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NIT Rourkela designs label-free biosensor for affordable breast cancer diagnosis

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It is highly effective at distinguishing the cancerous cells from healthy breast cells



Researchers at the National Institute of Technology Rourkela, Odisha have investigated a novel semiconductor device-based biosensor that can identify breast cancer cells without the need for complicated or expensive laboratory procedures.

Since cancer cells often do not show any initial signs of progression, it is crucial to diagnose them at an early stage for prevention and cure. While several diagnostic procedures, such as X-ray, mammography, Enzyme-Linked Immunosorbent Assay Test (ELISA), Ultrasonography, and Magnetic Resonance Imaging (MRI), are used to identify the disease, they require specialised equipment and trained personnel. Additionally, these diagnostic methods are often inaccessible to people in remote areas.

To address these challenges, Dr Sahu and his team have designed a novel approach that uses the physical properties of cancer cells to detect them. Cancerous breast tissues, which hold more water and are denser than healthy tissues, interact differently with microwave radiation. These differences, known as dielectric properties, make it possible to distinguish between healthy and cancerous cells.

To take advantage of this, the research team has proposed an electronic device, ‘TFET’ (Tunnel Field Effect Transistor), based on TCAD simulation results, that can effectively detect breast cancer cells. FETs are commonly used in electronics, but here they have been adapted to function as a sensitive detector of biological materials. Unlike many traditional tests, this biosensor does not need any added chemicals or labels to work.

The findings show that the sensor is sensitive in detecting T47D cancer cells due to their high density and permittivity. It is also highly effective at distinguishing the cancerous cells from healthy breast cells, offering improved sensitivity compared to existing technologies.

Another key feature of the developed technology is its affordability. TFET-based biosensor is affordable compared to the conventional testing methods and other existing FET-based biosensors.

The developed technology holds significant promise for future medical applications, resulting in low-cost, easy-to-use diagnostic devices that bring early breast cancer detection to clinics, mobile testing units, and home settings. As the next step, the research team is exploring potential collaborations for fabrication and scientific validation of the developed technology.