May 27, 2025
KANEKA CORPORATION

Elucidation of the Crystal Structure of PHA Synthase -Expected to Enhance Green Planet™ Production-

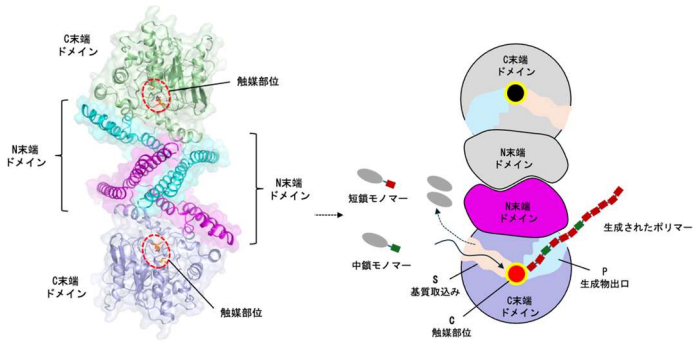
Kaneka Corporation (Headquarters: Minato-ku, Tokyo; President: Kazuhiko Fujii) is the first in the world to elucidate the crystal structure of full-length PHA synthase which is the most important enzyme (*1) involved in the biosynthesis of polyhydroxyalkanoate (PHA), a raw material for biodegradable polymers, using X-ray crystallography (*2). These findings were made in collaboration with the Institute for Research Initiatives of Nara Institute of Science and Technology (President: Kazuhiro Shiozaki).

KANEKA Biodegradable Polymer Green Planet™ (hereinafter "Green Planet"), developed by Kaneka, is a type of PHA called PHBH (*3) naturally produced by microorganisms. In this study, the full-length structure of PHA synthase, which has long been a mystery, was elucidated, and the mechanism of PHA synthesis in microbial cells was revealed for the first time. This finding provides important clues for understanding enzyme function at the molecular level. We will utilize the results of this research to advance studies aimed at efficiently producing high-performance PHA.

Furthermore, the results of this research were published in the May 6 (Tuesday) issue of the German international scientific journal "Angewandte Chemie International Edition" (*4).

Since research and development of Green Planet started in the early 1990s, we have continued our activities by combining our unique biotechnology and polymer technology. Based on the results of this research and our unique molding technology, we will dramatically improve industrial productivity and contribute to the realization of a sustainable society by promoting Green Planet globally.

(*1) Essential proteins that act as catalysts in various chemical reactions that occur within living organisms.
(*2) A method of determining the three-dimensional arrangement of molecules in a crystal by applying the phenomenon of light diffraction and analyzing the diffraction patterns obtained when X-rays are irradiated onto the crystal.
(*3) A copolyester composed of two monomers, 3-hydroxybutyrate (3HB) and 3-hydroxyhexanoate (3HH).
(*4) "Angewandte Chemie International Edition" Online Library
https://onlinelibrary.wiley.com/doi/10.1002/anie.202504626



Crystal structure of PHA synthase (left)

Catalytic mechanism for converting plant-derived monomers into PHA (right) (*5)

(*5) It has been demonstrated that dimerization mediated by the N-domain is critical for the enzyme to function in its active state. Hydroxyalkanoate monomers (short-chain and medium-chain) derived from plant-based raw materials are incorporated into the active site, and the enzyme, stabilized by a dimeric structure mediated by the N- domain, continuously polymerizes the monomers to synthesize polyhydroxyalkanoate (PHA). The resulting polymer is discharged through the product efflux pathway.