Discovery and utilization of enzymes from the “aldoxime-nitrile pathway”

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Enzymes are very specific and efficient catalysts. They catalyze reactions under milder conditions than those in most of chemical synthetic processes. Industrial biotechnology using these biocatalysts has advantages on high reaction rate, efficiency, and selectivity. The industrial biotechnology continuously requires effective and stable enzyme(s) for its sustainable development.

We have identified and characterized several enzymes for industrial use from prokaryotes and eukaryotes as bioresources. It is now well known that Rhodococcus rhodochrous J-1 produces an industrially important enzyme nitrile hydratase (NHase) for acrylamide production (1). We discovered aldoxime dehydratase (2), upstream of NHase, playing a role in the “aldoxime-nitrile pathway”. On the other hand, screening for the synthetic activity of optical active cyanohydrins, valuable building blocks for synthesis of fine chemicals and pharmaceuticals, has resulted in identification of hydroxynitrile lyases (HNL) from plant species (3). Since some millipedes emit (R)-mandelonitrile and hydrogen cyanide, I predicted the occurrence of HNL in a millipede. The purified HNL from Chamberlinius hualienensis had much higher specific activity than those of already known plant R-HNLs (4). (R)-Mandelonitrile was synthesized in high enantiomeric excess. Thus, not only microorganisms, plants and animals are considered as bioresources for exploring new enzymes.

References
(3) Y. Asano and N. Kawahara, Industrial Biotechnology, 12, 91-97 (2016).