No. 20

Development of full-automated macromolecular crystallization/observation robot system HTS-80

Hideyuki Miyatake,[a] Seong-Hoon Kim, [a] Itsuro Motegi,[b] Hirofumi Matsuzaki,[b] Hideyoshi Kitahara, [b] Akira Higuchi[b] and Kunio Miki[a,c]

([a]RIKEN Harima Institute/SPring-8, 1-1-1 Koto, Mikazuki-cho, Sayo-gun, Hyogo 679-5148, Japan, [b]Panasonic Factory Solutions Co., Ltd., 1-1-30 Shibadaimon, Minato-ku, Tokyo 105-8586, Japan, and [c]Department of Chemistry, Graduate School of Science, Kyoto University, Sakyo-ku, Kyoto 606-8502, Japan)

e-mail:miyatake@postman.riken.jp

Crystallization of macromolecules is one of the time limiting-steps in structural biological studies, which deeply depends on simple series of trials and errors. Once the dispensation of crystallization plates is finished, the routine observation of the plates is followed for a long period. In such the situation, the desire for automatization in the processes of crystallization and observation of crystals is naturally arising. The latest progresses in robotics and visualizing technologies seem to meet the demand. Such the technologies are largely employed in the high-throughput projects. The huge facilities used in the projects, however, are unrealistic for the ordinary laboratories. Instead, easy to use and compact equipments are more desirable in our dairy studies. Although there are some commercially available equipments for dispensation, they still require a lot of human intervention during the operation. In this context, we have developed a novel automated robot system to carry out the middle-throughput crystallography.

In the situation above, we developed the robotic system, termed as HTS-80 (Panasonic Factory Solutions, Co. Ltd.). The system is based on the fundamental concept as follows; full-automated operations of protein crystallization from dispensation to growth observation and evaluation of crystals. The concept is realize by each unit of highly accurate two types of 12ch+1ch dispenser heads, automatic sealing, automatic evaluation of crystal growth, observation optics installed in the storages and flexible scheduling software. We can use both of commercially available crystallization plates and reagents. Once we set the target proteins and any crystallization reagents into the system, all we should do is to check the outputs on a personal computer.

The system consists of three major units of a dispenser, a storage and an observation. The dispenser unit is adaptable to the both of crystallization methods of sitting drop vapor diffusion and micro batch, and the observation unit is adaptable to all the methods above. They are organized by a personal computer with a user-friendly GUI based software. After dispensation into the crystallization plates, they are automatically transferred by a robot arm to the storage units, followed by the automatic observation according to arbitrary schedules. Each state of the crystallization droplet is judged by our original image processing software. This system successfully carried out all of the crystallization steps.