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Two novel cyanobacterial α -dioxigenases for the biosynthesis of fatty aldehydes

In Jung Kim, Yannik Brack, Thomas Bayer, Uwe T. Bornscheuer
Department of Biotechnology and Enzyme Catalysis, Institute of Biochemistry, University of Greifswald, Greifswald, Germany

Abstract:

α -Dioxigenases (α -DOXs) are known as plant enzymes involved in the α -oxidation of fatty acids through which fatty aldehydes, with a high commercial value as flavor and fragrance compounds, are synthesized as products. Currently, little is known about α -DOXs from non-plant organisms. The phylogenetic analysis reported here identified a substantial number of α -DOX enzymes across various taxa. Here, we report the functional characterization and *Escherichia coli* whole-cell application of two novel α -DOXs identified from cyanobacteria: CalDOX from *Calothrix parietina* and LepDOX from *Leptolyngbya* sp. The catalytic behavior of the recombinantly expressed CalDOX and LepDOX revealed that they are heme-dependent like plant α -DOXs but exhibit activities toward medium carbon fatty acids ranging from C10 to C14 unlike plant α -DOXs. The in-depth molecular investigation of cyanobacterial α -DOXs and their application in an *E. coli* whole system employed in this study is useful not only for the understanding of the molecular function of α -DOXs, but also for their industrial utilization in fatty aldehyde biosynthesis.

Keywords: α -dioxigenase, fatty aldehyde, fatty acid, *Cyanobacteria*, aroma compounds