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Current glucose monitoring devices are based on devices originally created in the 1960's. They have been made smaller are easier to use and can log data, their measurements basically are the same as the first laboratory sensors. The patent must prick their finger so that they can squeeze a droplet of blood on a strip coated with an enzyme (usually glucose oxidase) that reacts to form hydrogen peroxide from the available glucose and oxygen. The hydrogen peroxide generated is then measured amperometrically with an electrode. The cost, inconvenience and pain incurred in using these systems have led to heavy research to develop non-invasive glucose monitoring techniques. The major current areas of research and the sensor technologies they use will be discussed. The techniques to be covered include interstitial fluid chemical analysis, breath chemical analysis, infrared spectroscopy, optical coherence tomography, temperature modulated localized reflectance, Raman spectroscopy, polarity changes, ultrasound, fluorescence, thermal spectroscopy, ocular spectroscopy and impedance spectroscopy.

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Detection and quantification of illicit compounds at trace level is very much important for public health, security and safety. Mass spectrometry (MS) has already been demonstrated its versatility for detection and quantification of a wide range of compounds at trace level because MS can provide molecular level information of the target compounds. So far, none of the ion source can ionize efficiently for a wide range of compounds. For example, electrospray ionization (ESI) and nano-ESI have been widely using for bio-molecules. Nano-ESI has shown better resolution than ESI but it has clogging problem. To overcome such a problem, several attempts have been taken to develop new ionization source, for example, MALDI, DESI, probe-ESI (PESI) etc. Recently, we have developed new atmospheric pressure chemical ionization (APCI) using alternating current (ac) instead of dc and found as a soft ionization source. Moreover, hollow cathode discharge (HCD) ionization source has been fabricated for detection of explosives at trace level. A desorption method has also been developed using an ultra-cutter to desorb highly non-volatile illicit compounds and ionized dielectric discharge (DBD) ionization source and found better limit of detection (LOD). A vacuum glow discharge ionization (vacuum-GDI) source has been fabricated for compounds those give negative ions. A further attempt has also been taken to fabricate a hybrid ionization source with DBD/ESI for polar/non-polar, volatile/non-volatile compounds.

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