

[10:30 – 11:10]

Microbial production of coenzyme Q10

Jung-Woo Suh

Fermentation R&D center, Yungjin Pharm. Co., Ltd.

239-3, Galgot-ri, Jinwi-myun, Pyeongtaek-si. Gyeonggi-do, Korea

Abstract

Coenzyme Q10(CoQ10) is a biological quinone compound that is widely found in living organisms including yeast, plants, and animals. CoQ10 has two major physiological activities:(a)mitochondrial electron-transport activity and (b)antioxidant activity. Various clinical applications are also available : Parkinson's disease, Heart disease, diabetes. Because of its various application filed, the market size of CoQ10 is continuously expanding all over the world. A Japanese company, Nisshin Pharma Inc. is the first industrial producer of CoQ10(1974). CoQ10 can be produced by fermentation and chemical synthesis. In several companies, these two methods are used for the production of CoQ10:chemical synthesis – Yungjin, Daewoong, Nishin Parma; fermentation – Kaneka, Kyowa, Yungjin, etc. Researchs in microbial production of CoQ10 have several steps : screening of producing microorganisms, strain development, fermentation process, purification process, scale-up process, plant production. Several strategies are available for the strain development : Random mutation and screening, directed metabolic engineering. For the optimization of fermentation process, various conditions (nutrient, aeration, temperature, culture type, etc.) are considered. Purification is one of the most important step because the quality of final products entirely depends on its purity. The production cost will be reduced and the quality of the CoQ10 will be improved by continuous researches in strain development, fermentation process, purification process.

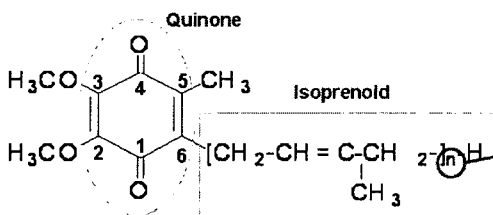
Coenzyme Q10 ? (1)

■ General Fact

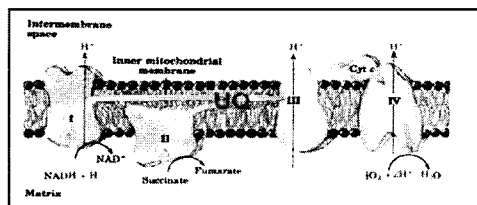
- Natural product (discovered by Frederic Crane in 1957)
- Vitamin-like compound which has major two physiological activities
 - a) Mitochondrial electron transport activity
 - b) Antioxidant activity
- Naturally existed in human body, but remarkably decrease after forty years old
- Nissin Pharma Inc. : First industrial producer (1974)
- Application fields : medicin, functional foods and cosmetics

Coenzyme Q10 ? (2)

■ Chemical structure and characteristics



- ▷ Composed of two units : Quinone head, Isoprenoid side chain
- ▷ Designated as Q₆, Q₇, Q₈ ... by the number of isoprenoid units in the side chain
- ▷ Lipid-soluble components of membrane-bound electron-transport chains

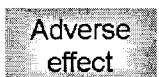


Clinical application



Efficacy

Parkinson's disease and mitochondrial cytopathies:
 Preliminary evidence for benefit
 Congestive heart failure, hypertension, and ischemic heart disease : conflicting or preliminary evidence
 Diabetes : conflicting evidence for improvement in glycemic control



Adverse effect

Rare: gastrointestinal upset reported in less than 1 % of study patients



Dosage

Mitochondrial cytopathies: 150 mg/day or 2 mg/kg with titration up to 3,000 mg/day in some patients
 Parkinson's disease: 200 to 1,200 mg/day in four divided doses
 Cardiovascular: typically 50 to 200 mg/day
 Diabetes: 100 to 200 mg/day

KT&G and you

Microbial Production of CoQ10

Development flow-chart of Microbial production of CoQ10

Screening of
Microorganism strains

Strain development

Fermentation process

purification process

Scale-up process

Plant production

Various Microorganisms producing CoQ10

Strain	Researchers
<i>Rhodospiridium sphaerocarum</i>	Ajinomoto
<i>Trichosporon cutaneum</i>	
<i>Trichosporon JY-155</i>	Jujo Paper
<i>Cryptococcus laurentii</i>	
<i>Rhodotorula glutinis</i>	
<i>Sporobolomyces salmonicolor</i>	Ko Aida
<i>Oosporidium margaritiferum</i>	
<i>Paracoccus denitrificans</i>	
<i>Rhodobacter sphaeroides</i>	Kyowa
<i>Agrobacterium tumefaciens</i>	
<i>Pseudomonas sp.</i>	

KT&G and you

