

Methylootrophs: physiology in the phyllosphere, and the impact on agriculture and environment

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Abstract

Methylootrophs are bacteria and yeasts, which can utilize methanol and/or methane, play key roles in the carbon cycle between CO₂ and methane. Methanol is considered a prospective carbon resources produced from a natural gas, methane. It is easily transported and does not compete with food resources. In 1970's, high-cell density cultivations of methylootrophs were developed to produce single cell proteins, which lead to the technological basis for application of methylootrophs in production of useful chemicals and proteins. In nature, methanol exists in a form of pectin methylesters of plant cell wall. We found that methanol concentration in the phyllosphere fluctuated during daily light/dark cycle. In the phyllosphere, methylootrophic yeasts adapt to such circadian environment, and proliferate through regulation of C1-metabolism with peroxisome synthesis and autophagic degradation. Pink-pigmented facultative methylotrophs (PPFMs), e.g. *Methylobacterium* sp., are dominant microbial species in the phyllosphere, and the symbiotic relationship between plant and PPFMs, e.g., promotion of plant growth, has been recognized recently. We found that a homolog of circadian gene *KaiC* was necessary for efficient colonization of PPFMs on plants. We also succeeded in increasing the crop yield of rice in the paddy field by spraying PPFMs. These findings gave us new insights into the physiological role of "cellular response to methanol" including methanol-induction, which is a basis for yeast heterologous gene expression. Such application of methylootrophic microbes to industry and agriculture has a potential to increase the input of natural gas-derived carbon atom to biomass, changing the conventional concept of global carbon cycle.

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Biography

Yasuyoshi SAKAI has completed his PhD at the age of 28 years from Kyoto University. He is the professor at Graduate School of Agriculture, and the director of Research Unit of Physiological Chemistry, C-PIER, Kyoto University. He has published more than 175 original papers and 80 review articles in reputed international

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