

# Agro & Specialty Chemical Business

## Moving swiftly to launch new market-oriented products, based on a fusion of intellectual assets.



**Hajime Yoshitake**  
Managing Director  
Director of Agro & Specialty Chemicals Group

### Stabilization of existing businesses

The agrochemical business situation has suffered from reduced use of agrochemicals, reduced cultivated acreage, and soaring development costs. In addition, at the World Trade Organization's new multilateral trade negotiations, there has been difficulty reaching a 2003 agreement on standards for agrochemicals.

Under these conditions, the Agrochemicals Division was actively involved in contracted production of active ingredients and final products, overseas production of active ingredients, construction of IPM (Integrated Pest Management) systems, and strengthening our overseas operations.

On the other hand, the increasing number of companies engaged in specialty chemical business resulted in fierce price competition. The Specialty Chemicals Division is proceeding with comprehensive profitability improvements, through development of active pharmaceutical ingredients (API) (including generic), contracted manufacture of API, consigned overseas production of API, improvements to the competitiveness of our functional intermediates, efforts to distinguish ourselves from the competition, and combinations of new and existing products.

### Expansion of peripheral business through a fusion of our technologies and intellectual assets

When this group was launched, the goals were 20.0 billion yen in non-consolidated net sales (FY 2006) and 28.0 billion yen in consolidated net sales. To reach this, our agrochemical business is focused primarily on enlargement of our business base. We are actively involved in license-in and marketing chemicals from other companies, as well as contracted production of agrochemical intermediates.

In addition, through active collaboration with companies, government, and universities, we are promoting the development of new pharmaceutical technologies, nanotechnology, biological pesticides, and other products that incorporate new technologies.

The Specialty Chemicals Division is actively proceeding with a fusion of intellectual assets. These aggressive efforts include production of API using both fermentation microbial transformation and organic synthesis technologies, contracted production of high-potency active ingredient for anti-cancer drugs and other pharmaceuticals using advanced synthesis technology, and development of electronic materials and other sophisticated intermediates.

### Creation of next-generation business areas

The most important feature of this group is development utilizing advanced specialized technologies in areas from general-use chemical products to advanced chemical synthesis. It is also distinguished by its application of the synergistic effects achieved by full utilization of the intellectual assets accumulated in a broad range of fields including fermentation technology and chemical synthesis.

In the agrochemical field, we are proceeding with the development of genetic technology by genome-oriented pesticide discovery and viral pesticides, and with the development of micro- and nano-chemical technology by utilizing the technology of fine granule chitosan fermentation and micro-chemical processes. Specialty Chemicals Division research and development is based on collaborations with universities, companies, and research institutions across Japan, involving high-efficiency production, dangerous reactions, enzymatic reactions, high-efficiency fermentation, and fine particle production technology. It includes the development of specific products that will form the technological base for the next generation, such as polymer materials (resins and films), and materials for fuel cells.

## [Agrochemical Business]

### Genome-oriented pesticides discovery

In cooperation with the National Institute of Agrobiological Sciences, Nippon Kayaku has begun development of agrochemicals utilizing the genetic information of destructive insect pests. We intend to market these pesticides in FY 2011 as "genome-oriented pesticides." Genetic drugs are already widespread in pharmaceutical development, and there is much potential for their use in agrochemical development as well. Our group has begun constructing a system for genetic pesticides, and began dispatching researchers to government research institutions in FY 2003. Based on the biological mechanisms we have discovered in the agrochemicals previously developed by our company, we intend to focus our development targets to efficiently apply our work with genome-oriented pesticides discovery to the development of next-generation agrochemicals. The development of genome-oriented pesticides discovery involves learning the three-dimensional structures and functions of the proteins generated by the genes in the subject insect, and then creating substances which inhibit or accelerate these functions. These substances are then made into the active ingredients, of the pesticide.

For example, the DNA of the rice pest *Nilaparvata lugens*, which originated in China, and the soybean pest *Spodoptera litura* are similar to the DNA of the silkworm, 80% of which has already been mapped. Therefore it is possible to identify the target genes by comparison with silkworm DNA. Genome-oriented pesticides discovery are highly effective against destructive insect pests, and the insects are unlikely to develop an immunity to this type of pesticide. Because of these advantages, there is much promise for genome-oriented pesticides discovery in terms of new large-scale agrochemical production.

FY 2003 sales for our agrochemicals business were 11.2 billion yen, and we are aggressively working towards a target of approximately 15.0 billion in FY 2005.

## [Specialty Chemical Business]

### NEDO Program for Generating Innovative Materials Industries Participation in "micro analysis and production systems project"

The Research Association of Micro Chemical Process Technology, of which Nippon Kayaku is a member, was selected to conduct the "micro analysis and production systems project." This Japan-based project is related to the Program for Generating Innovative Materials Industries conducted by the New Energy and Industrial Technology Development Organization (NEDO). The project involves R&D into micro chemical process technology involving agents ranging in size from a few micrometers to a few hundred micrometers. These systems, utilizing phenomena that occur in the microscopic world, are receiving much attention as a high-efficiency, energy-saving, environmentally-friendly process for chemical synthesis.

Micro-chemical processes are broadly divided into micro-chemical plant technology and microchip technology. The estab-

lishment of micro-chemical plant technology allows chemical reactions that are more efficient and faster, and which require fewer resources and less energy. This technology represents a fundamental change in the process from conventional R&D to industrial production. With microchip technology, chemical operations are integrated on a microchip for development of chips for analysis and synthesis, and of new detection methods. It is expected that application of this technology to ultra high-speed analysis and diagnosis systems will generate a large life sciences market.

We are also conducting modeling and simulations for the purpose of systematizing these technologies and facilitating their application to general use. Trial calculations show that this innovative and environmentally-friendly technology will create a new market of approximately 800 billion yen in 2010.

### Reinforcement of facilities for production of high-potency active ingredients – Expanding contract manufacturing of API

In autumn 2003 Nippon Kayaku expanded its contract manufacturing business, utilizing technology for production of high-potency active ingredients gained through many years as a manufacturer of anti-cancer drugs. Combining original synthesis and bioscience technologies, we are working to meet the demand for integrated production covering API, intermediates, and final pharmaceuticals. In particular, we are working to differentiate ourselves from the competition in the production of anti-cancer drugs and other high-potency active ingredients.

The production of anti-cancer drugs naturally requires GMP (Good Manufacturing Practices – standards related to manufacturing control and quality control of pharmaceuticals). In addition, because the drugs are more active than other pharmaceuticals and require advanced hazard protection measures, control of the production process requires an advanced level of technology and experience. We possess production equipment for anti-cancer drugs, one of our primary products, which can be used to produce chemically hazardous drugs. In 2003, additional multi-purpose production equipment for chemically hazardous drugs was installed at the Takasaki Plant (Gunma Prefecture), completing a system for contract manufacturing of anti-cancer drugs and other high-potency active ingredients.

We also possess particular expertise in optical resolution technology for chemical synthesis, and have accumulated a broad range of refining technologies for fermentation, which allow efficient production of products derived from microorganisms while eliminating impurities. Microorganism processes are also essential in the production of some high-potency active ingredients. For this reason, we are planning to add fermentation equipment for high-potency active ingredient production.

At the Takasaki Plant, we have for many years engaged in integrated production of anti-cancer drugs that pass FDA standards, and have constructed a complete GMP system covering all stages from base chemicals to the final pharmaceuticals.