アルコール代謝評価を目的とした蛍光法を用いた呼気用探嗅カメラ

A fluorometric “sniff-cam” for breath ethanol to evaluate alcohol metabolism

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Exhaled breath contains various volatile organic compounds (VOCs) whose concentration varies depending on health status. Highly sensitive measurement of these VOCs is expected to simplify evaluation of metabolic capacity and disease screening. Breath can be sampled non-invasively and instantly; therefore, an imaging system for breath VOCs can reduce stress to the patients. In this contribution, we introduce a fluorometric imaging system (sniff-cam) for gaseous ethanol to evaluate alcohol metabolism.

In the sniff-cam, conversions of ethanol concentrations to fluorescence signal was conducted using a fluorescence property of NADH (Ex: 340 nm, Fl: 490 nm) that was a product of an enzymatic reaction by alcohol dehydrogenase (ADH) (Fig. 1a). The sniff-cam was composed of an ADH-immobilized mesh, a UV-LED sheet (81 LEDs) and a sensitive CCD camera. Two band pass filters (BPFs, 340 ± 42.5 nm, 490 ± 10 nm) were placed in order to improve the noise-to-signal ratio. The ADH-immobilized mesh was prepared as follows: ADH solution was applied to a cotton mesh and dried for an hour at 4°C, followed by immobilization by crosslinking with glutaraldehyde solution. After drying the mesh for one hour at 4°C, the mesh was immersed in NAD^+ solution.

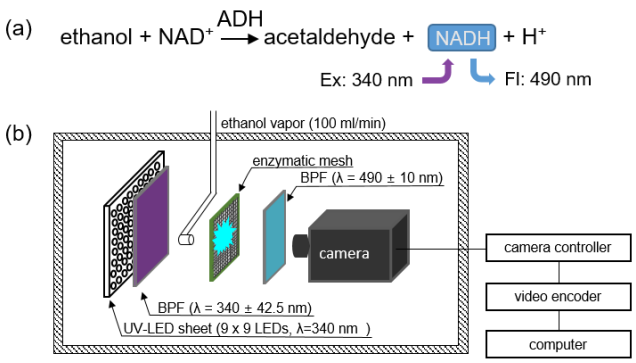

Fig. 1 (a) Principle of NADH-based fluorometric imaging system. (b) Sniff-cam with ADH-immobilized mesh for gaseous ethanol.

When ethanol vapour was introduced to the mesh, UV-light was illuminated to the mesh where NADH was produced, and change in emitted fluorescence intensity was imaged by the camera (Fig.1b). The dynamic range of the sniff-cam was determined as 0.5-150 ppm which encompasses a typical breath ethanol concentration after drinking. The selectivity of the sniff-cam was also investigated using typical VOC chemicals in exhaled breath. Fluorescence was observed only from samples containing ethanol. These characteristics suggest that the sniff-cam can be applied to imaging of breath ethanol for the assessment of alcohol metabolism.