

口头报告

分论坛 2 天然产物转化和代谢工程

## **Identification of a novel piperidine oxidase and rational arrangement of the oxidase into indigoidine pathway by protein scaffold for blue pigment production**

Wang Lei 1, Yu Dayu 2

Sci-Tech Center for Clean Conversion and High-valued Utilization of Biomass Jilin  
Province, Northeast Electric Power University

1, [wanglei1982@neepu.edu.cn](mailto:wanglei1982@neepu.edu.cn), 2, [yudy@neepu.edu.cn](mailto:yudy@neepu.edu.cn)

Indigoidine is a natural blue pigment produced by several bacteria derived non-ribosomal peptides (IgiD), and can be used to food and cosmetics safely. It is hypothesized that indigoidine is formed through condensating two L-Gln molecules into the 3',3'-bipyridyl structure, however, the detailed mechanism after L-Gln is cyclized has not been clarified. Here we confirm that L-Gln is cyclized into 3-aminopiperidine-2,6-dione and then oxidated into 3-amino-3H-pyridine-2,6-dione which can auto-combined to generate the blue pigment. The oxidation is performed by the Ox-domain of IgiD and a novel piperidine oxidase (IgiB), and the activity of IgiB is inhibited by L-Gln. According to sequence blast IgiB has little homology to other oxidases. Based on the enzymatic characters of IgiB and IgiD, series of protein scaffold complexes are designed to arrange the IgiB, IgiD and glutamine synthetase of the indigoidine pathway. The protein scaffold strategy elevates the titer of pigmentation from 2.8 g/L to 6.6 g/L. As an unusual oxidase with little homologue, IgiB may engender new oxidation mechanism. To our knowledge, IgiB is the first reported protein with definite assistant function for indigoidine synthesis, it may improve productivity of other pigment with piperidine derivant group. The protein scaffold complexes design strategy supplies an approach for arranging enzymes demand divergent substrate concentration.

**Key words:** indigoidine, piperidine oxidase, non-ribosomal peptides, protein scaffold