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Ergothioneine fermentative production in *Escherichia coli*

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Ergothioneine (ERG) is sulfur-containing amino acid synthesized by certain bacteria and fungi. Recently, findings point to critical functions in human physiology. Human takes ERG from food and concentrates it in specific tissues or cells such as liver, kidney, central nervous system and red blood cells. ERG is marketed as dietary supplement or nutraceutical so that acts as anti-oxidant. It has been recognized that filamentous fungi or actinomycetes produce ERG. However, in 2010, the ERG biosynthetic gene was identified for the first time. Here, we challenged to produce ERG from glucose with our constructed cysteine producer. *E. coli* has a regulation system that synthesized cysteine from energetically-favored thiosulfate, as the assimilation of sulfate spends 2 ATP and 4 NADPH. This cysteine producer produces 16 g/L of cysteine from thiosulfate. Therefore, we established world-first ERG fermentation and challenged production of much cheaper ERG. We cloned ERG biosynthetic genes from *Mycobacterium smegmatis* and performed heterologous expression of cloning ERG genes in *E. coli.* The analysis of the culture medium by LC-MS/MS detected ERG peak. When a plasmid carrying these ERG biosynthetic genes was introduced into cysteine producer with enhanced biosynthesis, weakened degradation and improved export of L-cysteine, the transformants slightly produced ERG into medium from thiosulfate (30 mg/L of ERG). Interestingly, this transformants produced 200 mg/L of ERG from sulfate. We propose that spending of NADPH is important for production of ERG.

Biography

Miyu Nishiguchi is currently pursuing Masters in Applied Microbiology at Nara Institute of Science and Technology, Japan.

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