

## Stick-type bioelectronic sniffer device for acetaldehyde vapor

Mitsuhiro OGAWA<sup>1</sup>, Kohji MITSUBAYASHI<sup>1</sup>,  
Hiroyuki MATSUNAGA<sup>2</sup>, Genki NISHIO<sup>2</sup>

<sup>1</sup> Department of Biomedical Devices and Instrumentation,  
Institute of Biomaterials and Bioengineering, Tokyo  
Medical and Dental University, Chiyoda-ku,  
Tokyo 101-0062, Japan

<sup>2</sup> Graduate School of Engineering, Tokai University,  
Hiratsuka, Kanagawa 259-1292, Japan

As an indirect measurement of blood acetaldehyde concentration, several research groups have investigated the analysis of acetaldehyde in breath [1]. In this paper, a bioelectronic sniffer (bio-sniffer) device for acetaldehyde vapors that has a reaction cell with both gas and liquid phase components separated by a porous diaphragm membrane, were fabricated with using aldehyde dehydrogenase (ALDH) [2]-[5] and the calibration was demonstrated.

A stick type bio-sniffer for acetaldehyde was fabricated with using a PTFE membrane as the substrate and Au electrodes immobilized with aldehyde dehydrogenase (ALDH: EC 1.2.1.5, 20 units/mg, Boehringer Mannheim, France). This sensor was based on the enzyme reaction of ALDH that is shown as chemical reaction equation (1). The developed stick type sniffer is 3 mm wide and 65 mm length and the length of the sensitive area is 5 mm. In the presence of NAD<sup>+</sup>, acetaldehyde is dehydrated by the enzyme ALDH to CH<sub>3</sub>COOH, NADH and H<sup>+</sup>. Hence, this sensor detects NADH produced by the reaction.



Fabricated bio-sniffer device was evaluated with a computer-controlled potentiostat (Potentiostat, Model 1112, BAS Inc., Tokyo, Japan) at a potential of 420 mV vs. Pt. As the results, a calibration curve of the snifer was obtained and the calibration range was 0.11-10 ppm.

### REFERENCES

- [1] A. W. Jones, *Alcohol and Alcoholism*, **30**, 271-285 (1995).
- [2] K. Mitsubayashi, K. Yokoyama, T. Takeuchi, and, I. Karube, *Anal. Chem.*, **66**, 3297-3302 (1994).
- [3] H. Matsunaga, S. Toda and K. Mitsubayashi, *Journal of Advanced Science*, **14**, **1&2**, 19 (2002).
- [4] K. Mitsubayashi, Y. Hashimoto and Y. Nakayama, *Journal of Advanced Science*, **12(3)**, 211-216 (2000).
- [5] J. K. Park, H. J. Yee, K. S. Lee, W. Y. Lee, M. C. Shin, T. H. Kim, S. R. Kim, *Anal. Chim. Acta*, **390**, 83-91 (1995).