts after contact with the sample and provides a molecular fingerprint. Significant challenges of Raman spectroscopy are sample fluorescence due to dyes and similar issues with lack of sensitivity that Infrared (IR) spectroscopy faces.



SURFACE ENHANCED-RAMAN SPECTROSCOPY (SERS)

"ALTHOUGH SERS IS NOT WIDELY EMPLOYED IN DRUG CHECKING, IT IS GAINING ATTENTION ON ACCOUNT OF IT'S POTENTIAL FOR TRACE DETECTION."



SERS amplifies Raman scattering via metal nanoparticles in solution to detect trace level components. This method also reduces fluorescence, however its sensitivity can be lowered in complex mixtures as shown above. It also requires significant method development and validation for each specific application.



To learn more about our unique drug checking project, visit substance.uvic.ca