SILICON BASED MATERIALS FOR THE PURIFICATION OF GENOMIC DNA

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Nowadays we assist to a big boost in the miniaturization of conventional medical and biotechnological equipment, in particular in the development of micro total analysis systems that include sample preparation, separation and detection system on a small, single chip [1]. Such systems are capable to save time and labor and not last, money. Moreover, they are minimal invasive, being necessary only very small amount of biological sample, for example blood, to have a significant result. Modern microchip platforms integrate DNA purification, target amplification by polymerase chain reaction (PCR) and DNA detection in a single device. Combination of these processes into a single device can minimize sample loss and contamination problems as well as reduce analysis times and costs. Many examples of miniaturized PCR microchips are early reported in literature [2], while less effort has been exerted toward miniaturizing DNA purification methods. Different strategies are available to perform DNA extraction on a chip. Recently, amino-coated silicon microchip has been found to show high capacity to bind DNA, due to the occurrence of electrostatic interaction between amine groups and nucleic acids [3].

In this study we analyze the ability of different substrates to selectively absorb/desorb the genomic DNA with the aim to purify the DNA present in untreated biological samples from unwanted components. Silicon based surfaces were coated with different amino-silane molecules to make them positively charged. The efficiency of DNA adsorption/elution from differently treated samples was evaluated from large samples. Amino-coated substrates were characterized by contact angle, AFM, XPS, fluorescence microscopy and absorption spectroscopy to define the surface chemical and morphological properties. Genomic DNA (purified from whole blood) was monitored on the surfaces by fluorescence microscopy and its release in different elution conditions was quantified by fluorescence spectroscopy and microscopy. The distribution of the adsorbed DNA was homogeneous, while the amount of released DNA was approximately 7.9 ± 2.7 ng/cm^2, by changing the pH of buffer from 7.5 to 10.6. The eluted DNA was good for PCR amplification. The knowledge acquired from the study of macro samples is being moved to microchannels devices and in particular to the integration of a module for DNA purification, based on amino-silane coating, in a PCR microdevice.

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