Wellness monitor via human skin gases

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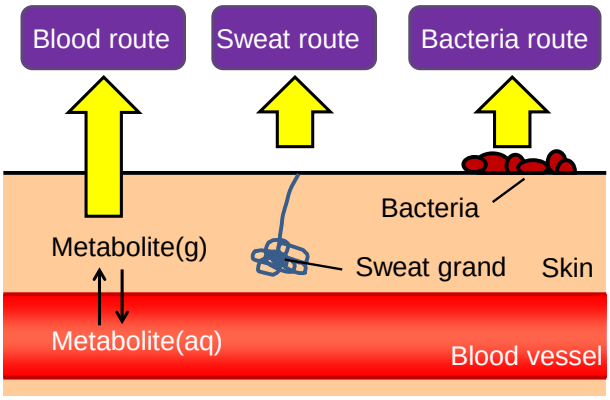
What is human skin gas?

Trace gases emitting from human skin surface has been inviting considerable attentions as a potential non-invasive biomarker of individual physical or physiological status. The gases are synthesized by internal metabolism or bacterial activity on the skin surface.

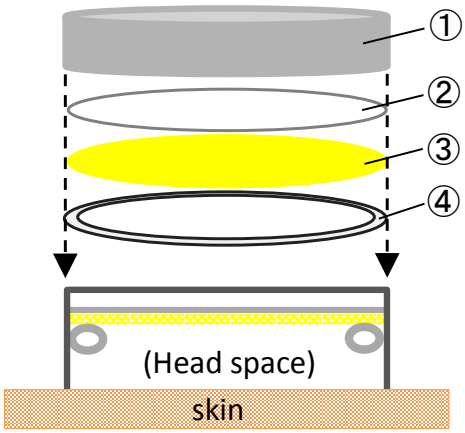


Passive Flux Sampler

We have developed a novel human skin gas sampler, Passive Flux Sampler (PFS). The PFS simply consists of sampler body, trapping filter and stoppers. When the sampler was placed on the surface of skin, gases are trapped by the filter. The trapped substances are identified and determined by HPLC, GCMS and others.

PFS for

- Aldehydes and ketones
- Lower fatty acids
- Ammonia and amines
- Volatile Organic Compounds, VOCs



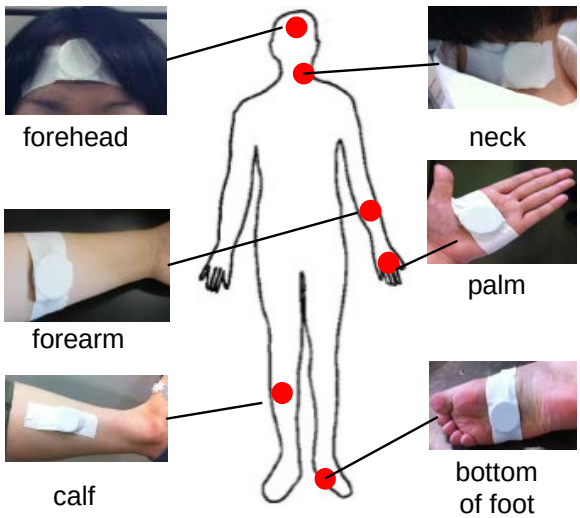
①Stainless dish ②PTFE plate
③Trapping filter ④O-ring

Advantages of PFS method

Features of the PFS method include non-invasive simple, quantitative and high-throughput, and thus it realizes ubiquitous and easy-to-use measurements of emission fluxes of human skin gas even by non-medical professionals.

$$E = \frac{W}{S \cdot t} \cdots (1)$$

E : Emission flux (ng cm^{-2} h^{-1})
W: Collection amount (ng)
S : Collection area (cm^2)
t : Sampling duration (h)



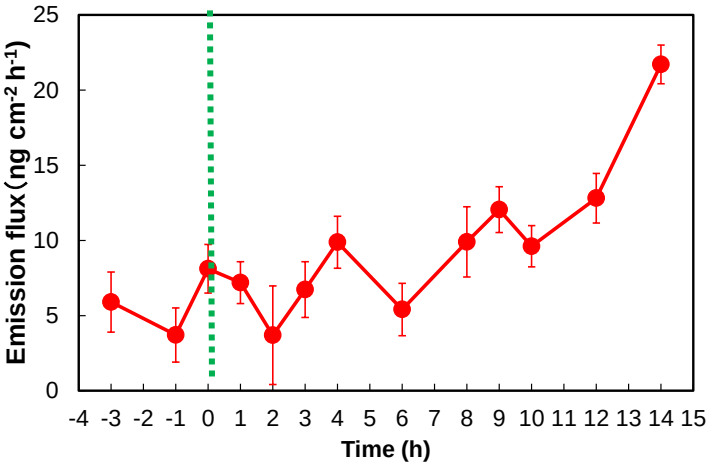
Case studies

This study was conducted under approval of Ethics Committee on Human Studies, Tokai University

Alcohol intake detector

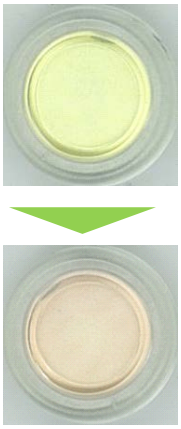
Acetaldehyde is well known as a metabolite of ethyl alcohol. Then, acetaldehyde emanating from skin surface was measured by PFS-HPLC method. The results showed the emission fluxes of 8 volunteers (age 21-24) varied after drinking (Alc.5% beverage, 350 ml) with some peaks even after 14 hours from the drinking.

$$CH_3CH_2OH \rightarrow CH_3CHO\uparrow$$



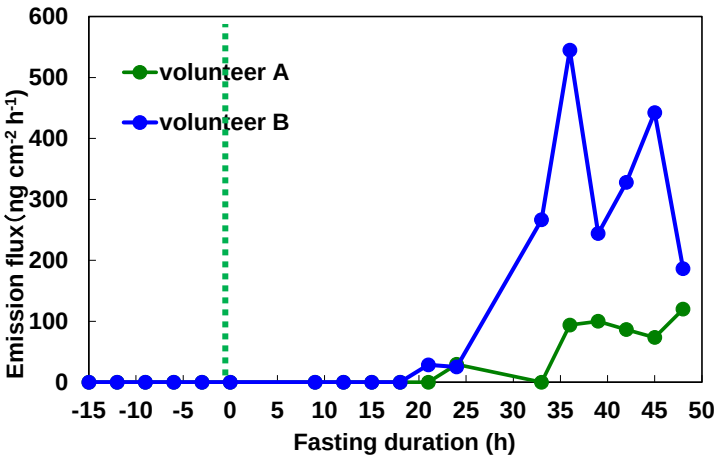
Stress indicator

Ammonia is a product of the metabolic reaction of protein. Since its emission is enhanced by both physical and mental stress loadings, ammonia will be a possible biomarker for stress response. We have then developed a colorimetric indicator which responds to ammonia gas with a color change from yellow to red. Gastec Corporation, Japan is co-developing partner of this indicator.



Fasting monitoring

Acetone is a member of ketone bodies which are products of the metabolic reaction of fatty acids when there is low blood glucose. Emission fluxes of dermal acetone of 2 healthy male volunteers (age 21, 22) were measured by the PFS-HPLC method and they were markedly influenced by the period of fasting.



Potential applications

Medical Application - Early detection of disease, Monitoring of cure process
Daily Health Check - Alcohol checker, Stress indicator, Detection of excess diet
Human Identification - Sensory human skin gas pattern analysis
Deodorant Performance Evaluation – Monitoring of minimizing body odor by deodorant

Patent and references

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・Takahashi, K., Sekine, Y. et al., *Indoor Environment*, 16(1), 15－22(2013)