Mechanism of microbial production of AC and BD optical isomers and substrate specificity of butanediol dehydrogenase

Yuchen Li¹, Xiangying Zhao², Mingjing Yao¹, Wenli Yang¹, Yanlei Han¹, Liping Liu¹, Jiaxiang Zhang¹, and Jianjun Liu¹

¹Affiliation not available
²Qilu University of Technology

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Abstract

3-Hydroxybutanone (Acetoin, AC) and 2,3-butanediol (2,3-butanediol, BD) are two essential four-carbon platform compounds with numerous pharmaceutical and chemical synthesis applications. AC and BD have two and three stereoisomers, respectively, while the application of the single isomer product in chemical synthesis is superior. AC and BD are glucose overflow metabolites produced by biological fermentation from a variety of microorganisms. However, the AC or BD produced by microorganisms using glucose is typically a mixture of various stereoisomers. This was discovered to be due to the simultaneous presence of multiple butanediol dehydrogenases (BDH) in microorganisms, and the AC and BD can be interconverted under BDH catalysis.

In this paper, beginning with the synthesis pathways of microbial AC and BD, we review in detail the studies on the formation mechanisms of different stereoisomers of AC and BD, summarize the properties of different types of BDH that have been tabulated, and analyze the structural characteristics and affinities of different types of BDH by comparing them using literature and biological database data. We also review recent work on the production of octadecanoic acid. Using microorganisms, the recent research on the production of optically pure AC or BD was also reviewed.

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