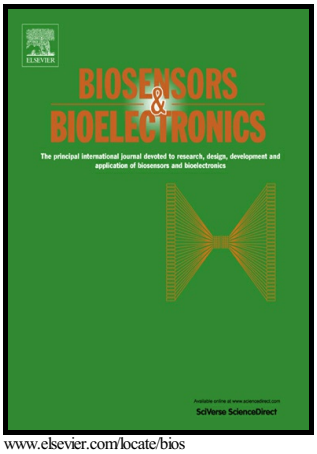

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Lab-on-a-chip systems for photodynamic therapy investigations

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In recent years photodynamic therapy (PDT) has received widespread attention in cancer treatment due to its smaller surgical trauma, better selectivity towards tumor cells, reduced side effects and possibility of repeatable treatment. Since cancer is the second cause of death worldwide, scientists constantly seek for new potential therapeutic agents including nanotechnology-based photosensitizers used in PDT. The new-designed nanostructures must be carefully studied and well characterized what require analytically useful and powerful tools that enable real progress in nanoscience development. This review describes the current status of PDT investigations using microfluidic Lab-on-a-Chip systems, including recent developments of nanoparticle-based PDT agents, their combinations with different drugs, designs and examples of *in vitro* applications. This review mainly lays emphasis on biological evaluation of FDA approved photosensitizing agents as well as newly designed nanophotosensitizers. It also highlights the analytical performances of various microfluidic Lab-on-a-chip systems for PDT efficacy analysis on 3D culture and discusses microsystems designs in detail.

Keywords: Lab-on-a-chip, cancer, photodynamic therapy, combination therapy, nanotechnology

1. Introduction

Modern Lab-on-a-chip technology started at the beginning of the 1990's with the paper of Manz, Graber and Widmer, presenting Miniaturized Total Chemical Analysis Systems as a novel concept for chemical sensing in microfluidic area (Manz et al., 1990). Due to increased interest in biochemical analysis of a living cell, microfabrication techniques have entered to life sciences. Having regard to the many advantages of Lab-on-a-chip technologies such as easy integration of all kinds of analytical standard operations into one device, manipulating large number of cells simultaneously, small size of the device, low reagent