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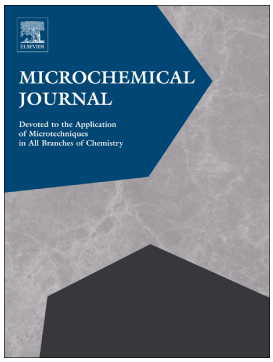

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Immobilization of functionalized gold nanoparticles in a well-organized silicon-based microextracting chip followed by online thermal desorption–gas chromatography

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Abstract

In this survey, firstly, a silicon wafer–based microchip, possessing a 50–cm microchannel with the dimensions of 120 and 60 μm, was manufactured by chemical etching technique. Subsequently, the inner surface of the microchannel was coated with a primary layer of gold nanoparticles synthesized by galvanic displacement. Then a self–assembled monolayer of 3–mercaptopropyltriethoxysilane was immobilized on the first layer. Eventually, a polydimethylsiloxane film with a thickness of 16±1 μm was formed on the walls of the microchannel by means of sol–gel method. Field emission scanning electron microscopy and atomic force microscopy were extensively employed to investigate the status of both microchip fabrication and the multilayer coating steps. The entire surface of the prepared microchip was sealed by thin borosilicate glass plate. Furthermore, a ceramic plate with a screen–printed platinum heater was attached to the back of the silicon wafer microchip in order to heat up the microchannel during thermal desorption process. Additionally, a six-port injection valve was utilized between the microchip and nitrogen source allowing the stream of sample and heated gas being introduced into the microchannel. By adopting this extraordinary strategy, the so–called lab–on–a–valve endowed with the feature of direct conjunction with the injection port of the gas chromatography which so far been rarely considered. This lab–on–a–valve system was

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