



● Basic Stage

(Fiscal Year 2003-2005)

Hakodate Area

Development and Research for Value-added *Kjellmaniella crassifolia Miyabe* (Gagome) and Squid

- **Major Participating** Industry: Kyowa Concrete Industry Co., Ltd., Towa Denki Seisakusho Co., Ltd., MARUNAMA KOSEI CORPORATION Co., Inc., etc.
- **Research Organizations** Academia: Graduate School of Fisheries Sciences Hokkaido University, FUTURE UNIVERSITY-HAKODATE, Hakodate National College of Technology
- Government: Hokkaido Industrial Technology Center

Main Results of City Area Program

1. Investigation of the life cycle and other aspects of Gagome

1) Developmental study of mariculture and reproductive technologies for Gagome

The mariculture and reproductive study of Gagome was performed by establishing kelp beds and net systems around the Hakodate coast, revealing that Gagome grew to about 2 m in the net system over 6 months.



Mariculture and reproduction of Gagome (*Kjellmaniella crassifolia Miyabe*) in coastal seas using a net system (kelp-growing system)

2) Developmental study of land-based cultivation techniques for Gagome (*Kjellmaniella crassifolia Miyabe*)

A land-based cultivation system for Gagome was developed experimentally, and we developed cultivation technology using a blade and consecutive extraction technology of mucilaginous polysaccharides.



Land-based cultivation of Gagome (*Kjellmaniella crassifolia Miyabe*)

3) New high-value products developed from Gagome materials in Hokkaido

New products: Beauty and skin soap (Gagome kelp soap), health and diet supplement (Laminest) that contains kelp polysaccharide, skin conditioner (Aquist), etc.



New value-added products made from Gagome (*Kjellmaniella crassifolia Miyabe*)

2. Investigation into developing squid products of high value and integrity

1) Development of transportation technology for live fish and fresh squid

We investigated the sealed-pack transportation of live squid, with the squid being kept alive for up to 56 hours. We also developed transportation technology for fresh fish as living tissue.



Operation involving the packaging of squid in plastic bags for transportation

2) Development of a test dryer for evaluating the manufacture of high-quality dried squid

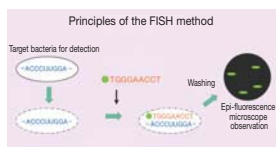
We developed a procedure based on controlling the temperature, the humidity and air-flow rate of the drying air, providing an efficient manufacturing technology for producing high-quality dried squid. Based on this technology, an evaluation-aided test dryer was also developed.



Drying equipment for evaluation

3) Development of fluorescence in situ hybridization (FISH) following cultivation

The FISH following cultivation method was developed for rapid specific detection of viable bacteria and the method could be applied to various foods.



Principles of the FISH method

4) Development of separation and purification technology for squid-ink pigment particles

We developed the technology required for efficient separation and purification of monodisperse globular squid-ink pigment particles of about 0.3 microns in size.



Separated and refined squid-ink pigment

Approaches after Completion of Project

1. Investigation of the life cycle and other aspects of Gagome

This investigation of the Basic Stage project is to be continued in the Development Stage project.

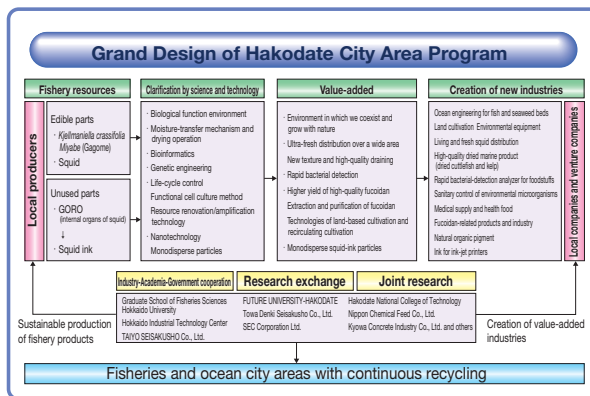
- 1) Composition of special substances, genome analysis, and construction of a sustainable Marine Garden system.
- 2) Effective utilization of functional components as medical, pharmaceutical, fine chemical, and food materials.

2. Investigation of the development of squid products with high value and integrity

Each of the investigations of the Basic Stage project is to be continued (as outlined below) in the Development Stage project.

- 1) An investigation of quality-retention technology for squid is progressing as follows.
 - Research and application regarding function-preservation technology for biological tissue.
- 2) An investigation into high-quality dried squid by controlling bacterial growth is progressing as follows.
 - Food-design system based on functionality and texture.
- 3) An investigation into a rapid bacterial-detection analyzer based on bioinformatics and genetic information is progressing as follows.
 - Highly sensitive bacteria-monitoring system based on molecular ecology that is superior to the official bacterial method.
- 4) An investigation into the separation and purification of squid-ink particles is progressing as follows.
 - Effective utilization of functional components as medical, pharmaceutical, fine chemical, and food materials.

An investigation of [Identification of species and geographic origin based on biological information and traceability technology] has been newly added to the Development Stage project, and six investigations are in progress.



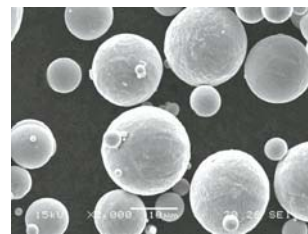
●Basic Stage

(Fiscal Year 2003-2005)

Utsunomiya and Central Tochigi Area

Development and Industrial Application of Ultra-precision Magnetic-Field-Assisted Machining Processes

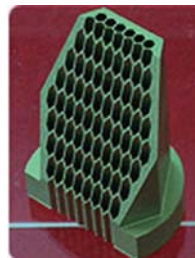
- **Major Participating Industry**···IZUMO INDUSTRIAL CO., LTD., KUWANAN., Co., Ltd., SUZUKI PRECISION CO., LTD., and others
- **Research Organizations Academia**···Utsunomiya University, School of Science and Engineering Teikyo University, Kanto Polytechnic College
- **Government**···Industrial Technology Center of Tochigi Prefecture



Gas-atomized magnetic abrasive



Prototype machine for the internal finishing of tubes



Honeycomb machining by ultrasonic vibration cutting



Others

The Tochigi Industrial Promotion Center
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Core Research Organization

Utsunomiya University

Main Results of City Area Program

1. Development of novel magnetic abrasive, manufacture of practical prototype machines for internal finishing and deburring by magnetic abrasive finishing

We plan to develop a gas-atomized magnetic abrasive sufficient to finish stainless steel tubes used for high-purity gas-piping systems. Moreover, we seek to develop magnetic media using an electrochemical method, magnetic abrasive with a plastic core, and other products.

We will manufacture a prototype machine for the internal finishing of tubes and a portable deburring machine. Consultation and technical discussions will focus on establishing the feasibility of the practical application of the magnetic-field-assisted finishing and deburring processes.

2. Development of the technology of micro-machining by ultrasonic vibration machining

To suppress the exit burrs of irregular micro-scale holes in precise and minute parts, machining experiments were conducted using ultrasonic vibration equipment. We found that the ultrasonic vibration machining method is suitable for micro-machining, as the cutting resistance is remarkably decreased, the straightness and roughness of the machined surface are improved, burrs are suppressed, and high-precision straightness is attained when cutting difficult-to-cut materials such as stainless steel and pure titanium.

Approaches after Completion of Project

1. R&D for ultrasonic vibration machining technology

With the aim of forming a new project to utilize the results of the City Area Program, the "Tochigi Machining Technology Workshop" was established in 2006. The workshop included a forum on the technology of ultrasonic vibration machining, as mainly investigated at Teikyo University and Suzuki Precision Ltd.; related topics and study results were widely promoted.

Moreover, the project of the "Tochigi Consortium," sponsored by Tohigi Prefecture, is proceeding with R&D, focusing on prototype machines and utilizing technologies applied to the ultrasonic vibration machining method. Since 2007, four companies in the Tohigi region have become involved and one university, in addition to the above members.

2. Ongoing research into magnetic-field-assisted machining processes

We are continuing our joint research to develop a magnetic-field-assisted deburring process, new magnetic abrasives, and a nanometer magnetic abrasive finishing process to meet the needs of companies in our prefecture. We are also promoting these technologies by presenting our research at conferences and via other means.

●Basic Stage

(Fiscal Year 2003-2005)

Fukui Central Area

Development of technology to produce new materials for energy devices using nano-plating

- **Major Participating Industry**···KIYOKAWA Plating Industry Co., Ltd., Tanaka Chemical Corporation, SAKAI OVEX CO., LTD., and others
- **Research Organizations Academia**···University of Fukui, Fukui University of Technology, Fukui National College of Technology
- **Government**···Industrial Technology Center of Fukui Prefecture

Main Results of City Area Program

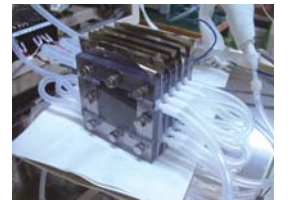
1. Development of a high-efficiency energy system using nano-plated materials

Ni or Ni-PTFE composite film is coated on PTFE particles of 1000 μm or less in diameter. The sheet prepared by pressing these particles has the permeability of gas and shows electrical conductivity. This flexible sheet was tested as an electrode and separator composite for Ni-PEFC.

Using a PEFC cell stack for compressing hydrogen, the hydrogen in the off-gas from the PEFC system can be separated and compressed. The hydrogen storage alloy covered with Ni-PTFE composite film was prepared and used to store the hydrogen after compression. The separation and compression of hydrogen increased the efficiency of the power consumption of the entire system.

2. Preparation and characterization of anti-scale film on stainless steel

To prepare anti-scale stainless tubing for a cooling system in a nuclear plant, we developed a process that covers the surface of stainless steel with layered CrN film at nanometer-scale thickness or less to prevent corrosion. For production trials, we also developed testing equipment for environmental simulations that was able to reproduce the environment near the secondary cooling equipment of nuclear plants at the lab scale. The test demonstrated the performance of the nano-scale, multi-layer, hard anodic oxide coating.



Stack prototype with compact Ni-PTFE composite particles



Environmental simulation testing machine that simulates the environment of an actual machine with high temperatures and pressures

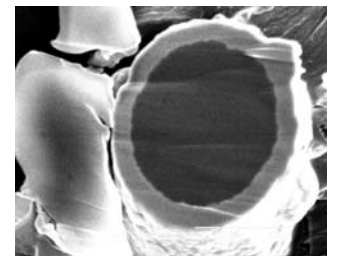
Approaches after Completion of Project

1. Nano-plated carbon-fiber-reinforced aluminum alloy suitable for press-forming

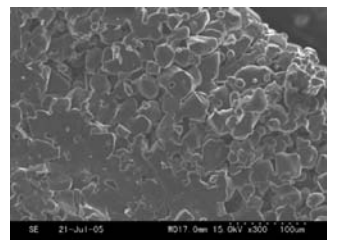
We designed and prepared a new nano-plated carbon-fiber-reinforced Al-alloy material with malleable and ductile properties. The alloy is applied as packaging material for a large-size lithium ion battery assembly used for electric vehicles.

2. Development of a terahertz device and application to prepare new materials for nuclear power systems

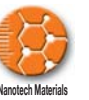
We established a new heating system to prepare B4C for use as a control rod in a nuclear reactor, using electromagnetic waves emitted from 300 GHz gyrotron. The preparation technique, using a wave-guide tube with fine corrugations in the 300 GHz band, is applied to the development of the devices in the terahertz band. We prepared an ultralow-loss wave-guide for terahertz electromagnetic waves and applied it to a horn-type highly sensitive antenna in the terahertz region.



Nano-plated pitch-based carbon fiber



Fractured surface of B4C ceramics sintered by sub-millimeter waves



Nanotech Materials

Fukui Industrial Support Center

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University of Fukui, Fukui University of Technology, Fukui National College of Technology, Industrial Technology Center of Fukui Prefecture

●Basic Stage

(Fiscal Year 2003-2005)

Wakayama City Area

Development of Organic Materials for Next-Generation Electronic Devices

- **Major Participating Research Organizations**
- Industry: Shin-nakamura Chemical Co., Ltd., Sugai Chemical Industry Co., Ltd., Wakayama Seika Kogyo Co., Ltd.
 - Academia: Wakayama University, Osaka Prefecture University, Wakayama National College of Technology
 - Government: Industrial Technology Center of Wakayama Prefecture



Nanotech Materials

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60 Ogura, Wakayama City, Wakayama 649-6261 JAPAN
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Core Research Organization

Industrial Technology Center of Wakayama Prefecture

Main Results of City Area Program**1. Development of environmentally friendly functional thin films for a high-sensitivity medicinal sensor**

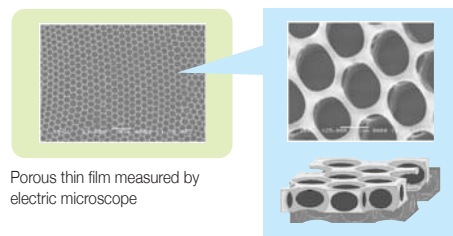
We succeeded in making a porous thin film with a honeycomb structure produced using doughnut-type calixarenes that recognize various compounds. When the films were used as a gas sensor microbalance with crystal oscillator, the concentration of volatile organic compounds (VOCs) such as toluene was measured at 1 ppm levels.

We also developed a new synthetic method of producing calixarenes using microwaves. The method reduced the reaction time from 5–6 hours to 15–20 minutes.

2. Development of new organic electronic luminescent (EL) materials

We obtained new organic EL materials with a tri-heterocyclic aromatic ring in the structure, for use as next-generation display materials. We developed organic EL devices using these materials, yielding a brightness of about 20,000 cd/m² and emission efficiency of 4.5 cd/A.

We also made organic EL devices using poly-pyrrole derivatives and assessed their function as electric-hole-transporting materials. The results reveal that the materials have the same characteristics as known materials in terms of voltage, electric current, and brightness.



Porous thin film measured by electric microscope



Gas sensor using a molecular recognition compound



Organic EL sample device for blue color

Approaches after Completion of Project**1. Development of organic functional materials using environmentally friendly resources & technologies**

We are exploiting synthetic methods of producing new compounds, preparation technologies for organic thin films, and assessing the characteristics of new fluorochromes obtained in this project (Basic Stage). We are also making use of the results obtained by (1) the project Leading Research Utilizing Regional Science and Technology carried out in 1998-2000, a project of the Ministry of Education, Culture, Sports, Science and Technology of the Japanese Government; and (2) the results of strategic R&D projects planned by the local government of Wakayama Prefecture. We combined these results with technologies and materials developed by enterprises in Wakayama Prefecture, and are seeking to expand upon the earlier results. We are now developing new technologies and materials (on the basis of the results described above) in the fields of functional materials and functional foods as part of the City Area Program (Development Stage, as begun in 2007).

2. Proposal and adoption to the Regional New Consortium Project (Ministry of Economy, Trade and Industry, and projects of other ministries of the Japanese Government)

The theme of "The development of technologies to produce electronic substrates with a high aspect ratio of 10 μm" was adopted for 2006-2007. We carried out research into the practical use of resistant materials made by the precise polymerization of methacrylates. We are now studying the practical uses of these polymers as photosensitive materials for electronic substrates, with the aim of developing a printing screen plate.

●Basic Stage

(Fiscal Year 2003-2005)

Kurume Area

Development of tailor-made medicines & diagnostic agents, and functional foods for the prevention of disease

- **Major Participating Research Organizations**
- Industry: GreenPeptide Co., Ltd., Chlorella Industry Co., LTD., DOJINDO Laboratories, and others
 - Academia: Kurume University, Kyushu University, Kyushu Institute of Technology, and others
 - Government: Biotechnology & Food Research Institute of Fukuoka Industrial Technology Center, Fukuoka Forestry Research and Technology Center, National Institute of Advanced Industrial Science and Technology (AIST), and others



Life Sciences

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Core Research Organizations

Kurume University, Kyushu University,
Biotechnology & Food Research Institute of Fukuoka Industrial Technology Center

Main Results of City Area Program**1. Peptide vaccine**

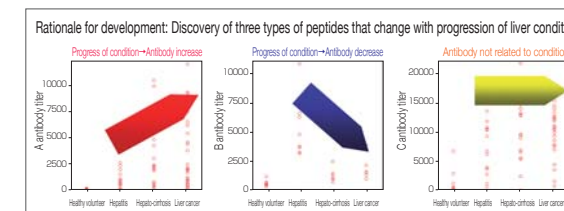
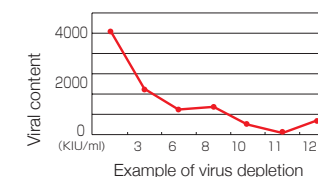
- **Confirming depletion of HCV virus following a peptide vaccine, and safety study (the first vaccine remedy in the world)**

We made progress in readying a peptide vaccine for practical medical use by confirming a decrease in virus activity and vaccine safety in a clinical study. As a result, a venture company was established by the university.

- **Practical use of a diagnosis kit for HCV infection and prediction of progression of the patient's condition**
- Upon discovering anti-peptide antibodies specific to HCV infection and antibodies related to progression of the patient's condition, a university-launched venture company was established to advance the practical use of agents of infection diagnosis and in predicting prognosis.

2. Confirmation of dysuria improvement effect of functional foods from Ganoderma lucidum via a clinical study, and plans for commercialization

The effect of Ganoderma lucidum extract on dysuria, along with its safety, was verified in a clinical trial using volunteers. We are now nearing completion of non-clinical and clinical studies. We are currently investigating application of the extract as foods for specified health use.



Peptide antibodies that change with progress of liver condition



Prototypes produced to confirm dysuria improvement effect of functional foods

Approaches after Completion of Project**Joint research****1. Development of a tailor-made peptide vaccine for the prevention of liver cancer recurrence**

Following the results attained in the City Area Program Basic Stage, translational research into the vaccine is ongoing in the Development Stage.

2. Development of new diagnostic agents and remedies against hepatitis C virus (HCV)

We aim to commercialize a diagnostic agent for HCV infection; R&D is ongoing, using government funds.

3. Development of foods for specified health use employing bio-active substances in Ganoderma lucidum

We have completed clinical dose-finding, efficiency verification, and overdose-effect studies for Ganoderma lucidum extract; its application as foods for specified health use is currently under investigation.

Feasibility studies

R&D into 12 of 18 studies judged feasible for practical use was carried out using other funding sources. To date, two products (siRNA transfection reagent and lactoferrin-containing cosmetics) have been commercialized, and two prototypes (DNA aptamer and intraoral medical devices for sleep apnea syndrome) have been developed. Five new venture companies have been established.



siRNA transfection reagent(HilyMax®)



lactoferrin-containing cosmetics (Up-Well EXTRA®)

●Basic Stage

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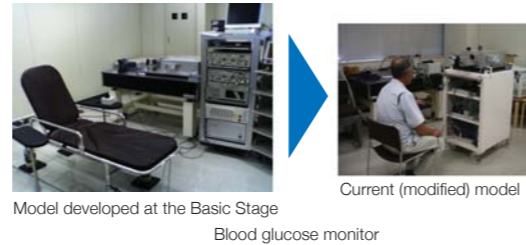
Nagasaki/Isahaya/Omura Area

Development of Non-Invasive Sensing Technology for QOL Medical Diagnosis

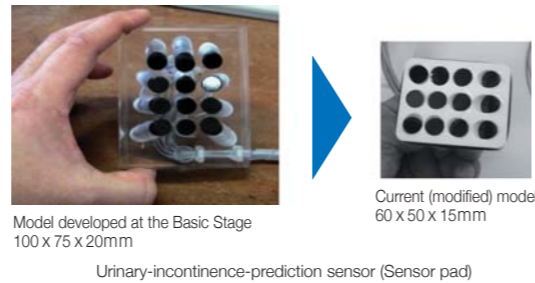
- Major Participating Industry...CHORYO CONTROL SYSTEM CO., LTD.; NIHON RIKO MEDICAL CORP., LTD.; Mechatronics Co., Ltd.; and others
- Research Organizations Academia...Nagasaki University, Nagasaki Institute of Applied Science, and others
- Government...Industrial Technology Center of Nagasaki, National Hospital Organization Nagasaki Medical Center of Neurology, and others

Main Results of City Area Program

1. Measurement of blood parameters (blood glucose level) using a laser
The high light-scattering properties of living tissues interfere with blood parameters measured by laser. The Three Fiber Diffuse Reflectance Measurement (TFDRM) method is capable of correcting light-propagation lengths affected by vasomotion. This enables correction of optical path lengths in accordance with the dilation/constriction of blood vessels, and will lead to the realization of a non-invasive blood glucose monitor with precision comparable to that of simple blood-sampling-based monitors. The TFDRM method is also applicable to quantitative measurement of human tissue components other than blood glucose.



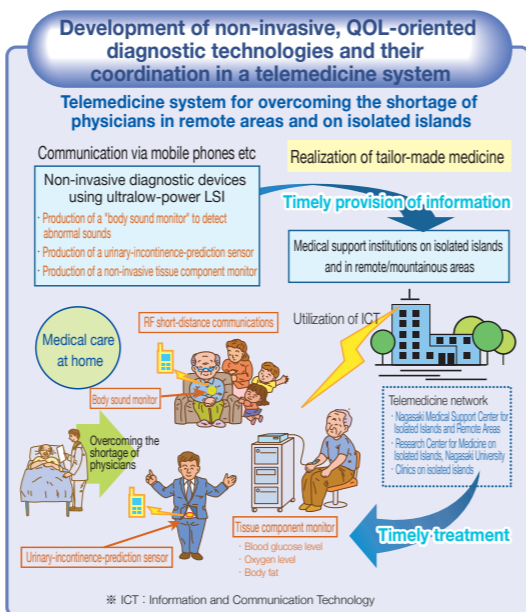
2. Measurement of pooled urine using ultrasound
The urinary-incontinence-prediction sensor comprises (1) a sensor pad that emits ultrasound and detects the reflected waves; (2) a measurement unit to accurately determine the pooled urine volume in the bladder based on the measurement data; and (3) an alarm unit to notify the wearer or caregiver when the calculated volume has exceeded the threshold value. The following were developed: a device and method that enables precise 3D measurement of the shapes of organs, such as the bladder, from the limited space between the pubic bone and the peritoneum; a dysuria management system; and an ultrasonic sensor pad for the system. We also developed a film-type ultrasound gel used for acoustic coupling between the ultrasonic sensor and the human body.



Approaches after Completion of Project

Efforts to develop a telemedicine system to overcome the shortage of physicians in remote areas and on isolated islands

In remote areas and on isolated islands, populations are aging rapidly, and a shortage of physicians poses a serious problem. The development of telemedicine systems for supporting medical care at home is thus urgently required. To address this issue, Nagasaki Prefecture has focused on the production of non-invasive, QOL-oriented diagnostic technologies developed through the City Area Programs, as well as the development of telemedicine systems that use these technologies. Specifically, the prefecture is using the following two approaches. First, the prefecture is conducting surveys in cooperation with research agencies regarding the needs of medical professionals and test participants, as well as the needs of companies (including the manufacturers and retailers of measurement devices), and preparing and establishing new business plans based on the survey results. Second, the prefecture is investigating the following three areas of technological development, and the usefulness of measurement devices is being verified based on clinical trials: a) development of a lung sound diagnostic system for early detection of lung sound abnormality that would be incurable if left untreated until subjectively noticed by the patient; b) development of a urinary-incontinence-prediction sensor to help maintain the dignity of elderly individuals suffering from urinary incontinence; and c) development of non-invasive optical measurement technology for living tissue components that alleviates the patients' burden associated with blood sampling.



●Basic Stage

(Fiscal Year 2003-2005)

Kumamoto Southern Area

Development of a Biomass Recycling System for Land and Sea that Aids Environmental Conservation

- Major Participating Industry...ASTOM Co., Ltd., RBS Co., Ltd., SAKURAI SEIGI Co., Ltd., and others
- Research Organizations Academia...Sojo University, Kumamoto University, Prefectural University of Kumamoto, and others
- Government...Kumamoto Industrial Research Institute, Kumamoto Prefectural Agricultural Research Center, Kumamoto Prefectural Fisheries Research Center, and others

Main Results of City Area Program

1. Joint research projects (project applying the purifying function of seaweed and the project utilizing materials with physiological activity)
This research explored the possibility of eco-friendly technology by applying seaweed to the restoration of a coastal environment, leading to the establishment of a method for restoring eelgrass (a kind of seaweed) beds in the tidal flat. Moreover, we applied the technology to increase the abundance of seaweed (e.g., wakame seaweed and gulfweed) in a reef zone. We also examined the influence of the technology on the marine biota and the possible uses of cultured seaweed. Consequently, a project organized by the residents and local administration of the area for the restoration and utilization of the environment was launched based on the cooperation of industry, academia, and the government of the urban area. This project contributed to, for example, tourism and the development of new products.

2. Project to assist in further developing the results of the study (the recovery of ionic compounds discharged from organic-waste treatment facilities)
This project focused on the equipment and system required for the treatment of drainage from livestock farms using a cylindrical ion-exchange membrane. This technology was used to develop the equipment required to collect ingredients from manure, such as ammonia from composting facilities that is generally discharged into drainage channels and the atmosphere. We developed a new cylindrical unit with an ion-exchange membrane that can respond to various biomasses. "The multiple-purpose equipment for electricity dialysis for desktop laboratories" was produced as an experiment after proving the efficiency of the unit. This equipment can be employed in wastewater treatment, slurry-type biomasses, and the removal and recovery of heavy metals from the environment, among other uses.

Approaches after Completion of Project

Following the completion of joint research projects with local residents, two activities ("Meeting to study ways to restore eelgrass beds" and "Conference to promote the proliferation of seaweed") were inaugurated in the project area. Separate monthly meetings are held for investigations and study, and further projects are being organized with universities, research organizations, local authorities, fisheries companies, tourism agencies, etc. To promote the proliferation of seaweed, the extent of the planting area is being continually expanded. At the same time, the effect on restoration of marine resources is under investigation. In terms of the restoration of the seagrass bed and the use of seaweed, the Fishermen's Association of Minamata is playing a key role in promoting studies of the technology required to restore the seagrass bed, in cooperation with relevant companies. Seed and sapling production for the seaweed, as well as diving technology for underwater investigations, has been introduced to the members of the Fishermen's Association. Moreover, tests have been conducted on the technology developed in collaboration with the area of Hakodate (a city in Hokkaido, Japan) to produce a seagrass reef. The produced seaweeds are used in local products by local food-processing companies and tourism agencies. Some of the products have already been commercialized. An event termed "Kaisou Kabunusi" (meaning a system in which local residents can support the seaweed business by purchasing shares in the company) has taken root in the district; it has been held repeatedly and is used to present programs for residents to take part in environmental restoration, nutritional education, etc., with the events being held on the seashore. These activities are supported by the researchers and research institutes in charge of the project.

