Technical Overview

Pharma and Biopharma

Agilent

Trusted Answers

Verifying Raw Materials Using Spatially Offset Raman Spectroscopy

Introduction

Spatially offset Raman spectroscopy (SORS) is a powerful technology used for identifying materials inside unopened packaging. SORS enables Raman analysis of materials through thick or opaque containers such as paper sacks, plastic tubs, and bottles. This Technical Overview explains how SORS works, and how it is used for raw material identification (RMID) verification to improve QC speed and workflow.

Raw Material Identity Verification Through Containers

To avoid manufacturing errors, accepting incoming materials for pharmaceutical manufacture requires verification of the material's identity. The resources needed to do this testing can be high, particularly where 100 % testing is mandatory or desirable. RMID testing by Raman spectroscopy is commonplace due to its speed and convenience; however, Raman requires a clear line of sight to the raw material, which is not the case with most packaging. Sacks, tubs, bottles, and FIBCs are often made of opaque or fluorescent materials, which means that testing by conventional spectroscopy requires the containers to be opened. Opening containers requires a powder-handling booth, protective clothing, and cleanup, and significantly increases cost and required resources.

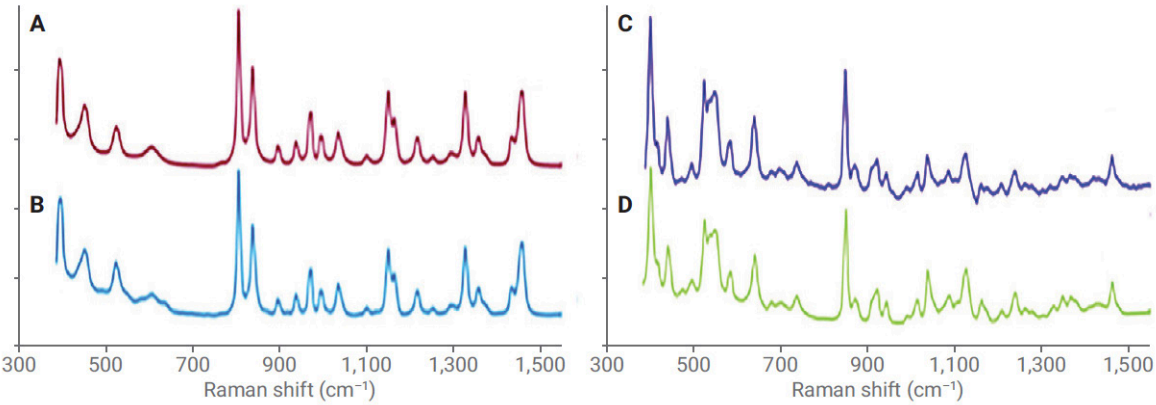
SORS

Spatially offset Raman spectroscopy (SORS) is a derivative of Raman spectroscopy that enables high-quality Raman spectra of the contents of opaque packaging to be measured in seconds for an effective noninvasive material identification. Figure 1 shows the SORS measurement of sucrose through a 1.5 mm thick polypropylene (PP) tub. Non-transparency and fluorescence from packaging defeats conventional Raman instruments. SORS produces a high-quality spectrum through several millimeters of opaque plastic, multiple layers of paper, or many millimeters of colored glass, allowing positive identification where it would otherwise be impossible (see Figure 1A and B). The SORS spectrum in Figure 1C is a clear match for the sugar reference spectrum shown in Figure 1D.

How SORS Works

In a SORS measurement two spectra are automatically collected at differing laser excitation positions on the container (Figure 2). A surface or "Zero offset" container rich Raman spectrum is collected at the same place the material/container is illuminated, then a sub-surface or "Offset" content rich spectrum is collected after redirecting the laser some millimeters away. A scaled subtraction of the "Zero" spectrum from the "Offset" spectrum allows the container signal to be removed, leaving only the contents spectrum for analysis. The SORS spectrum, which is free from background or container spectrum, is then matched against a reference for identification verification.

Example containers.



Polypropylene container.

Figure 1. A) Conventional Raman spectrum through a white PP container without sucrose inside; B) with sucrose; C) SORS spectrum through the same white PP container, t = 8 s; D) reference sucrose spectrum.

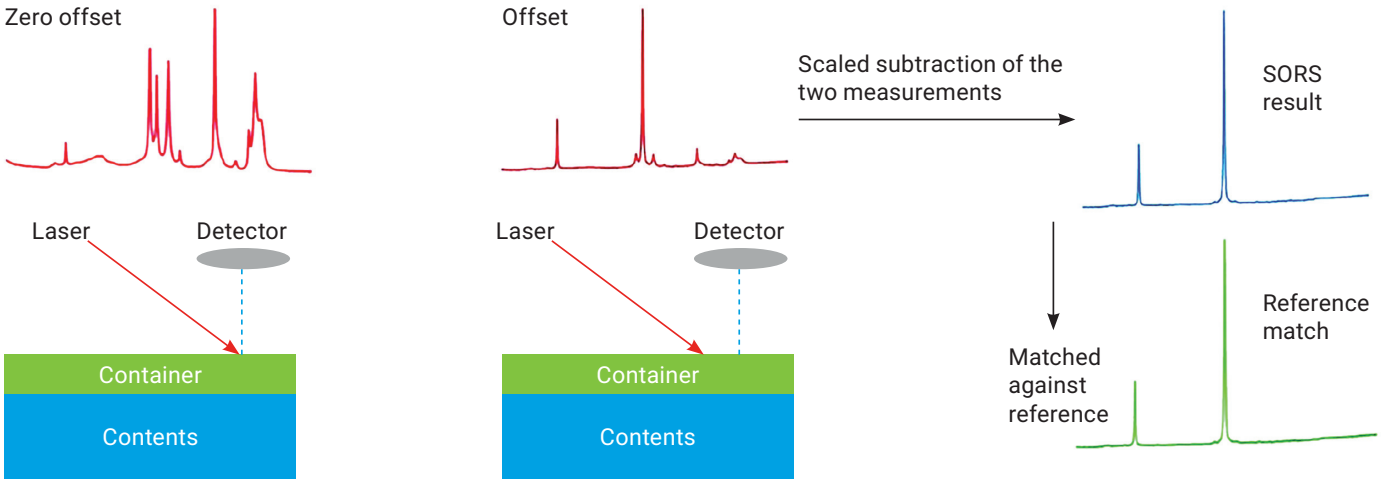


Figure 2. SORS measurements through a container. Zero offset geometry (left), with spatial offset (right). Scaled subtraction retrieves the contents spectrum only, which is matched with a reference for identification.

SORS Advantages for Raw Material Identification

SORS transforms the RMID process by enabling warehouses to check incoming raw materials directly in quarantine for better throughput.

- Opening/Sampling of containers in a sampling room is no longer needed.
- Moving and handling of containers is drastically reduced.
- 100% ID is achievable.
- Multi-point sampling (surveying) on a single container can easily be performed.

SORS enables the analysis of raw material through “line of sight” or transparent packaging like liners or clear glass bottles and opaque containers like FIBCS, amber bottles, white PE tubs or paper sacks.

- The container contribution is removed dynamically, raw material spectra used for ID are isolated from container contribution for a truly container interference free result.
- Liner opacity, color or thickness, container opacity, chemical makeup or inherent fluorescence are easily handled.

SORS preserves the integrity of the raw material packaging. Sterility or packaging environmental conditions are maintained during the identification test.

- Raw materials like surfactants, buffers and media blends are kept sterile for manufacturing of complex biologics.
- Shelf life of raw materials like polysorbates is maintained and unnecessary waste is reduced.

Agilent SORS Systems for Raw Material Identification

The Agilent Vaya Raman system is the first handheld Raman system with SORS technology for the fast identification of raw materials through containers. Compatible with most raw materials, Vaya works in seconds through clear vials, transparent / colored liners, white / colored plastic tubs, FIBCs, papers sacks and amber glass bottles.

The Agilent RapID Raman system is a portable wheeled system for raw material testing when working with the most challenging opaque containers. RapID is compatible with most pharmaceutical materials and excipients in most containers (excluding metal and fiber drums).

Agilent Vaya Raman system

Agilent RapID Raman system

RapID and Vaya can be used directly in warehouse quarantine areas. With simple workflows, barcode readers, and built-in networking support, routine testing is fast and efficient. RapID and Vaya systems are designed for use in GMP-governed raw material ID processes and support 21 CFR Part 11 compliance.

www.agilent.com/chem/raman

DE.4275810185

Printed in the USA, February 25, 2020
5994-1806EN

Agilent
Trusted Answers