Your Research Partner for Photonics Solutions

Pharmaceuticals | Food Technology | Medical Devices | Sensors & Systems

Innovation Through Light

CENTRE FOR ADVANCED PHOTONICS & PROCESS ANALYSIS

CAPPA

Pharmaceutical Cleaning Verification using Deep UV Resonance Raman Spectroscopy (DUVRSS)

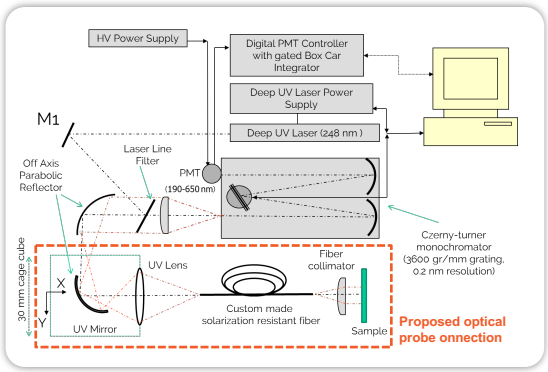
*Cleaning verification is a quality control process for determining the effectiveness of a cleaning event, and forms an important component of **Process Analytical Technology (PAT)**. It is used to establish that product cross contamination is controlled, ensuring patient safety and product quality. Current verification is made using visual inspection and/or analytical verification (e.g. Total Organic Carbon (TOC), HPLC/UPLC, UV or conductivity). This project aims to develop a preferred direct surface measurement using **Deep UV Resonance Raman Spectroscopy**.*

Proposed Solution - DUVRSS

Deep UV Resonance Raman Spectroscopy provides a combined Raman and fluorescence spectra measurement with improved detection limits vs Surface-enhanced Raman spectroscopy (SERS) and a considerable level of chemical specificity. Rapid analysis & feedback on contaminant levels and identity can be achieved with minimal sample preparation. Specific improvements on existing technologies like HPLC are contained within an easy-to-use analysis protocol. This project will:

Build a bench top prototype to determine the detection/sensitivity of DUVRRS for use with pharmaceutical excipients, APIs and cleaning agents.

Investigate the applicability of using an optical fibre to develop a contact probe for hard to reach areas

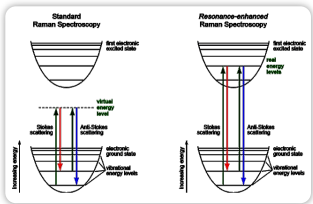


Industry Impact

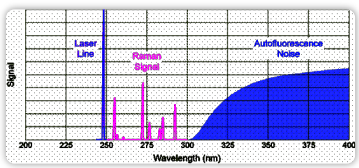
- ***Help identify difficult to clean areas***
- ***Simultaneous multi-component detection***
- ***Reduced production downtime from days to hours***
- ***Improved sample response times prevent a measurement backlog***
- ***Identification of molecular functional groups allows end users to apply targeted cleaning procedures***

Raman Spectroscopy

Raman spectroscopy is a non-contact, non-destructive, method of elucidating the composition and structure of unknown materials without sample handling, processing, or use of reagents. Visible and near-IR lasers have photon energies below the first electronic transitions of most molecules, but when the photon energy of the laser lies within the electronic spectrum of a molecule, as is the case for UV lasers and most molecules, the intensity of Raman-active vibrations can increase by many orders of magnitude. This effect is called "resonance-enhanced" Raman scattering.



PMTC
Advanced Technology Solutions in Pharmaceutical Manufacturing
TECHNOLOGY CENTRE
ENTERPRISE IRELAND
IDA IRELAND SUPPORTED



Advantages of DUV Resonance Raman

- ***Rayleigh Advantage:** Scattering of photons is ~1/λ⁴, so higher in the UV.*
- ***Resonance Enhancement:** Factors of ~10⁵ compared to normal Raman scattering.*
- ***Fluorescence Avoidance:** Excitation in the UV allows easy filtering out of fluorescence, since Raman fingerprints are far away.*
- ***Ambient Background Elimination:** Essentially no background irradiation from solar or artificial lighting.*
- ***Chemical Specificity:** Only those Raman bands associated with electronic transitions are enhanced, enabling easier interpretation.*

The CAPPA Technology Gateway is co-financed by the Government of Ireland and the European Union through the ERDF Southern, Eastern & Midland Regional Programme 2021-27

Rialtas na hÉireann Government of Ireland

Co-funded by the European Union

Southern Regional Assembly

Enterprise Ireland

MTU Ollscoil Teicneolaíochta na Mumhan Munster Technological University

***Web:** www.cappa.ie* ***Email:** cappa@mtu.ie* ***Twitter:** @cappa_ie* ***Phone:** +353 21 433 5338*

***Post:** CREATE Building, Munster Technological University, Bishopstown, Cork, Ireland, T12 P928*