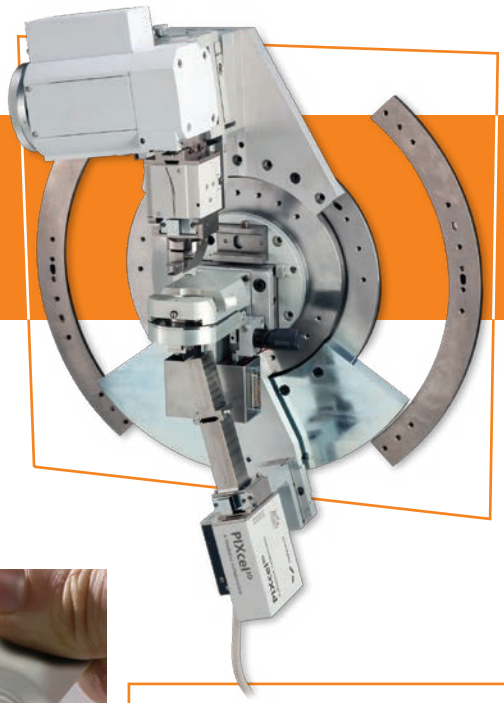
PANalytical

X-RAY POWDER DIFFRACTION

Easy and fast analysis of complex street drugs



Introduction
X-ray diffraction (XRD) is an established analysis technique used to confirm identity of crystalline substances, and it is widely accepted by courts of law. XRD is becoming an invaluable tool for forensic and drug laboratories. Additionally this technique is utilized by a growing number of institutions and recognized by international organizations such as SWGDRUG* as a class A method for controlled substances identification.
With the aid of the PANalytical CanDI-X, the world's first search-match database for controlled substances, it is possible to positively identify these materials, their precursors and additives non-destructively, within minutes.

Ready for any sample
Narcotics come in various forms: as powders, tablets or liquids. X-ray diffraction allows for analysis of all these forms, regardless of the matrix type. There is no potential for carry-over effects as samples stay sealed during transportation and measurement (see Figure 1), and cannot leave traces in the instrument. Powder samples always stay horizontal thus fully avoiding gravity-induced spilling or losses.
The sample material is not altered by this analysis technique and can still be used as evidence in court. Usually only milligram quantities are required for analysis.

Figure 1. Sample preparation for transmission X-ray diffraction.

Cocaine in cream

With X-ray diffraction, crystalline components in difficult matrices can easily be detected. The example in Figure 2 shows that apart from a slight change in background, the cream does not hinder the detection of cocaine. There is no instrument blockage by the cream because with XRD the sample is not in direct contact with other instrument components.

Summary
Easy sample preparation (powders, tablets, blisters, creams etc.), fast data collection and straightforward identification.
This non-destructive technique is suitable for complex mixtures, with no risk of cross-contamination between samples.

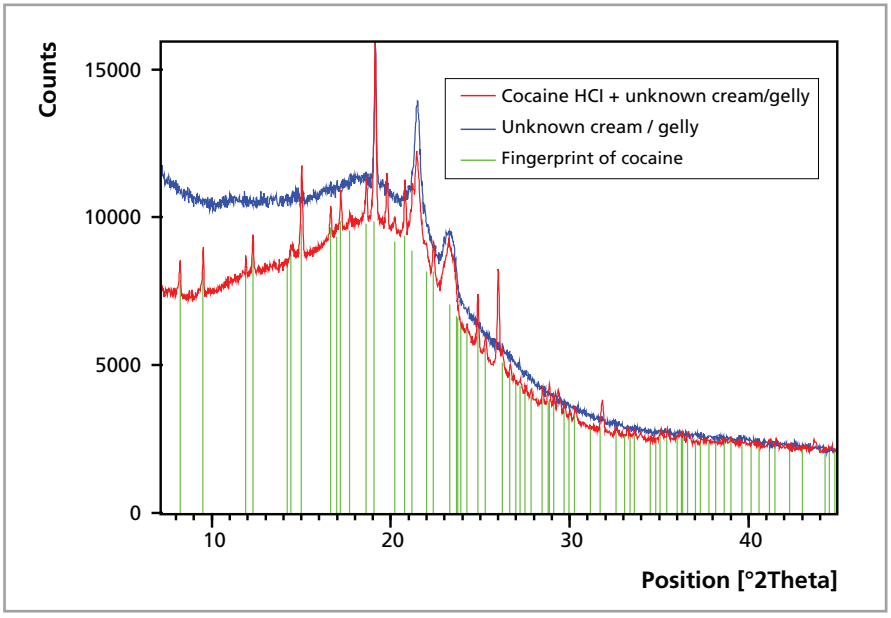


Figure 2. Diffraction pattern of cocaine blended in a cream. There is no risk of cross-contamination between samples run on an XRD instrument

Identification of GHB
The preparation and identification of liquid gamma-hydroxy butyric acid by non-XRD methods can be difficult due to the hygroscopic nature of the material. This sample was dried on a hot plate and collected on a stainless steel spatula. The resulting white solid was powdered and measured by XRD. Sample preparation, data collection and search-match analysis required less than 10 minutes to positively identify GHB (Figure 3). All peaks are explained by one single reference pattern, showing that this sample consists of pure GHB.

Identification of complex drug mixtures
Using the XRD technique makes automatic identification of multiple active ingredients possible, even in the presence of other substances that would normally cause interferences in standard chromatography. Figure 4 illustrates the positive identification of 3 controlled substances (methamphetamine•HCl, amphetamine•SO_4, pseudodephederine•HCl) in the presence of a large amount of caffeine.

Experimental:
All data represented above was collected using an X'Pert Powder system in transmission geometry. The examples were analyzed with the search-match software HighScore together with the CanDI-X database, which was developed with data and samples from the Drug Analysis Services of Health Canada.

Conclusion
X-ray diffraction is a well recognized method for the identification of crystalline materials. Sample preparation and data collection are fast, easy and straightforward, without carry-over effects. The method is suitable for complex mixtures and a wide range of materials. This non-destructive technique keeps samples intact as exhibits in the court of law.

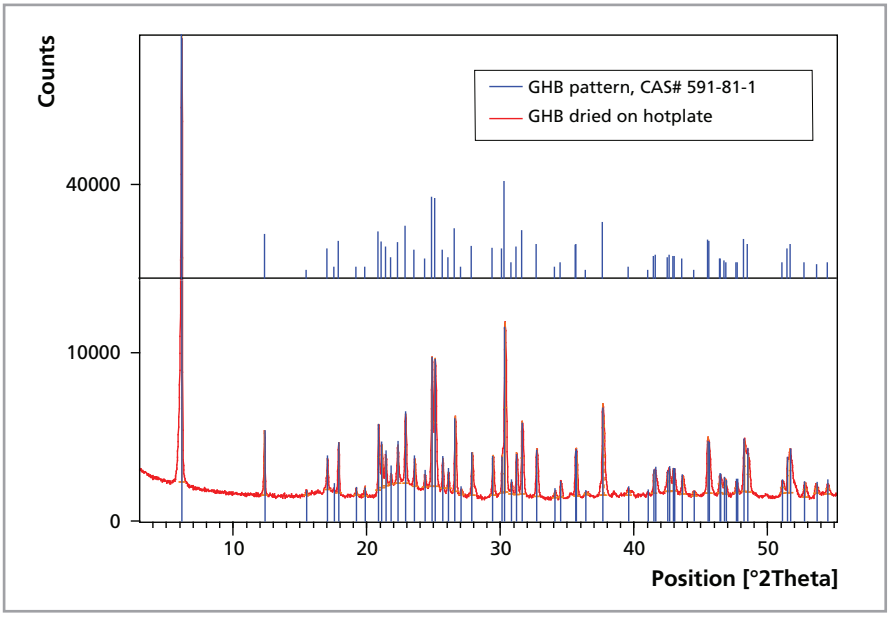


Figure 3. Diffractogram of gamma-hydroxy butyric acid (red trace) and reference pattern (blue sticks) proving 100% pure GHB in less than 10 minutes

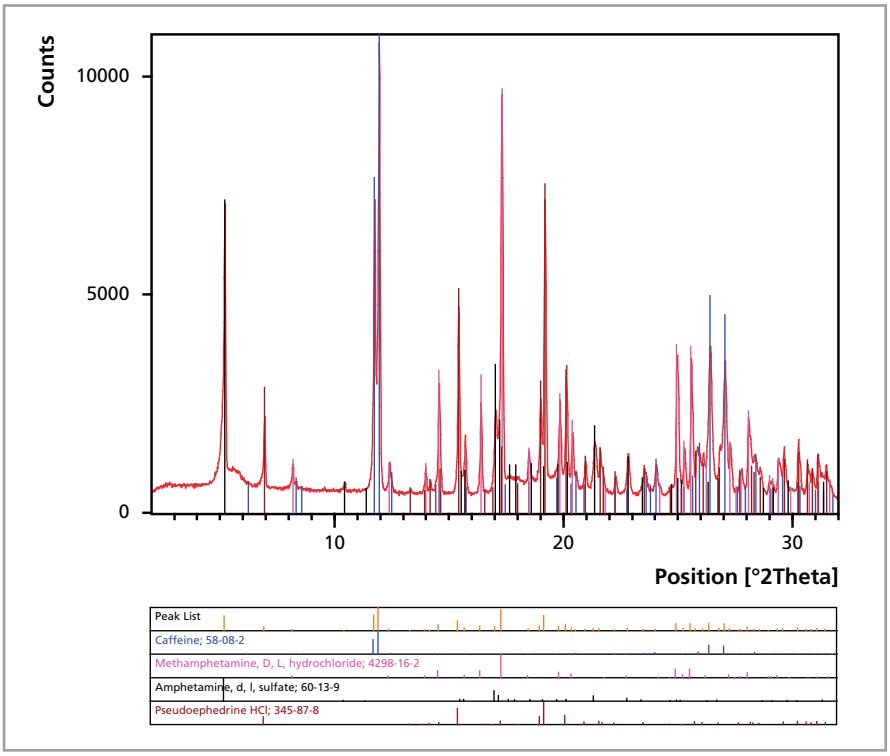


Figure 4: Each of the phases in a complex mixture provides a unique fingerprint and can be identified by X-ray diffraction.

* http://www.swgdrug.org

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