

2.7.7 Laboratory : Bioengineering

Member :	Professor	Adachi, Shuji, Dr. Agric. Sci.
	Assistant Professor	Kobayashi, Takashi, Dr. Agric. Sci.
	Doctor's program	3
	Master's Program	8
	Undergraduate	4
	Other	4

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Development of novel food processing technology by subcritical water treatment

Water that maintains its liquid state in the temperature range of 100 to 374°C under pressurized conditions is called subcritical water. Subcritical water has two distinct features: one is a low dielectric constant, which is close to that of organic solvents, and another is a high ion product. Setting off with the aim of developing novel food processing technology by leveraging these unique features of subcritical water, we have been devoting our efforts to carrying out both basic and applied researches in subcritical water treatment, in regards to the conversion of little-used biomaterials to useful materials and the degradation (hydrolysis) kinetics of saccharides, amino acids, etc., respectively, from the reaction engineering point of view.

b) Characterization and application of nano- and microdispersed food ingredients

Nanoemulsions with oil droplet diameter of a few tens nanometer are expected of exhibiting some unique properties and functionalities, which are not found in the existing microemulsions. Nonetheless, the scientific knowledge pertaining to nanoemulsions is still insufficient at present. Taking into consideration the mass transfer phenomenon at the oil-water interface, we performed a systematic study on the effects of the decrease in oil droplet size of the disperse phase upon the oxidation of unsaturated fatty acids in the phase, wherein the oxidation reaction was found to have been impeded despite the high specific surface area of the nanoemulsions. We also proposed a model that explained the phenomena.

c) Analyses and development in food processing

Processes such as cation-exchange resin-mediated separation of saccharides and dehydration of pasta which produces rehydratable noodle are examples of existing food processes. However, the phenomena that occur during the processes are not yet to be fully understood. By applying both the existing and new approaches and new models to these processes, we endeavor to gain insight into the phenomena that happen through the processes and thereby contribute toward establishing a reasonable design method for substance production.

A-2.Publications and presentations

a) Publications

Original Papers

- S. Kikuchi, S. Ochi, and S. Adachi: Simultaneous estimation of the binding constant of saccharide to sodium ion and the swelling pressure of cation-exchange resin. *Food Sci. Technol. Res.*, 16(6), 531-536 (2010).

- P. Khuwijitjaru, S. Anantanasuwong, and S. Adachi: Emulsifying and foaming properties of defatted soy meal extracts obtained by subcritical water treatment. *Intl. J. Food Prop.*, 14(1), 9-16 (2010).

- T. Kobayashi, T. Ehara, T. Mizuoka, and S. Adachi: Efficient synthesis of 6-O-palmitoyl-1,2-O-isopropylidene- α -D-glucofuranose in an organic solvent system by lipase-catalized esterification. *Biotechnol. Lett.*, 32, 1679-1684 (2010).

- N. Jeyashoke, T. Y. Chiou, T. L. Neoh, Y. Murayama, T. Kobayashi, and S. Adachi: Effect of temperature-rising rate on the antioxidative ability of the defatted rice bran extract obtained by subcritical water treatment. *Food Sci. Technol. Res.*, 16(3), 197-200 (2010).

- R. Wang, T. L. Neoh, T. Kobayashi, Y. Miyake, A. Hosoda, H. Taniguchi, and S. Adachi: Degradation kinetics of glucuronic acid in subcritical water. *Biosci. Biotechnol. Biochem.*, 74(3), 601-6052 (2010).

- Y. Watanabe, K. Idenoue, M. Nagai, and S. Adachi: Stability of catechin in aqueous solution with coexistent ascorbic acid or octanoyl ascorbate and organic acid. *Food Sci. Technol. Res.*, 16(2), 111-114 (2010).

- Y. Murayama, T. Kobayashi, and S. Adachi: Properties of extracts from soy sauce cake using subcritical water treatment. Japan J. Food Eng., 11(1), 67-71 (2010).

Reviews

- S. Adachi: Engineering studies on extraction and separation of food substances. Nippon Shokuhin Kagaku Kogaku Kaishi, 57(7), 275-287 (2010).

- S. Adachi: Extraction of functional materials from unused bioresources by their subcritical water treatment. BIO INDUSTRY, 27(5), 7-13 (2010).

b) Conference and seminar papers presented

- Annual Meeting of Japan Society for Food Engineering, 2010 (3 papers)

- The 57th Meeting of the Japanese Society for Food Science and Technology (1 paper)

- The 41st Autumn Meeting of the Society of Chemical Engineers, Japan (2 papers)

- The Kansai Branch Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2010 (2 papers)

- The 11th China-Japan-Korea Joint Symposium on Enzyme Engineering (1 paper)

- The 64th Meeting of the Japan Society of Enzyme Engineering (1 paper)

- The 1st Meeting of the Division for Creating Lipid Functionalities (2 papers)

- Annual Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry, 2010 (2 papers)

A-3.Off-campus activities 1

Membership in academic societies

- Adachi, S. : The Japan Society for Food Engineering (director), The Japanese Society for Food Science and Technology (editor), Japan Society for Bioscience, Biotechnology and Agrochemistry (editor), Japan Oil Chemists' Society (secretary of Kansai branch; board member of scholarly activities)
- Kobayashi, T. : Japan Society of Bioscience and Bioengineering (biomedia committee)

A-3.Off-campus activities 2

Research grants

2.Other Research Grants

- Nanotechnology project, the Ministry of Agriculture, Forestry and Fisheries :Shuji Adachi :
Assessment of anti-oxidation and stability of nano- and microparticles in food diversion system and their control
- Development of pioneering technology for industrialization, Wakayama Prefecture :Shuji Adachi :
Development of novel enzymatic methods for purification of sterol, triterpenalcohol and their esters
- Adaptable and seamless technology transfer program through target-driven R & D, Japan Science and Technology Agency :Takashi Kobayashi :Development of effective enzymatic production system of sugar esters

A-4.International cooperations and overseas activities 1

International meetings(country,roles)

- Adachi, S. :The 11th China-Japan-Korea Joint Symposium on Enzyme Engineering, Chengdu, China (Invited lecture).

A-4.International cooperations and overseas activities 2

Visiting Research Scholars

- Doctor course student 1 (P. R. China)
- Research student 1 (P. R. China)
- Research fellow from private school 1 (P. R. China)
- Doctor course student 1 (Taiwan)
- Doctor course student 1 (Thailand)
- Master course student 1 (Thailand)

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level : Food Engineering (Adachi, S.), Physical Chemistry in Food Science I (Adachi, S.), Physical Chemistry in Food Science II (Adachi, S.), Laboratory Course in Chemical Engineering (Adachi, S., Kobayashi, T.).
- Graduate level : Food Production Technology (Adachi, S.), Bioengineering Seminar (Adachi, S.), Experimental Course in Bioengineering (Adachi, S.).

B-2.Off-campus teaching etc.

Part-time lecturer

- Adachi, S.: Graduate School of Engineering, Osaka City University (Special lecture)

Open lectures, etc.

- Adachi, S.: Seminar at Nanyo High School, Kyoto Prefecture (lecturer).
- The 25th Seminar of the Organization for Promoting Bioindustry, Shizuoka University (lecturer).: Seminar of Super-heated steam cooking (lecturer).

B-3.Overseas teaching 1

International students

- International students : Master 1 (Thailand) Doctral 3 (China 1, Taiwan 1, Thailand 1)
Research Students 3 (China 1, Netherland 2)