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IISc suggests blood glucose detection through painless photoacoustics

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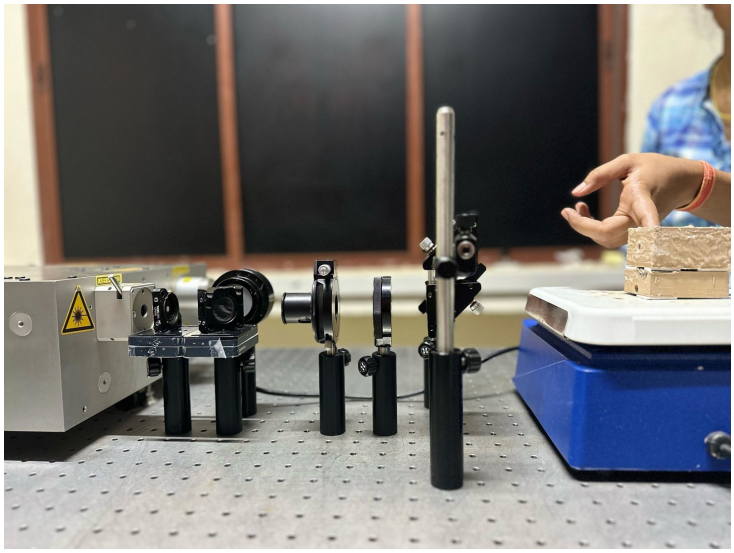
The researchers used polarised light that oscillates only in a specific direction



Blood glucose is usually measured using invasive methods involving pricking small needles into the skin. But people suffering from diabetes have to test their glucose levels many times in a day. This repeated use of needles is inconvenient and can increase the risk of potential infections.

A new study by researchers at the Department of Instrumentation and Applied Physics (IAP), Indian Institute of Science (IISc) in Bengaluru offers an alternative solution via a technique called photoacoustic sensing.

In this technique, when a laser beam is shined on biological tissue, the tissue components absorb the light and the tissue heats up slightly (less than 1°C). This causes the tissue to expand and contract, creating vibrations which can be picked up as ultrasonic sound waves by sensitive detectors. Different materials and molecules inside the tissue absorb different amounts of the incident light at different wavelengths, creating individual “fingerprints” in the emitted sound waves. Importantly, this procedure does not damage the tissue sample being studied.

In the current study, the team exploited this approach to measure the concentration of a single molecule, namely glucose. They used polarised light – a light wave that oscillates only in a specific direction. Sunglasses, for example, reduce glare by blocking out light waves that oscillate in certain directions.

Glucose is a chiral molecule, which means that it has an inherent structural asymmetry that causes polarised light to rotate its orientation of oscillation when it interacts with the molecule. Surprisingly, the team found that the intensity of the emitted sound waves changed when the orientation of the polarised light interacting with glucose in the solution was changed.

“We don’t actually know why the acoustic signal changes when we change the polarisation state. But we can establish a relationship between the glucose concentration and the intensity of the acoustic signal at a particular wavelength,” explains Jaya Prakash, Assistant Professor in IAP and corresponding author of the study.

As many commonly used drugs are chiral in nature, such a technique can have wide-ranging applications in healthcare and diagnostics.