Development of Kansei Biosensor

Kiyoshi Toko
Distinguished Professor
Kyushu University

[Background]
Recently, a prompt establishment of objective evaluation method for taste, fragrance, quality and safety of food products is strongly demanded. There are needs for taste and odor measuring system, i.e., Kansei biosensor. The aim of this research is to establish interactions between the developed artificial receptor membranes and molecules in relation to taste and odor which issue from chemical substances, and to clarify its mechanism.

[Results]
Phenols were found to be best for one of the surface-modifying materials of lipid/polymer receptor membranes of taste sensor (electronic tongue) for sweet substances. The best chemical composition for realizing highest sensitivity to sweetness was obtained by evaluating electric charge density and hydrophobicity of the above improved membranes. In development of odor sensor (electronic nose), information useful for functional groups and molecular sizes of chemical substances was obtained by making mixed SAMS (SAM: Self-Assembled Monolayer), as shown in Fig. 1. Furthermore, an integrated circuit used for a miniaturized taste sensor was developed (Fig. 2). As for the sensor chip, a plastic substrate, on which Ag thin-film electrodes and lipid/polymer membranes are formed, was first developed.

[Outlook]
The present research has made a taste sensor to measure basic five taste qualities (sweet, salty, sour, bitter, umami taste) completed, and has made a large progress toward quantification of odor. We aim to establish de facto standard of the present taste/odor measuring method. Moreover, we try to develop a sensing/evaluating system which can integrate other senses such as the senses of touch, sight and hearing with the senses of taste and smell.

Fig. 1 Molecular-recognizing surface using mixed SAMS

Fig. 2 Integrated circuit for a miniaturized taste sensor

Related Grants-in-Aid for Scientific Research:
FY2006-2011 Grant-in-Aid for Scientific Research (S): "Development of Kansei Biosensor"