Sensors and Materials, Vol. 6, No.1 (1994) 063-070
MYU, Tokyo

S & M 0156

Ethanol Biosensor Utilizing Double Membrane

Masao Gotoh, Chien-Yuan Chen[1] and Isao Karube[1]

Development 1 Dept. Research and Development Division, NOK Corporation
4-3-1 Tsujido-shinmachi, Fujisawa 251, Japan
[1]Research Center for Advanced Science and Technology, University of Tokyo
4-6-1 Komaba, Meguro-ku, Tokyo 153, Japan

(Received May 31, 1993; accepted December 3, 1993)

Key words: alcohol dehydrogenase, biosensor, coenzyme, ethanol, membrane

An ethanol biosensor system was constructed of a double membrane and electrodes. The concentration of ethanol was determined without the addition of coenzyme in each measurement, as both alcohol dehydrogenase and coenzyme NAD^+ were immobilized. In order to immobilize both alcohol dehydrogenase and NAD^+, we applied a double membrane, one layer of which was an alcohol dehydrogenase-NAD^+-polyvinylchloride membrane and the other a photo-cross-linking PVA-SbQ membrane [PVA-SbQ is a poly(vinyl alcohol) bearing stilbazolium groups]. The characteristics of this sensor system were investigated using ethanol as the standard. Ethanol in buffer was determined to be in the range of 0.01-6 v/v%. Ninety-percent response time of this sensor system was approximately 20 seconds. The steady-state current of this sensor system was reproducible within ±4% of the relative error. Ethanol concentrations were measured for one month with this sensor system without the addition of coenzyme.

1. Introduction

The need for a quick, simple and reliable method for measurement of ethanol led to the development of enzymatic methods which utilize alcohol oxidase or alcohol dehydrogenase.

Alcohol oxidase catalyzes the oxidation of lower primary aliphatic alcohols according to the reaction

$$RCH_2OH + O_2 \rightarrow RCHO + H_2O_2.$$

Various studies have been conducted on the application of biosensors utilizing alcohol