2.1.8 Laboratory : Quality Analysis and Assessment

Member :	Professor	Matsumura, Yasuki, Dr. Agric. Sci.
	Associate Professor	Hayashi, Yukako, Dr. Agric. Sci.,
	Assistant Professor	Matsumiya, Kentaro
	Doctor's program	1
	Master's Program	9
	Undergraduate	4
	Other	1
	Researcher	1

A. Research Activities (2009.4-2010.3)

A-1. Main Subjects

a) Evaluation and improvement of quality as food stuffs for soybean and wheat.

A great variety of foods are produced from various crops, for instance, soybean curd (tofu) and bread is prepared from soybean and wheat, respectively. The quality of final product changes according to cultivars of crops, weather, district, and conditions of storage and transportation, etc. It is not practical and economical to evaluate the suitability of crops to final products in a large scale. This situation needs us to develop the new methods to evaluate the quality of crops as foodstuffs efficiently and accurately using only a small sample. We are testing validity of various analytical methods, in order to establish the appropriate evaluation methods in a small scale for soybean and wheat. Another goal of this research is to understand the factors determining the quality of the crops. If we get a plenty information on such factors, we will be able to give a good index to breeding scientists when improving the properties of crops.

b) Quality control of food products containing lipids.

Lipids coexist with water, proteins and other components in many foods such as mayonnaise, milk, ice cream, soybean curd, etc. In these emulsion type foods, lipids are dispersed in water as fine particles. The stability of lipid particles against flocculation and coalescence is crucial for the acceptability and shelf-life of the emulsions. Chemical aspects, such as oxidation degree of lipids, also affect deeply flavor, safety, nutritional and physiological quality of emulsion foods. The objective of our research is to improve the quality of

emulsion foods by controlling the physical and chemical stability of lipids. Recently, the interaction of lipids with proteins and polysaccharides in low water activity system such as pasts and powders became our target of research.

c) Control of interaction of food macromolecules.

Main food macromolecules consist of proteins and polysaccharides. Our group has been studying the effects of plant polysaccharides on the dispersion behavior and gelling properties of milk and soybean proteins. Our goal of this project is to understand the mode of macromolecules' interaction such as network formation of mixed polymers, phase separation, and coacervation, etc., and to develop the new useful texture of food macromolecules. Our group is also trying to improve the physical properties of food macromolecules using the new type enzyme, for instance, protein-deamidase.

d) Analyses of perceptional mechanism of umami taste by physiological and biochemical methods.

Scientific interest in how food taste affect the functioning of the human body, for example, appetite, digestive enzymes, metabolism, etc., is growing. Five primary taste stimuli-acids, salts, sugars, amino acids and bitter substances-have been used as standard stimuli. The taste reception to amino acids, sugar and some bitter substance are known to be initiated by the adsorption of the chemical stimuli to the receptors on the taste cell membranes. In this laboratory, the taste perceptional mechanisms are focused and studied by the electrophysiological (taste cell patchclamp and nerve recordings) and biochemical techniques (optical calcium imaging and immunoassaying methods) using mice and humans. Also, sensory evaluation of human and preference test of mice would reveal the main pathway in the bitter and umami taste transduction under fatigue.

e) Aroma compounds in plants and foods

We enjoy enormous varieties of aroma compounds in plants (flowers and leaves) and foods. The composition of aroma compounds is various according to the kinds of plants and foods. Aroma compounds are also influenced by diverse environmental factors, for example, climate and nutritional conditions in the soil for plants, and processing and storage conditions for foods. We are investigating the effects of aroma compounds from plants and foods on human physiology.

A-2.Publications and presentations

a) Publications

Original Papers

- Change of Taste Sensitivity to sucrose due to physical fatigue.
Narukawa M, Ue H., Morita K., Kuga S. Isaka T. And Hayashi Y. (2009)
FSTR, 15(2), 195-198
- Rennet-induced aggregation and curd formation from skimmed milk powders prepared under different sterilizing conditions
Y. Miyamoto, K. Matsumiya, H. Kubouchi, M. Noda, K. Nishimura and Y. Matsumura (2009)
Bioscience, Biotechnology, and Biochemistry, 73(9), 2054-2064
- Signalling mechanisms in mouse bitter responsive taste cells
M. Narukawa, E. Minamisawa, Y. Hayashi (2009)
NeuroReport, 20(10), 936-940
- Effects of heating conditions on physicochemical properties of skim milk powder during production process
Y. Miyamoto, K. Matsumiya, H. Kubouchi, M. Noda, K. Nishimura and Y. Matsumura (2009)
Food Science and Technology Research, 15(6), pp.631-638
- Effects of bacteriostatic emulsifiers on stability of milk-based emulsions
K. Matsumiya, W. Takahashi, T. Inoue, Y. Matsumura (2010)
Journal of Food Engineering, 96, 185-191
- Analysis of caffeine transduction in mouse taste cells
H. Fujito, R Kiatada, T. Taniguchi, S. Oh, Y. Matsumura, Y. Hayashi (2009)
Japanese J. Taste and Smell Res. 16(3), pp.331-334.
- The effects of physical stress from athletic training camp on gustatory sensation
M. Uemura, H. Ue, S. Kuga, T. Isaka, Y. Matsumura, Y. Hayashi (2009)
Japanese J. Taste and Smell Res. 16(3), pp.459-462.

<u>Reviews</u>

- Statistics in food science and technology
Kentaro Matsumiya and Yasuki Matsumura (2009)
J. Jpn Soc Food Engineering, 29(2), pp.1-9.
- Sensory properties of fat and utilization of fat replacers
Kentaro Matsumiya and Yasuki Matsumura
Japanese J. Taste and Smell Res. 16(1), pp.69-76.
- Novel function required for emulsified foods - To overcome difficulties in processing
Yasuki Matsumura and Kentaro Matsumiya (2009)
The food industry. 52(20), pp.20-29.

b) Conference and seminar papers presented

- The Annual Meeting of Japan Society for Bioscience, Biotechnology and Agro chemistry 2010: 6 presentations
- 48th JOCS Annual Meeting: 2 presentations
- The 43rd JASTS Annual Meeting: 2 presetations
- The Annual Meeting of Japanese Society for Food Science and Technology 2010: 4 presentations
- The Food Colloids 2010: On the Road from Interfaces to Consumers: 2 presentations
- Hiroshima Forum on Functionality of Lipids: 2 presentations
- International Seminar on Food Hydrocolloids - Fundamentals and application of hydrocolloids -: 1 presentation

A-3.Off-campus activities

Membership in academic societies

- Matsumura, Yasuki : Symposium on Physical Properties of Foods and Food Materials (Member of the Steering Committee), Kansai Branch of Japanese Society for Food Science and Technology (Counselor), Rheology Society of Japan, Division of Dispersion and Interfacial Science (Member of the steering committee), Japan Society for Food Engineering (Counselor + Editorial Committee), Japan Society for Bioscience, Biotechnology and Agrochemistry (Editorials Committee), Japan Society of Food Engineering (Counselor + Editorial Committee), Japan Oil Chemists Soceity (Member of the Steering Committee of Kansai branchi + Representative of Function and Structure of Food Oil Division)
- Hayashi, Yukako : Japanese Society for the Study of Taste & Smell (Counselor + Editorial Committee)
- Matsumiya, Kentaro : Japan Oil Chemists Soceity (Member of the Steering Committee of Function and Structure of Food Oil Division)

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (B) : Matsumura, Y. : Evaluation and Control of Physical Properties and Flavor of Foods Utilizin Human Sensing System
- Scientific Research (C) : Hayashi, Y : Identification of the type of Taste cell and the related component in the taste transduction.

2.Other Research Grants

- Sponsored Research Funds (Ministry of Agriculture, Forestry and Fisheries) : Matsumura,

Y.: Development of techniques on nano-scale processing and evaluation of food materials.

B.Educational Activities(2009.4-2010.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Food Quality Science (Matsumura, Y.), Quality Analysis and Assessment (Matsumura, Y., Hayashi, Y.), Cell Biology I (Hayashi, Y.), Outline of Bioresource Science I (Matsumura, Y.), Laboratory Course in Bioresource Science I, II (Matsumura, Y., Hayashi, Y., Matsumiya, K.), Fundamentals for the Laboratory Cource in Bioresource Science (Hayashi, Y, Matsumiya, K.), Agriculture and Foods in Japan (Matsumura, Y)
- Graduate level: Quality Analysis and Assessment（Matsumura, Y., Hayashi, Y.）

B-2.Off-campus teaching etc.

Part-time lecturer

- Hayashi, Y: Doshisha Women's College of Liberal Arts (Experiment for chemistry A, Food Experiment for Processing, Experiment for Food)