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A Theoretical Consideration of Interactions between Lipid Membranes and Taste Substances

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The expressions of the membrane potential and membrane electrical resistance for lipid membranes were derived according to the theoretical framework of the charged membrane-aqueous electrolyte system. Experimental results on the interaction between taste substances and a lipid membrane were analyzed. The physicochemical parameters determining the reception of a taste substance in the lipid membrane system, i.e., the partition coefficient of a taste substance between the membrane and aqueous phases, the association constant between a taste substance and lipid molecules, and the mobility of a taste substance, were obtained by fitting the theory to the experimental data. The agreement between the theory and experimental results was fairly satisfactory except for in a high concentration range for sweet and bitter substances. The contributions of the phase boundary potential and internal diffusion potential to the transmembrane potential were theoretically evaluated for each taste substance.

1. Introduction

Investigations of membrane potential and conductance at the steady and transient states in artificial lipid membrane-aqueous electrolyte systems have confirmed that the lipid membrane itself responds to many kinds of taste substances.[1-5] Among these lipid membranes, the DOPH (dioleylphosphate) membrane has been