Diagnosis and therapy of precocious tumors with inkjet-printed mesoporous silica microdots

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Cancers represent a major health challenge in the world. Early detection of tumors is advantageous for treatments efficiency. Consequently, new biotechnologies are focusing on a way to solve that disease. In 2011, a study has been initiated at the SPCTS laboratory, in order to develop an endoscopic device suitable for early detection and treatment of tumors [1]. At first, this deviceis to be used for lung and bowel cancers, and for breast and prostate cancers with time.

Inkjet Printing (IJP), combined with Evaporation Induced Self-Assembly (EISA), affords to produce mesoporous silica microdots arrays that can be specifically functionalized by click chemistry [2].

For the diagnosis, bio-receptors are labeled with appropriate fluorophores and anchored to the microdots surface. When interacting with the specific cancerous biomarkers on tumor cells, a conformation change of the bio-receptors occurs, and the fluorophores get closer. Consequently, a Fluorescence Resonance Energy Transfer (FRET) occurs and is spectrally detectedby confocal laser microscopy. The functionalization with labeled bio-receptors affords a specific detection of cancerous biomarkers, as an identification technique for different types of tumors.

Once the diagnosis is effective,the endoscopic device can be upgraded with therapy function. On that purpose, the mesoporous silica microdots are specifically functionalized with photosensitizers, by click chemistry. A laser source is used to excite the photosensitizers, producing singlet oxygen that leads to apoptosis of tumor cells, by PhotoDynamic Therapy (PDT).Such a treatment technique is favorable concerning non-invasive aspects, compared to other existing techniques.

[1] O. De Los Cobos, M. Lejeune, F. Rossignol, J. Graffion, P. Faugeras, J. Vincent, F. Lalloué, H. Akil, *Dispositif photoactif permettant la détection et la transformation d'éléments chimiques à son contact*, French Patent N°13/01417
[2] O. De Los Cobos, « Capteurs biologiques multifonctionnels (bio-puces) mis en forme par impression jet d'encre », PhD thesis (University of Limoges, France, 2013)