Humidity-induced structural transition in orthorhombic lysozyme

K. Ozawa¹, K. Shimizu², S. Yamamura¹,²

¹ Graduate School of Science, Kitasato University, 1-15-1 Kitazato, Minami-ku, Sagamihara, Kanagawa 252-0373, Japan
² School of Science, Kitasato University, 1-15-1 Kitazato, Minami-ku, Sagamihara, Kanagawa 252-0373, Japan

yamamura@sci.kitasato-u.ac.jp

Keywords: Structural transition, Humidity, Lysozyme

Biomolecules such as proteins crystallize as hydrates. Most of those hydrates lose their crystallinity by dehydration. However some of these hydrates often maintain their crystallinity and cause structural transition during dehydration. We have been studying such structural change in biomolecular crystals due to humidity and developing a technique to control the humidity around the crystals.

Lysozyme is a well-known protein that exists in several crystal forms. Orthorhombic forms have mainly two types of unit cells dependent on crystallization conditions. One crystallizes under room temperature and alkaline conditions. The other crystallizes under relatively high temperature and acidic conditions. For the former, humidity dependence of crystal structure has been reported. The latter has been reported to have three polymorphs in the same drop from another crystallization condition, although no humidity dependence has been reported. In this paper we report the humidity dependence of the latter.

We have found humidity-induced structural transition involving five structures including three new structures in the high humidity region between 99 to 85% relative humidity. The most dried structure shows hysteresis, that is, large difference of transition point between dehydration and hydration. Noble structural transformations occur not only in simple translations, but also in large rotations of protein molecules.