一株红壤溶磷菌的分离、鉴定及溶磷特性

Isolation, identification and characterization of a strain of phosphate-solubilizing bacteria from red soil

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中文摘要:

摘要:【目的】为了提高红壤磷素利用率，探讨溶磷菌溶磷机理。【方法】利用难溶性无机盐培养基从花生根际土壤样品中分离到一株溶磷菌C5-A，结合菌落形态特征、生理生化和16S rRNA 序列确定该菌株的系统发育地位;通过菌株C5-A 在NBRIP 液体培养基培养过程中培养液pH变化确定其溶磷能力;利用液体发酵实验测定不同的碳源、氮源对菌株C5-A 溶磷的影响;通过高效液相色谱检测C5-A 在不同氮源培养液中有机酸的种类和浓度。【结果】菌株C5-A 鉴定为洋葱伯克霍尔德氏菌(Burkholderia cepacia)，遗传稳定性较好。在FePO4和AlPO4培养液中，菌株C5-A 的溶磷量和pH 变化呈显著负相关;菌株C5-A对磷酸三钙、磷酸铝、磷酸铁、磷矿粉均有较强的溶解能力，最高溶磷量分别为125. 79、227.34、60.02 和321.15 mg/L;菌株C5-A对不同浓度的两种磷矿粉有较强的溶解能力;分别以麦芽糖和草酸铵为碳源和氮源时溶磷量最高。高效液相色谱检测出10 种有机酸，分别为草酸(葡萄糖酸)、乙酸、苹果酸、琥珀酸和5 种未知有机酸，然而，乙酸而非草酸似乎是影响C5-A 溶磷的重要有机酸。【结论】从红壤花生根际土壤中筛选到一株对难溶性无机盐具有较强溶解能力溶的菌株C5-A，有望为开发高效红壤微生物磷肥提供种质资源。

英文摘要:

Abstract: [Objective] To improve use efficiency of phosphorus in latosolic red soil and to explore mechanism of phosphate solubilization. [Methods] Pikovskaya and National Botanical Research Institute's Phosphate broth were used to isolate a phosphate-solubilizing bacterium coded as C5-A from the rhizosphere soil of peanut. According to its morphological, physiological, biochemical properties and its 16S rRNA sequence, its position in phylogenetic development tree was defined. By measuring changes in pH of the National Botanical Research Institute's Phosphate solution in which C5-A was incubated, phosphate solubilizing capacity was determined. Through fermentation, effects of carbon and nitrogen sources on the capacity of strain C5-A were investigated. Kinds and concentrations of organic acids in the cultures different in N sources were also determined by HPLC. [Results] The strain was identified as Burkholderia cepacia, which is stable in hereditary. In aluminum phosphate and ferric phosphate solutions, its P solubilizing capacity was negatively related to pH. It solubilized tricalium phosphate, aluminum phosphate, ferric phosphate and rock phosphates powder, and could dissolve as much as 125.79 mg/L, 227.34 mg/L, 60.02 mg/L and 321.15mg/L P, respectively. For RPP, P solubilizing capacity of the strain was related to type and concentration of the powder. When using maltose and ammonium oxalate as C and N sources, the strain displayed its highest P solubilizing capacity. HPLC analysis detected 10 organic acids in the culture, namely: oxalic acid, acetic acid, malic acid, lactic acid, citric acid, cuccinc acid and 5 unknown organic acids. Interestingly, it is acetic acid rather than gluconic acid being the most important organic acid affecting P olubilization. [Conclusion] The strain isolated from the rhizosphere soil of peanut plants growing in a red soil field can dissolve hardto-solve inorganic salts, and is a promising microbial resource for development of high efficiency biological phosphorus fertilizer for latosolic red soil.

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