

# Identification of Unknown Materials for Homeland Security and Crime Scene Investigation Using the RamanStation 400 and RamanMicro 200



## Case Study 1

New York Subway Station: unknown white powder

In the summer of 2003, an unclaimed bag was reported on the New York subway. Further examination revealed that it contained an unmarked plastic bag containing approximately 5 lbs. of a white powder.

Due to the unknown nature of the substance, it was not removed from the bag for analysis but instead the spectrum was recorded directly through the bag using a fiber optic probe from the PerkinElmer RamanStation™ 400F.

The Auto-Subtract software routine was used to remove the plastic bag signals from the spectra (as shown in Figure 1). The built-in library searching of the spectral database identified the material as being starch. The entire process took less than 60 seconds.

## Introduction

In homeland security there is a need for rapid identification of unknown substances. The analysis of unknown white powders in particular is typically difficult, using methods that are time consuming and require a specialist's chemical knowledge. However, the PerkinElmer® RamanMicro™ 200 now provides the ideal solution for identifying a very wide range of explosives, biological and chemical weapons and everyday materials used in hoax mailings, such as: sodium bicarbonate, starch, sugar, household detergent and flour.

## Through-bag analysis

Analyzing unknown samples can be risky as the sample may be harmful. However, Raman spectra can be acquired through a range of containers such as plastic bags and glass bottles. For example, Raman spectra identified unknown materials sealed in plastic bags (as shown in Figure 1).

The following information has been taken from two real-life situations.

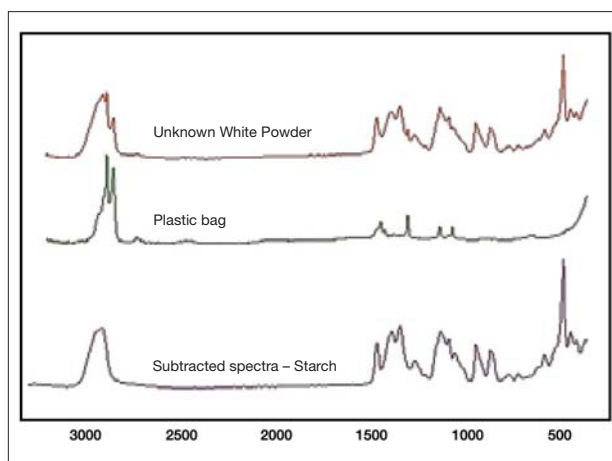


Figure 1. Identification of an 'unknown' white powder on the New York subway system.

## Case Study 2

John F. Kennedy Airport, New York: white powder found in the cockpit of a Boeing® 747 aircraft

In the spring of 2004, an airline ground crew found a small quantity of white powder on the floor of a Boeing® 747 cockpit. It was assumed that the material was a dangerous agent such as an explosive or a biochemical agent. Upon visual inspection using the RamanMicro's video camera, it was noted that the sample was made up of three components: fluffy white crystals, needle-shaped white crystals and what appeared to be a clear, plastic material.

Raman spectral analysis concluded that the white crystalline materials were glucosamine and mannitol (as shown in Figure 2). Glucosamine is a standard medication for arthritis sufferers and mannitol is a standard pharmaceutical filler. The plastic material was identified as gelatine, which is commonly used to make pharmaceutical capsules.

Visual analysis, spectral acquisition and spectral library searching was completed in a few minutes.

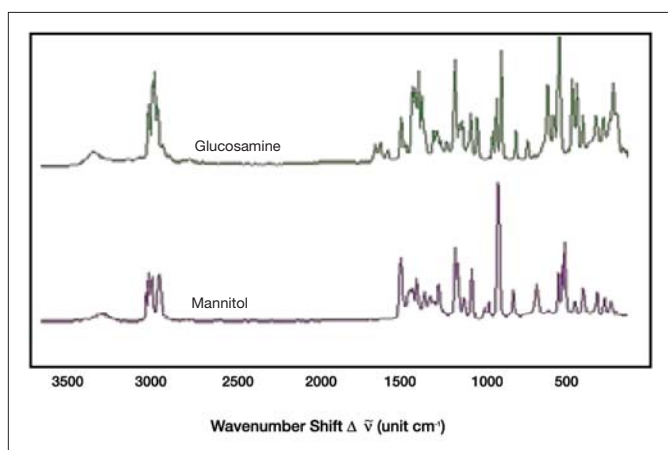


Figure 2. Identification of an 'unknown' powder at John F. Kennedy Airport.

## WMD and explosives identification

Not only can Raman spectroscopy be used to identify unknown white powders rapidly, it can also be used to identify explosives (Figure 3) and other biochemical agents such as anthrax and mustard gas (Figure 4).

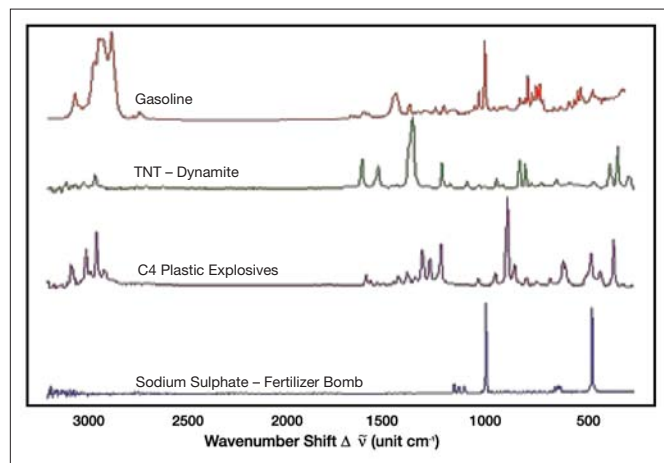


Figure 3. Differences between Raman spectra of common explosives.

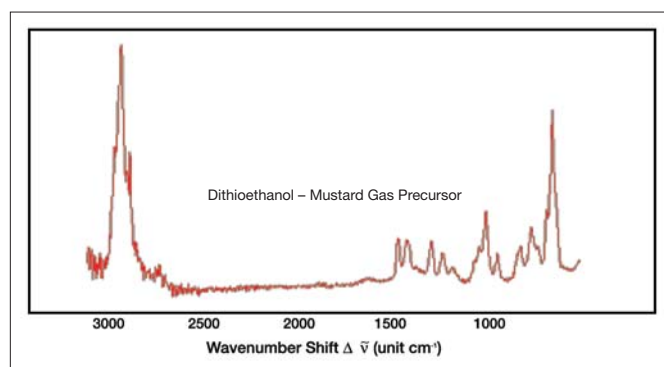


Figure 4. Raman spectrum of dithioethanol.

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