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COVIRAP : A Quick Covid-19 Test

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Why in News

Recently, **Indian Council of Medical Research (ICMR)** has approved a new low-cost **Covid-19** diagnostic method named **COVIRAP**, developed by the **Indian Institute of Technology (IIT), Kharagpur**.



Key Points

- **Working of COVIRAP:**

- COVIRAP has an **automated pre-programmable temperature control unit, a special detection unit on genomic analysis, and a customised smartphone app** for results.
- The machine has an **isothermal nucleic acid amplification method**, which did away with the need for a **thermocycler**.
 - **Isothermal amplification of nucleic acids** is a process that rapidly and efficiently accumulates **nucleic acid sequences** at constant temperature. The Isothermal Amplification Techniques have been developed as **alternatives to Polymerase Chain Reaction (PCR)**.
 - **Thermocyclers** are instruments used to **amplify DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) samples** by the **polymerase chain reaction**.
- Once the sample is processed in the machine after being mixed with solutions developed by the IIT team, treated paper strips (similar to the pregnancy strips) are dipped into it, and the emergence of coloured lines will depict the presence of the virus.

- **Benefit of COVIRAP Process:**

- **Economic:** It is a cheaper process, its machine costs less than Rs. 5,000 and the test kits would each cost about Rs. 500.
- **Quicker:** The **test is completed within an hour while RT-PCR test (Reverse Transcription Polymerase Chain Reaction)** takes 3-4 hours for testing the sample.
- **Simpler to Handle:** The portable test unit that **can be handled by unskilled operators outside the lab environment.**

It is also better than the **FELUDA test** because the FELUDA employs a gene editing technology called **CRISPR-cas9**, which requires a lab testing environment.

- **Reusable:** The **same unit can be used for a large number of tests** on replacement of the paper cartridge after each test.
- **Efficient:** This assay (testing) holds the **capability of detecting extremely low levels of viral loads** compared to any other method based on similar principles of testing.

This means that very early stages of infection can be detected, thereby isolating the patient and arresting the uncontrolled spread of infection in the community via asymptomatic patients.

- **High Accuracy:** It correctly detected **108 out of the 115 positive samples** identified by an RT-PCR machine, and **83 out of 85 negative samples**, meaning that it has a **94% sensitivity and 98% specificity** in comparison to RT-PCR (i.e lower than RT-PCR).
- **Other Usage:** The COVIRAP testing machine **can also perform tests other than Covid-19**. It can be used in influenza, malaria, dengue, Japanese encephalitis, TB etc, which are under the category of isothermal nucleic acid-based tests.

Novel solution
A look at how the new COVID-19 testing device works



Virus alert: Researchers with the COVIRAP device at IIT Kharagpur.
▪ SPECIAL ARRANGEMENT

- COVIRAP machine resembles a box and comes with a kit
- Kit has three master mixes which are markers of different genes to confirm the virus
- RNA samples are extracted from **nasal swabs** and mixed with the master mix in tubes
- Tubes are put in the machine which is set at a specific temperature and programmed to run for a fixed period
- Once the heating is over,

it's mixed with another solution and reheated

- A paper strip is dipped into reaction product
- Coloured lines develop, like in a pregnancy kit, to indicate presence or absence of virus
- A smartphone app can grab image of the strip and convey results
- COVIRAP can deliver results in an hour

DIFFERENCES WITH RT-PCR

- While RT-PCR machines can cost up to ₹25 lakh, the COVIRAP machine cost the IIT researchers only **₹5,000**
- COVIRAP test kits cost about **₹500**
- RT-PCR needs to be operated by a molecular biologist
- COVIRAP can be operated with minimal training

RT-PCR Test

- **Kary Mullis**, the American biochemist invented the PCR technique. He was awarded the **Nobel Prize** for Chemistry in 1993.
- Under this, **copies of a segment of DNA (deoxyribonucleic acid)** are created using an enzyme called Polymerase.

The 'chain reaction' signifies how the DNA fragments are copied, exponentially — one is copied into two, the two are copied into four, and so on.

- A fluorescent **DNA binding dye called the “probe” is added to DNA**, which shows the presence of the virus on a **fluorometer**.
- Since coronavirus is made of **RNA (ribonucleic acid)**, therefore to detect coronavirus, **RNA is converted into DNA** using a technique called reverse transcription.

A 'reverse transcriptase' enzyme converts the RNA into DNA.

- Copies of the DNA are then made and amplified.

Source: TH