Available online at www.sciencedirect.com
SCIENCE DIRECT
ELSEVIER
Sensors and Actuators B 109 (2005) 238–243
SENSORS AND ACTUATORS B CHEMICAL
www.elsevier.com/locate/snb

Transient parameters of a coated quartz crystal microbalance sensor for the detection of volatile organic compounds (VOCs)

A.K.M. Shafiqul Islam[a], Z. Ismail[b], M.N. Ahmad[c,*], B. Saad[a], A.R. Othman[d], A.Y.Md. Shakaff[c], A. Daud[a], Z. Ishak[e]

[a] *School of Chemical Sciences, University Science Malaysia, Penang, Malaysia*
[b] *School of Pharmaceutical Sciences, University Science Malaysia, Penang, Malaysia*
[c] *School of Material Engineering, Northern Malaysia University College of Engineering, 02600 Arau, Perlis, Malaysia*
[d] *School of Distance Education, University Science Malaysia, Malaysia*
[e] *Biotechnology Centre, MARDI, Kuala Lumpur, Malaysia*

Received 21 June 2004; received in revised form 21 December 2004; accepted 29 December 2004
Available online 5 March 2005

Abstract

A PVC blended lipid membrane coated quartz crystal microbalance has been prepared to mimic human olfaction system. Transient response curves of the sensor on exposure to methanol, ethanol, chloroform, acetone and benzene were studied. Transient parameters, viz., simple parameters consisting of peak heights, derivatives, slopes and integrals, and polynomial parameters consisting of coefficients from the curve fitting equations, were extracted from the transient response curves and used as data for the subsequent chemometric data analysis. The sensor showed good separation and classification of VOCs.

Keywords: QCM sensor; Lipid membrane sensor; Transient response; Volatile organic compounds

1. Introduction

Unpleasant odor emission from industrial and agricultural sources is seen as one of the big environmental pollution problems, especially in densely populated areas. In Malaysia, chemical plants, palm oil refineries, rubber industries, poultry feed mills are regarded as main sources of malodor in environmental pollution. Odors are usually detected using olfactometry in which the characterization is performed by a panel of well-trained personnel. An on/off button is used to express the objectivity of individual odor perception. However, this method depends on the physical and mental condition of the person involved. Another method for analyzing odor substances is the use of analytical techniques such as gas chromatography. However, the instruments are expensive and costly, and require highly skilled people.

Gas sensors based on a quartz crystal microbalance (QCM) is a very promising technology in the identification of gases because of its low cost, its potential of high integration and its ease of being packaged in a compact form [1]. Quartz crystal oscillation frequency changes upon deposition of given mass on its surface [2,3]. A number of compounds, e.g., phospho lipids [4], GC stationary phase materials and cellulose [5], can be used as sensitive coating materials. The lipid materials have the ability to mimic human olfaction and are used as odor adsorption membrane in the gas sensor. The response of the sensor on exposure to a gas depends on the type and concentration of the gas, period of exposure, other molecules present and history of the sensor [6]. Gas sensor array with an associated multivariate analysis such as the principal components is commonly used in the identification of gases and liquids [7,8]. Muller and Lange [9] were the first to show the classification of single gases the simple and model parameters of the response curves of the gases. This was also done with the transient curves of MOSFET gas sensor [5,10]

* Corresponding author. Tel.: +60 9798044; fax: +60 9798099.
E-mail address: mohdnoor@kukum.edu.my (M.N. Ahmad).

0925-4005/$ – see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.snb.2004.12.116