Abstract

The aim of the present work is the preliminary investigation of a platform for the optimal implementation of chemiluminescence (CL) based biosensing. Among all the optical strategies for biosensing, CL offers many positive features, such as high sensitivity of detection even in low volumes, no need for any external light source and simple instrumentation required for its measurement, which make it particularly suited for the development of ultrasensitive assays in a portable format for point-of-care (POC) settings. Nevertheless, the analytical performance of most of these portable devices is mainly limited by an inefficient optical coupling between the biosensor compartment where photon emission occurs (e.g., microfluidic chip) and the photodetector. While the principally exploited strategy is to place the CL chamber as close as possible to the photon detector, this leads to an ideal maximum photon collection efficiency of 50%, which however is usually much lower, due to several factors, such as reflection phenomena at interfaces between different materials. Therefore, a large fraction of emitted photons is lost, leading to lower assay sensitivity. Very recently, there was a growing interest in optical fiber CL-based biosensors where the fiber plays a crucial role both in the transduction and transportation of the generated light. Despite the recent interesting results on CL optical fiber immunosensors, it must be emphasized that an accurate and deep analysis of the optical properties of the interaction between the CL signal and the dielectric guide has not been fully addressed so far. The aim of this work is the realization of an optimized optical fiber CL biosensing system in which the reaction occurs very close to the external lateral surface of an optical fiber core. Preliminary data were obtained by a modified multimode fiber inserted in a capillary used to monitor a CL signal generated after an ovalbumin immunoassay.

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