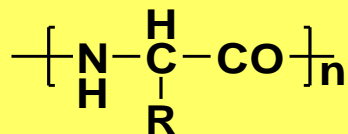


# Amino Acids Produced from Marine Wastes



## High-temperature high-pressure Water Reaction

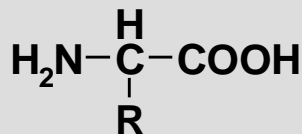
### Proteins



*Hydrolysis*

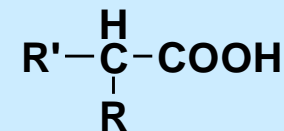
*(Non-Catalytic)*

### Amino acids



*Decomposition*

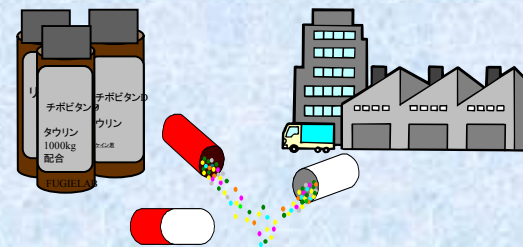
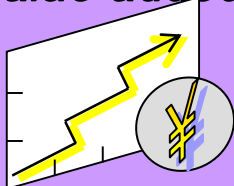
### Organic acids



*Ammonia*



*Value added*



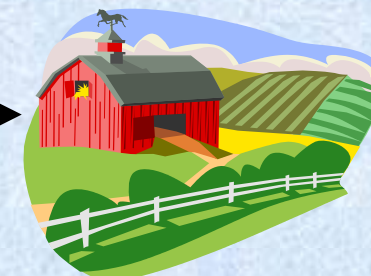
*for Medicine, Fine Chemicals,  
Industrial Materials*

**Marine Wastes  
(Entrails, Bones, etc.)**

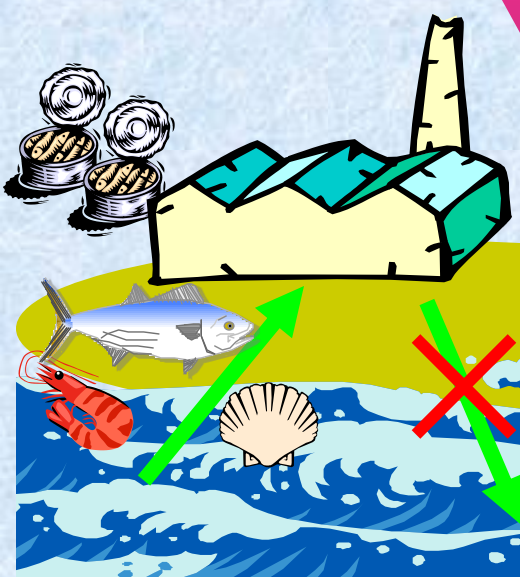


*Compost*

*the Treaty of London (since 1996)*



*For Agriculture*

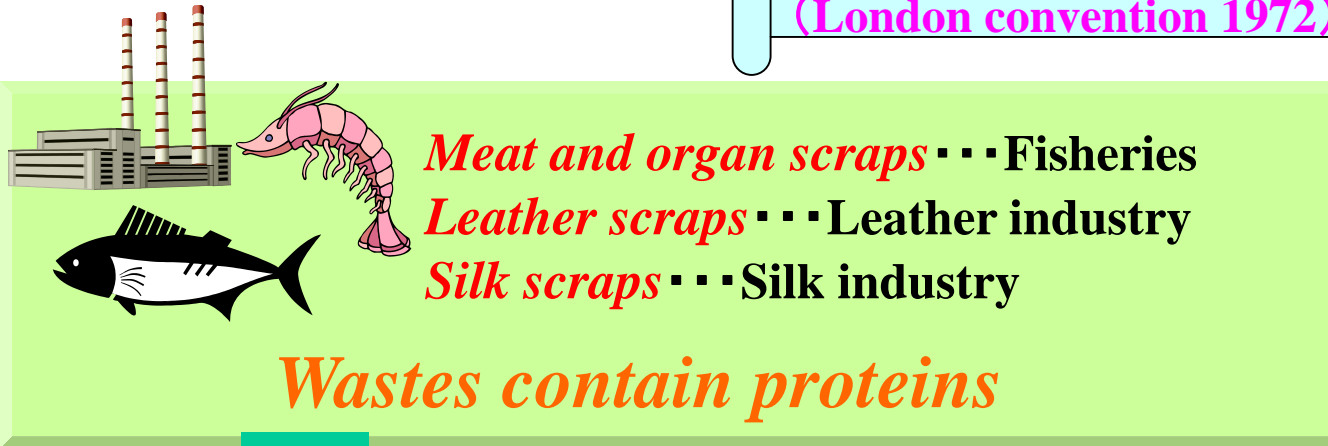


# Amino acid recovery from protein waste

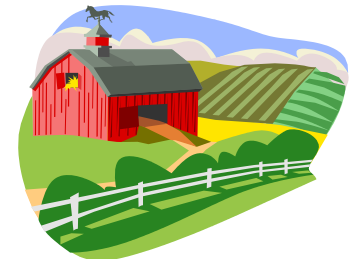
by high-temperature and high-pressure water reaction

## Recycling of waste

- The Basic Law for Establishing the Recycling-based Society  
**food recycling law, packing recycling law, etc.**
- Lack of landfill, prohibit dumping wastes into sea  
**(London convention 1972)**



*composting*

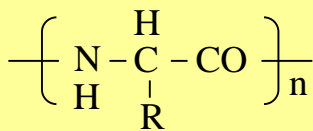


**Compost**  
**Livestock feed**  
etc.

**Development of recycle technology**

*Hydrothermal reaction*

**Protein**



**Hydrolysis**  
(Uncatalyst)

**Amino-acid**



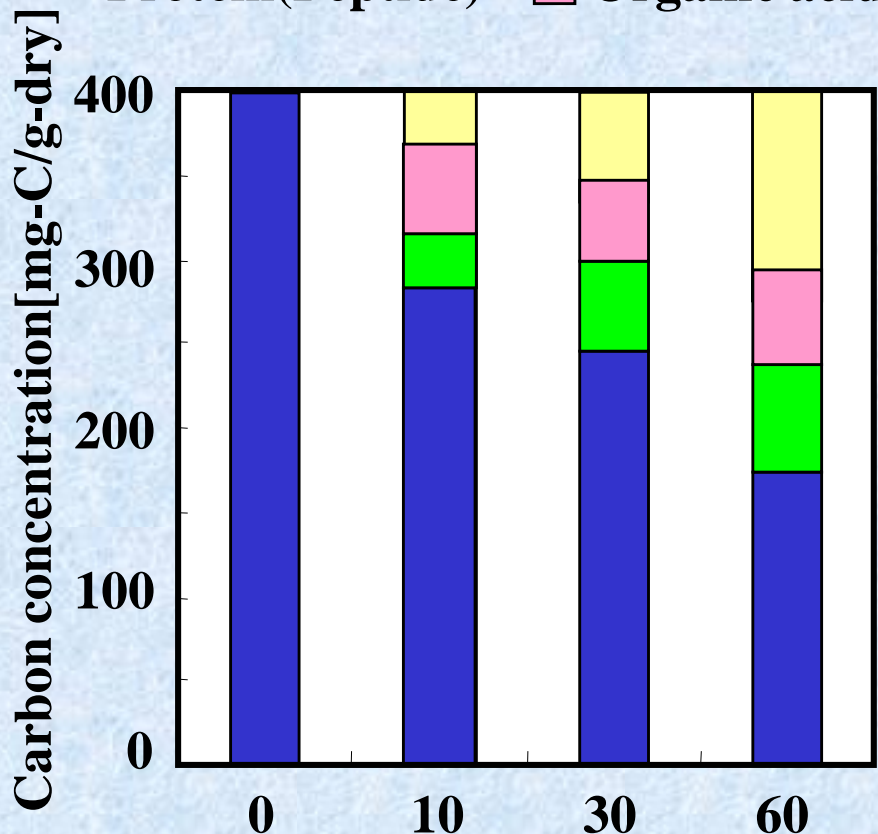
**Medical and chemical ingredients, etc.**

# Carbon and nitrogen balance by reaction of collagen

260°C、4.7MPa

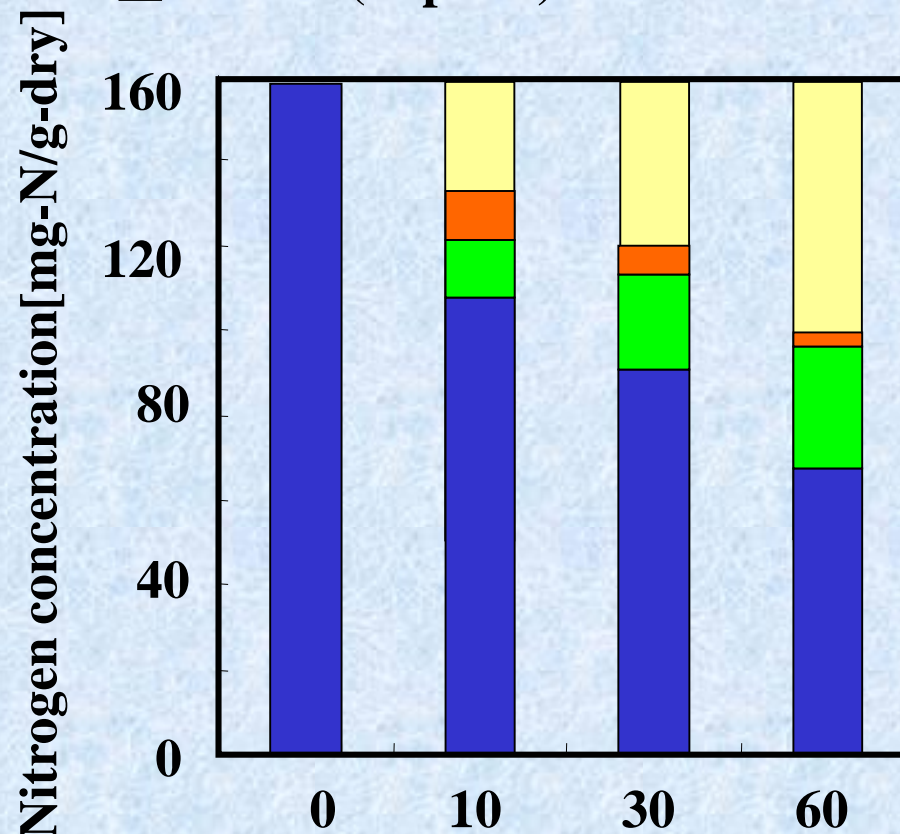
## Carbon balance

- Free amino acids
- Unknown (Amines, etc.)
- Protein(Peptide)
- Organic acid



## Nitrogen balance

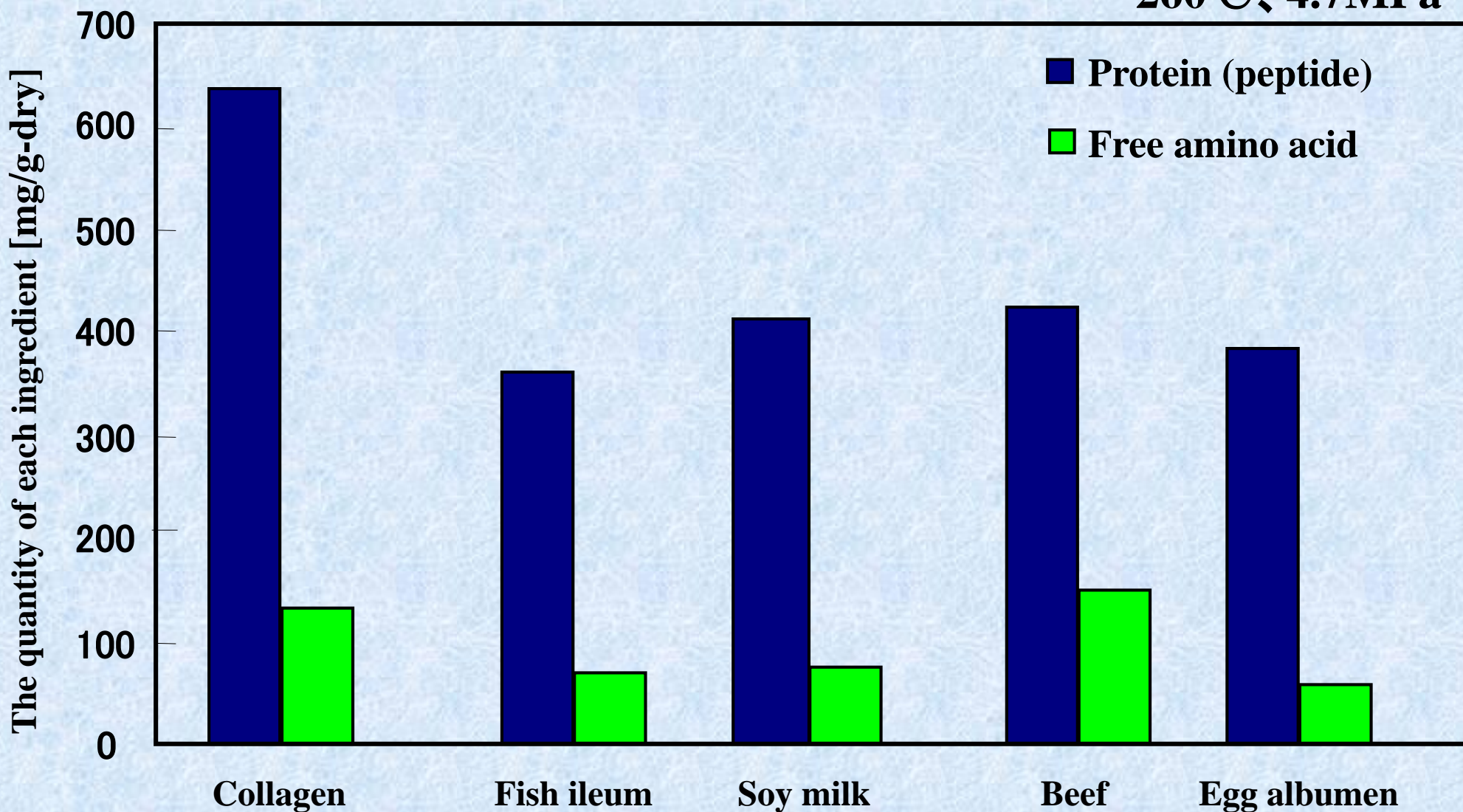
- Free amino acids
- Unknown (Amines, etc.)
- Protein(Peptide)
- Ammonia



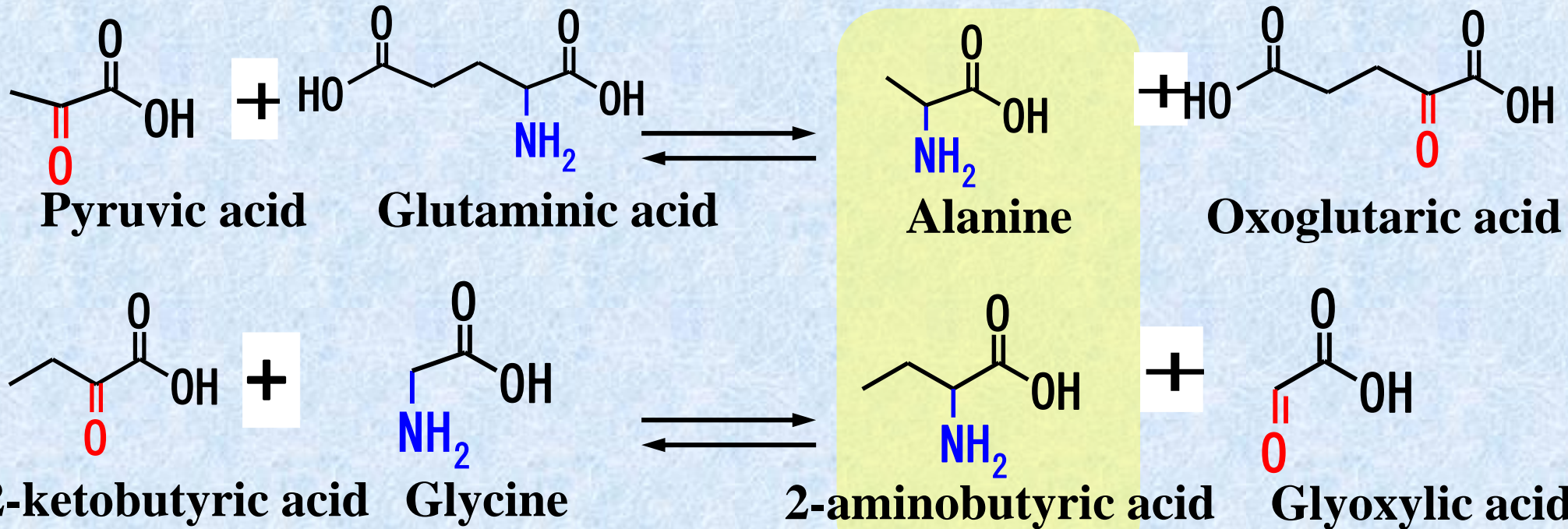
Reaction time [min]

# Reaction state of each sample in 30 minutes

260°C、4.7MPa



# *Amino acids obtained by Hydrothermal synthesis*



It is possible to produce an amino acid from an oxoacid and another amino acid

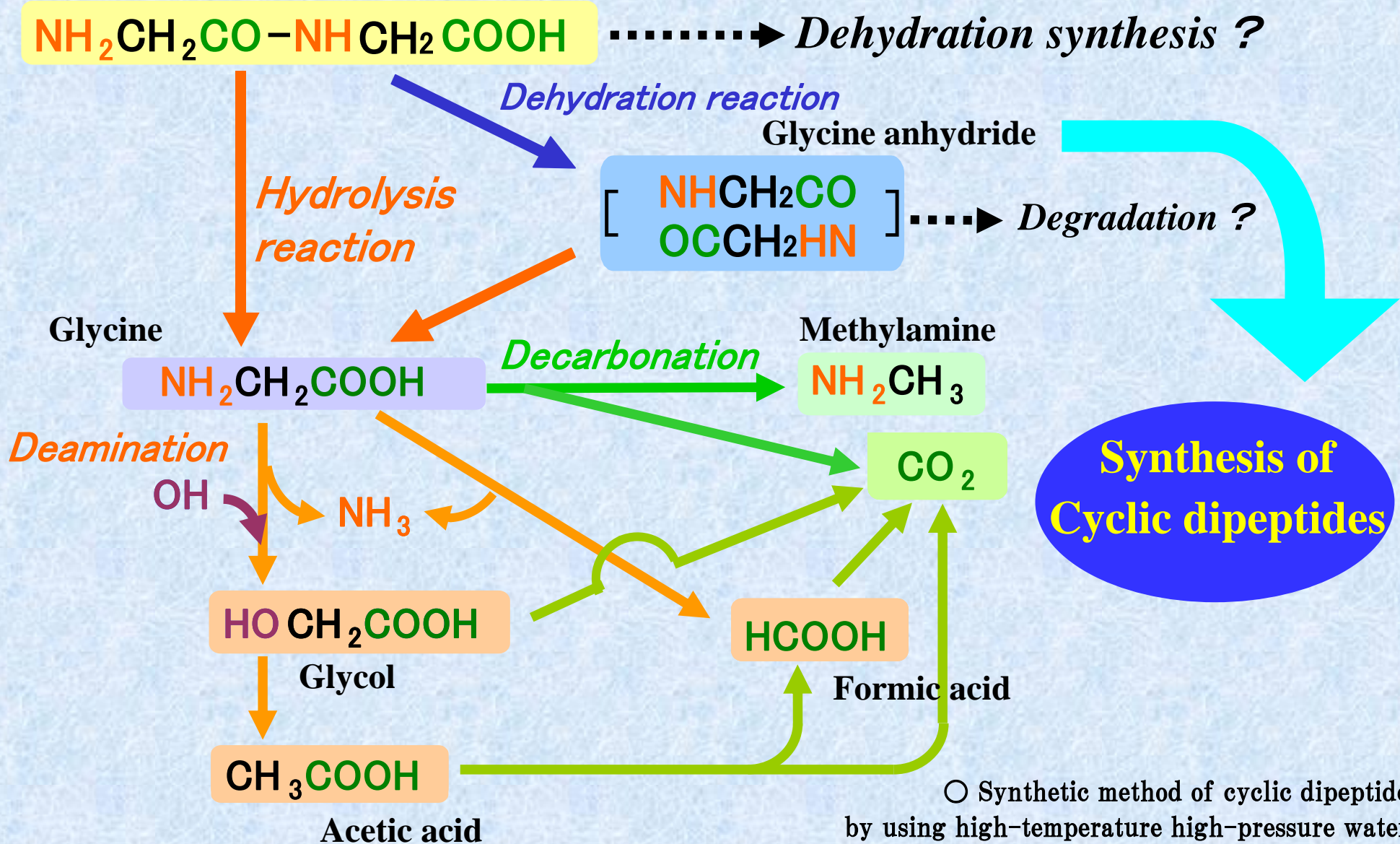
The reaction is similar to transamination

- Method for synthesizing amino acid using high temperature-high pressure water
- Method for synthesis of gamma-aminobutyric acid from glutamic acid using high temperature-high pressure water



# Degradation pathway of Gly-Gly in Hydrothermal reaction

Glycylglycine (Gly-Gly)



○ Synthetic method of cyclic dipeptide by using high-temperature high-pressure water  
Patent publication 2003-252896