黄孢原毛平革菌突变株抗碳氮营养阻遏产漆酶碳氮生理调控机理

Carbon-nitrogen regulation of a laccase-producing mutant of Phanerochaete chrysosporium resisting carbon and nitrogen nutritional repression

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作者	单位	E-mail
邱爱连	福建农林大学，生命科学学院，福州350002	E-mail:fafu5188@yahoo.com.cn
李文燕	福建农林大学，应用微生物技术研究所，福州350002	
范晓静	福建农林大学，应用微生物技术研究所，福州350002	
孟延	福建农林大学，应用微生物技术研究所，福州350002	
郑耀通	福建农林大学，应用微生物技术研究所，福州350002	

中文摘要:

摘要:【目的】通过比较不同碳氮营养及其消耗对产漆酶的影响，了解白腐菌模式种黄孢原毛平革菌解除营养阻遏产漆酶代谢的生理生态特性，揭示白腐菌合成漆酶的碳氮生理调控机理。【方法】分别利用限碳限氮(CL-NL)、限碳富氮(CL-NS)、富碳限氮(CS-NL) 与富碳富氮(CS-NS)4 种条件培养黄孢原毛平革菌野生型(WT) 与突变株，比较两者产漆酶动力学、菌体生长、葡萄糖与氨氮消耗差异及其相关性来揭示解除营养阻遏产漆酶调控生理特性，明确C、N 营养对产漆酶的生理调控途径。【结果】突变菌株除消耗速率比野生型略慢外，两者氨消耗趋势一致，但对葡萄糖的消耗比野生型快且氨氮浓度对葡萄糖的消耗影响不大。在CLNL、CL-NS、CS-NL、CS-NS 4 种培养条件下，野生型分别在培养后期的第11、14、19 和19 天的次生代谢时期产生0. 107、0.029、12.84 和18.05U/L 漆酶，启动漆酶合成及酶峰值出现的时间与基质中葡萄糖耗尽或接近耗尽的时刻，或同氨氮消耗至最低值的时刻相对应;与WT 产漆酶特性不同，突变株产漆酶伴随整个培养过程且均有两个产酶高峰，分别在培养的第8、7、12 天和12 天出现298.83、343.14、271.22、251.49U/L漆酶第一个产酶高峰，在培养的第12、13、19和19天产生257.69、298.78、213.81、216.93U/L 漆酶的第二个产酶高峰。碳氮营养对产酶的影响显示:两菌株只要初始碳源浓度相同(限碳或富碳) ，各自产酶动力学趋势基本一致;相反，即使初始氮源浓度相同但其产酶动力学趋势却不同，说明碳源对黄孢原毛平革菌产漆酶的影响比氮源更为重要。【结论】野生型黄孢原毛平革菌产漆酶受碳或氮饥饿调控，碳、氮各自独立发挥作用且在不同的营养条件下由不同营养素所调控，如在限碳条件下产漆酶主要由葡萄糖饥饿启动，而在富碳条件下则由氨氮饥饿所激发，以碳或氮菌体负荷表示是否达到启动酶合成的调控阀值比单纯碳或氮浓度更为合理。突变菌株漆酶合成的启动不受碳、氮营养所阻遏，可能涉及一个全局调控的改变，解除了漆酶合成的营养阻碍。

英文摘要:

Abstract: [Objective] Comparing the effects of different carbon-nitrogen nutrition and their consumption on laccase production, we studied the ecophysiological characteristics of Phanerochaete chrysosporium resisting nutritional repression, and the carbon-nitrogen physiological regulation mechanism of the white-rot fungi. [Methods] The mutant and the wildtype strains were respectively cultured under the conditions of: carbon and nitrogen limitation, carbon limitation and nitrogen sufficiency, carbon sufficiency and nitrogen limitation, carbon and nitrogen sufficiency, to compare their laccaseproduction kinetics, cell growth and glucose and ammonia nitrogen consumption to show the characteristics and the regulation pathway of carbon-nitrogen nutrition on laccase production. [Results] The wild-type strain produced 0.107U/L, 0.029U/L, 12.84U/L and 18.05U/L of laccase respectively on 11th, 14th, 19th and 19th day when glucose or ammonia nitrogen was consumed to the lowest value; the mutant produced laccase throughout the whole process with two peaks respectively on 8th, 7th, 12th and 12th day with laccase of 298.83U/L, 343.14U/L, 271.22U/L and 251.49U/L and on 12th, 13th, 19th and 19th day with laccase of 257.69U/L, 298.78U/L, 213.81U/L and 216.93U/L. The enzyme-production kinetics trends were similar between the two strains on the condition of the same initial carbon concentration but were different on the same initial nitrogen concentration, which showed that carbon source had more effect on laccase production. [Conclusion] The laccase production of the wild-type strain

was regulated by carbon or nitrogen starvation. Under different conditions, it was regulated by different nutrient. For example, under carbon limitation condition it was started by the glucose starvation, however under carbon sufficient condition the ammonia nitrogen starvation aroused it. The laccase production of the mutant didn t repress by carbon and nitrogen nutrition. Maybe it referred to a global regulation change which relieved nutritional repression on the laccase production.

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地址：北京朝阳区北辰西路1号院3号中科院微生物所内 邮编：100101
收信(款)人：《微生物学报》编辑部
电话：010-64807516 传真：010-64807327 电子信箱：actamicro@im.ac.cn