ISSN: 2161-0703
Volume-12
Medical Microbiology & Diagnosis
https://www.hilarispublisher.com/medical-microbiology-diagnosis.html

Joint Webinar on
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Applied Microbiology and Beneficial Microbes
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Title: The gene cluster involved in detoxification of plant-derived aromatic compounds was upregulated by lignin degradation products

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Received: February 28, 2023; Accepted: March 02, 2023; Published: March 27, 2023

Lignin is an aromatic resource with many potential applications, useful chemicals, materials, and clean biofuels. Recently, the enzymes with excellent selective conversion ability and biological funneling functions, have shown good possibility in improving utilization. To design a lignin conversion system based on microbial metabolism, it is important to identify genes involved in lignin metabolism and to understand their functions. According to transcriptome analysis using the lignin model dimer (GGGE) of Novosphingobium sp. MBES04, we reported that the gene cluster of four genes was specifically upregulated. Although the strain MBES04 metabolizes GGGE to guaiacylhydroxypropanone (GHP) using the ß-etherase system, the upregulated genes were not associated with this metabolism. Furthermore, the biological advantage of possessing the ß-etherase system was unclear, even though the strain MBES04 does not finally utilize GGGE as an energy source. The goal of this study was to clarify the role of the gene cluster and to understand the significance of the strain MBES04 having the gene for the ß-etherase system. The gene cluster was strongly expressed by GHP using screening of the lignin low molecule compounds. The analysis of the enzyme encoded by the gene suggests that the gene cluster contributes to the detoxification of compounds containing aromatic and hetero aromatic rings of plant derivatives. In addition, the growth of the strain MBES04 was enhanced by cluster induction in crude extracts from the eucalyptus. Therefore, we conclude that the □-etherase system of the strain MBES04 works as a switch for the induction of gene clusters in lignin partial degradation products, and the strain MBES04 adapts and maintains survival in environments with organic compounds of plant derivatives by upregulating clusters. These results will contribute to a comprehensive understanding of the metabolism of lignin-related compounds in the strain MBES04.

Biography

I am a PhD student at Gunma University, Japan. My major is microbiology and molecular biology. My research has focused on the utilization of lignin as an alternative to petroleum derived products. I have previously worked on the search and characterization of the novel enzyme which cleaves the ß-ether bond of lignin. I found thermotolerant and alkaliphilic enzyme, from Altererythrobacter sp. B11. Based on the structural model of the enzyme and kinetic studies of enzymes with mutations in the putative catalytic residues, I identified the key amino acids catalyzing the reaction. Currently, I am interested in valuable material production using the metabolic capacity of microorganisms and enzymes.