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Glucose Detection By Surface-Enhanced Raman Spectroscopy

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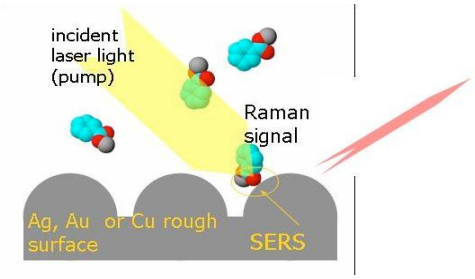
Diabetes is a metabolic disorder in which the body fails to intake and brake down glucose which causes glucose levels to fluctuate outside the normal physiological range. Approximately 18 billion people worldwide suffer from diabetes.

The current glucose sensors on the market draw blood and rely on electrochemical detection of glucose which is assisted by glucose specific enzymes such as glucose oxidase. However it is believed that these sensors provide an indirect measurement which can be influenced by the presence of various interferences. In an effort to find other methods of detecting glucose some ideas researchers came up with include polarization of light by glucose, fluorescence of glucose-protein complexes, vibrational spectroscopy such as infra-red absorption, and surface-enhanced Raman spectroscopy which is the method described here.

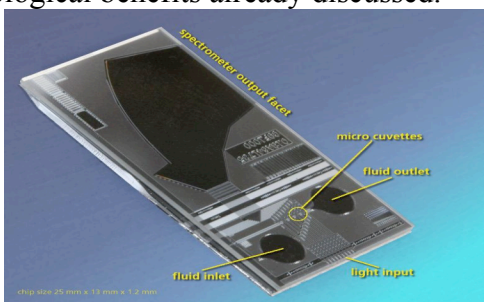
Raman scattering is the inelastic scattering of photons from a molecule when excited. However approximately only one out of every million photons is inelastically scattered. Most photons undergo elastic scattering with the same energy and wavelength. Since Raman scattering is inefficient a method to enhance this process has been discovered and named surface enhanced Raman scattering (or SERS for short).

SERS is a surface sensitive technique that results in the enhancement of Raman scattering by molecules absorbed on rough metal surface, usually silver, gold, or copper. The enhancement factor can be as much as 106-108, which allows the technique to be sensitive enough to detect single molecules. Also, because water does not have strong Raman scattering, it makes it easy to work with aqueous environments such as biological mediums.



The difference in energy between the incident photon and the Raman scattered photon is equal to the energy of a vibration of the scattering molecule. A plot of intensity of scattered light versus energy difference is a Raman spectrum. The Raman spectrum provides a unique signature of the molecule acting like a fingerprint in identifying it. This is how it can be used to detect glucose however that is not the only use to come of this technology.

A company called Serstech has created a chip that performs this detection however as they advertise it can be used to detect hazardous and explosive materials as well as environmental materials in addition to the biological benefits already discussed.



Sources:

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