Development of optical fiber biosensors for the detection of biomolecules by using localized surface plasmon resonance (LSPR) effect

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Abstract: The optical fiber biosensors play an important role for the diagnosis of biomolecules in real time with label free sensing. The development of optical fiber biosensors usually single mode and multimode fibers have been used. Whereas, in some cases some special type of optical fibers such as photonic crystal fibers, plastic fibers etc., were also been used. The basic key operating principal of optical fiber biosensors is the detection of change in refractive index in their vicinity. The operation of optical fibers is done by exciting the surface plasmons at the sensor surface which ultimately leads to the phenomenon of localized surface plasmon resonance (LSPR) effect. The excitation of surface plasmons is usually done by introducing the metal nanoparticle layers at the outer surface of sensor heads. The most common used nanoparticles are gold and silver, because of their better biocompatibility and higher response time. The authenticity of optical fiber biosensor can be done by their characterization using UV-Vis spectrophotometry, high resolution-transmission electron microscopy (HR-TEM) and scanning electron microscopy (SEM). The UV-Vis spectroscopy can be used for the determination of peak resonance wavelength of the used metal nanoparticles. The HR-TEM can be used to get the microscopy images of the metal nanoparticles to observe their distribution. The SEM can be used to get the microscopy images of the optical fiber structures to observe the particle distribution over the fiber structures. The sensing ability of optical fiber sensor probe can be observed by recording the LSPR spectrum in terms of transmitted and reflected intensity. The specificity of optical fiber sensors can be evaluated by functionalizing them with appropriate enzyme which get decomposed only in the presence of targeted analytes.

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