



Covid-19 Detection Using Mass Spectrometer

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Why in News

Researchers from the **Institute of Genomics and Integrative Biology (IGIB)** and the **National Centre for Disease Control (NCDC)** have developed a **technique that uses mass spectrometry** to detect **novel coronavirus (SARS-CoV-2)**.

- **IGIB is a premier institute of Council of Scientific and Industrial Research (CSIR)**, engaged in research of national importance in the areas of genomics, molecular medicine, bioinformatics, etc. It is based in **New Delhi**.
- **NCDC** is under administrative control of the Directorate General of Health Services in the **Union Ministry of Health and Family Welfare**.

Key Points

- **Mass Spectrometry (MS):**
 - It is an **analytical technique** used for **determining the elemental composition of samples**, quantifying the mass of particles and molecules, and elucidating their chemical structure.
 - MS is **based on ionization and fragmentation of sample molecules in the gaseous phase**.
 - The instruments used in this technique are called **mass spectrometers** and **mass spectrographs**, and they operate on the principle that **moving ions may be deflected by electric and magnetic fields**.
 - Clinical laboratories use the MS technology for **disease screening, diagnosis of disease and metabolic disorders**, monitoring of drug therapy, identifying drug toxicity and poisoning, and discovering new biomarkers.
 - **Biomarker** is short for **biological marker**, and is used as an indication that a biological process in the body has happened or is ongoing.

- **New Technique Covid-19 Detection:**

- The new technique based on mass spectrometry relies on **detecting the presence of two peptides which are unique to SARS-CoV-2 virus** and not seen in any other coronavirus or other viruses.

Peptides are building blocks of the viral protein.

- Only two peptides are used for quick virus detection, though seven peptides were found to be unique to SARS-CoV-2. One of the peptides is the **spike protein** and the other is a **replicase protein**.
 - The unique peptides were seen in over 54,000 genomic sequences of the SARS-CoV-2 virus deposited in a **public database (GISAID)** as on 1st July 2020.
 - The **GISAID initiative** promotes the rapid sharing of data from all influenza viruses and the coronavirus causing Covid-19. It was launched on the occasion of the **61st World Health Assembly** in **May 2008**.

- **New Technique vs RT-PCR:**
 - **No Amplification of RNA:**
 - The new method can directly detect the virus without amplifying the RNA for detection, as is the case with the **Reverse Transcription-Polymerase Chain Reaction (RT-PCR) test**, which is considered the gold standard of testing for the infection.
 - Scientists **could detect the peptides** of SARS-CoV-2 virus even in patients who have recovered from the symptoms and have **tested negative for the virus by RT-PCR**. The peptides were present even after 14 days of initial infection.
 - **Sensitivity and Specificity:** With the new technique, scientists have been able to detect novel coronavirus with **95% sensitivity** and **100% specificity** with respect to RT-PCR. This is **much better than the alternative rapid antigen kits**, currently in use in India for scaling up testing, that can throw up 20 to 50% false negatives.
 - **Sensitivity** measures how often a test correctly generates a positive result for people who have the condition that's being tested for (also known as **'true positive' rate**).
 - **Specificity** measures a test's ability to correctly generate a negative result for people who don't have the condition that is being tested for (also known as the **'true negative' rate**).
 - **Detection Time:** Detection of the virus takes less than **three minutes**; time from sample preparation to detection takes less than **30 minutes**.
The **RT-PCR takes a minimum of 2-5 hours** including time taken for a sample transportation.
 - **Cost:** The mass spectrometer is **expensive** but it would cost only about **Rs.100 per test**, and so **cheaper than RT-PCR**. Further, many research labs have the mass spectrometer.
 - **Pooled Testing:** The method **also allows for effective pooling of samples**. **Pooled testing** is when samples from more than one person are mixed together and tested. And, if one of the batches comes back positive, the samples from only that batch are retested individually to detect the person who has the infection. This method helps save cost and scale up testing.
 - Considering its benefits, it can **either complement RT-PCR** or be used as an **alternative to RT-PCR**.

Different Types of Test for Detecting Covid-19

- RT-PCR Tests
- Rapid Antigen Detection Tests
- RTnPCR Tests
- Feluda Tests
- ELISA Antibody Tests

- **SalivaDirect Test**

Source: TH