論文 / 著書情報
Article / Book Information

題目(和文)	過塩素酸耐性を示す好塩菌および耐塩菌の 米国ビッグソーダ湖からの分離と性質検討
Title(English)	Isolation and characterization of perchlorate resistant halophilic and halotolerant bacteria from Big Soda Lake
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種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
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論 文 要 旨

THESIS SUMMARY

専攻： Department of	生物プロセス　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　（工学）
学生氏名： Student's Name	松原　惇高	指導教員（主）： Academic Advisor(main)	中村　聡
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

The National Aeronautics and Space Administration (NASA), USA, other national space agencies and industrial companies around the world are interested in the exploration of Mars, with major goals including planetary exploration, the search for extinct or extant life, and for eventual human settlement as the fields transition from science fiction to reality. Transporting materials from the Earth to Mars is very expensive as cargo capacity is limited and the launch cost is expensive because of the large amount of energy and infrastructure needed to overcome Earth's gravity. These high costs for a long-term settlement program by providing all materials from the Earth are impractical for living permanently off of the Earth. One of the ways to reduce the cost of supplies and increase the probability of mission success is the use of the resources on Mars, that is *in situ* resource utilization (ISRU). Biotechnology offers a solution to the mass problem described above since a small initial mass of a single cell replicates and grows from the resources around it. Recent advances in genetic engineering and synthetic biology have shown that humans are rapidly increasing the range of products capable of being produced. However, the Martian surface is highly arid and contains chloride salts; in addition, 0.4-0.6 (w/v) % (w/v is omitted below) perchlorates were found. Thus, commonly used model organisms are not suitable for growth on Mars regolith since they usually cannot grow in the presence of high concentration of salts, and perchlorate is toxic for most organisms. Further, there is not enough knowledge about perchlorate-resistant microorganisms and effects of perchlorate on microorganisms. Therefore, garnering this knowledge is important and beneficial for not only use on Mars but also to more fully understand halophilic and halotolerant microorganisms in general.

I screened perchlorate-resistant halophilic and halotolerant microorganisms from Big Soda Lake, Nevada, USA, and characterized them. Perchlorate-resistant halophilic and halotolerant bacteria, BSL1, BSL2, BSL3 and BSL4 were isolated from Big Soda Lake. From the analysis of a rRNA-based phylogenetic tree, BSL1 shared the same root with *Bacillus licheniformis* (identity: 99.2%), BSL2 with *Bacillus pseudofirmus* (identity: 99.1%), BSL3 with *Halomonas salifodinae* (identity: 99.1%) and BSL4 with *Alkalibacillus filiformis* (identity: 99.1%).

The results of the salt resistance assay showed that BSL1 grew in the presence of 0 to 10% NaCl, but that it showed the highest OD_{600} at 24 h in the absence of NaCl. Therefore, this result suggested that BSL1 is a halotolerant bacterium. In contrast, BSL2 grew in the presence of 2.5 to 10% NaCl and showed the highest OD_{600} at 24 h in the presence of 2.5% NaCl, and it did not grow without NaCl. Therefore, this result suggests that BSL2 is a halophilic bacterium. BSL3 grew in the presence of 2.5 to 17.5% NaCl and showed the highest OD_{600} at 24 h in the presence of 7.5% NaCl. Therefore, this result suggested that BSL3 is a halophilic bacterium. BSL4 grew in the presence of 7.5 to 15% NaCl and BSL4 showed the highest OD_{600} at 24 h in the presence of 7.5%. Therefore, this result suggested that BSL4 is halophilic bacterium. Also, BSL3 showed the fastest growth in the isolates, reaching the highest OD_{600} in the presence of 7.5 or 10% NaCl.

The results of the perchlorate resistance assay showed that BSL1 grew in the presence of 2, 5 and 2% magnesium, sodium and calcium perchlorates, respectively. BSL2 grew in the presence of 0.5 and 1.5% magnesium and sodium perchlorates, respectively. BSL3 grew in the presence of 1.5, 2 and 1.5% of magnesium, sodium and calcium perchlorates, respectively. BSL4 grew in the presence of 1.5 and 2% of magnesium and sodium perchlorates, respectively. Therefore, BSL1, BSL3 and BSL4 grew in the presence of variety of perchlorate salts at least 0.5%, concentrations which exist on Mars. The results of the perchlorate resistance assay in the presence of two-component perchlorate salts (calcium, magnesium and/or sodium perchlorate salts), BSL1-4 grown at least in the presence of 0.5% mixed magnesium, sodium and/or calcium perchlorate, and the order of perchlorate resistance was BSL3 > BSL1 ≈ BSL4 > BSL2 based on the growth curves comparisons.

Therefore, some of the isolates could have potential to grow on Martian salts and perchlorates, and the search for life under these conditions is not only useful for ISRU on Mars, but also for use on perchlorate deposit on Earth.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).