REAL TIME MONITORING OF DNA HYBRIDIZATION WITH LONG PERIOD FIBER GRATING FOR FOOD INDUSTRY APPLICATIONS

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Deoxyribonucleic acid plays an important role in the life process because it carries heritage information and instructs the biological synthesis of proteins and enzymes through the process of replication and transcription of genetic information in living cells. The detection of its base sequences is of great importance in many fields, such as genetics, pathology, pharmacogenetics, or food industry. It is now well accepted that premium products depend critically on the origin of their raw material. Olive oil quality for intance depends critically on the quality of the olives used to produce it [1]. DNA markers, which have already been used to identify olive cultivars, are increasingly being applied to solve traceability and provenance issues. In this particular work we focus on DNA based identification of specific sequences in food to establish counterfeit control.

Great efforts have been exerted in the development of optical fiber biosensors for determination of various analytes, including DNA, proteins, antigens and cells. Label free sensors based in refractive index (RI) measurements are particularly atractive. With the development of nanotechnology, label free fiber-optic DNA biosensors experienced great progresses over other matrices-based DNA biosensors. Fiber-optic based biosensors offer miniaturization, portability, immunity to electromagnetic interference, corrosion resistance, multiplexing and remote sensing capability [2].

In this work a label free optical biosensor based in a long-period fiber grating was used for real time monitoring DNA hybridization processes aiming the identification of specific sequences. Probe DNA immobilization on the grating surface was successfully realized with both adsorption and covalent methods, which was subsequently hybridized with the complementary target DNA sequence. Both probe immobilization and hybridization process caused an effective refractive index change that lead to red shift of the resonance. Langmuir behavior showed a different interaction rate for adsorption and covalent methods. Probe immobilization was faster in the adsorption method. It is interesting to note that the covalent DNA biosensor was reusable after stripping off the hybridized target DNA from the grating surface, while adsorption DNA biosensor was suitable for single use applications.

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[2] L. Rindorf and J. B. Jensen, Photonic crystal fiber long-period gratings for biochemical sensing. Opt. Express, (2006), 18,8224-8231.