Detecting RNA Virus with Raman Spectroscopy

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A team from the Mumbai-based Tata Memorial Centre has turned to Raman Spectroscopy to detect RNA viruses present in saliva samples. It is a proof-of-concept study to analyse non-infectious RNA viruses using conventional Raman Spectroscopy without using any additional reagent to enhance the signal.

RNA Virus and Raman Spectroscopy

It has been reported that novel coronavirus is found in sufficient numbers in human saliva. For the study, the researchers spiked saliva samples with **non-infectious RNA viruses and analysed it with Raman Spectroscopy.** They analysed the raw Raman Spectroscopy data and compared the signals with both viral positive and negative samples.

Statistical analysis of all the 1,400 spectra obtained for each sample, showed a set of **65 Raman spectral features** was adequate to identify the viral positive signal. Most of the spectra were specific for the RNA molecule. The findings were confirmed by adding an enzyme that specifically **degrades RNA molecules** – the RNase – in presence of which the 65 spectra based feature was completely abrogated that **didn't happen in presence of DNase or proteinase.** It was thus confirmed that the signal came from the RNA contributed by the intact virions.

The signal set has 92.5% sensitivity and 88.8% specificity. The results are published in the Journal of Biophotonics. **To minimise variability and automate the analysis of the Raman spectra for RNA viruses, an automated tool was developed**—RNA Virus Detector—using a graphical user interface. The tool can be used for detecting RNA virus from an individual or a group of samples in an unambiguous and reproducible manner. This

tool, the first of its kind, takes raw data from a Raman Spectrometer analysis based on the 65 spectra signature and provides an objective output if viral RNA is present or absent in the sample.

This conceptual framework to detect RNA viruses in saliva could **form the basis for field application of Raman Spectroscopy in managing viral outbreaks**, such as the ongoing COVID-19 pandemic. Since the tool can **only identify RNA viruses and not identify the specific one**, it can be used only for screening. The RNA virus detected could be a common cold virus as well or any other RNA virus such as HIV. It **doesn't look for COVID-19 viral-specific signatures.**

This whole process of **data acquisition and analysis can be performed within a minute.** A portable (benchtop or handheld) Raman spectrophotometer installed at the port of entry such as airports or any point of care (in the field) can quickly screen passengers within minutes.