OSAKA METROPOLITAN UNIVERSITY
GRADUATE SCHOOL OF SCIENCE

# Analysis of supersulfide profile in seaweed and its health promoting effects

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## I. Background

### Oxidative stress

Oxidative stress is a physiological condition caused by excessive free radicals, which leads to oxidative damage of cells and tissues. It is a major driver of aging and many diseases (Figure 1).

Although synthetic antioxidants have been developed as potential therapies for oxidative stress–related conditions, their clinical effectiveness has been largely disappointing.

**Effective natural antioxidant is an urgent issue**

### Supersulfides

- A compound with a catenated sulfur atom in its body that include hydropersulfides, polysulfides or cyclic sulfur species (Figure 2). Abundant in living organisms including not only in procaryotes but also eukaryotes and endogenously produce in human body (Figure 3).

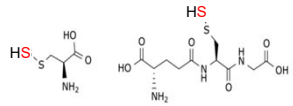



Figure 2: Supersulfides.

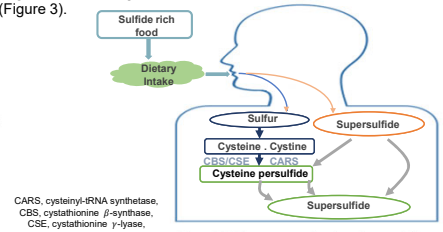



Figure 3: Endogenous production of supersulfides.

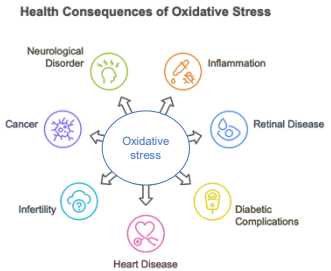



Figure 1: Health consequences of oxidative stress.

**Possible biological functions of supersulfide:**
- Antioxidant activity
- Mitochondrial biogenesis/ membrane potential formation
- Regulation of redox signaling

Ida *et al*, ***PNAS***. (2014)
Akaike *et al*, **Nature Comm.** (2017)

**Supersulfide a potential antioxidant**

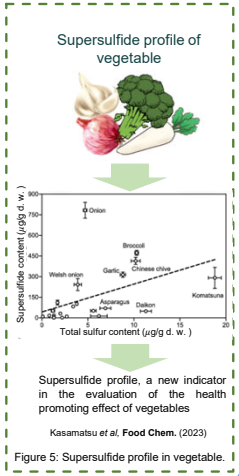



Figure 5: Supersulfide profile in vegetable.

### Seaweed

- Seaweeds are macroscopic photosynthetic marine algae, living mainly in coastal and intertidal zones and are rich in unique bioactive molecules rarely found in terrestrial plants.
- Like other plants and vegetables sulfur is essential element for seaweed and takes in the form of sulfate from the environment (Figure 4). Supersulfide profile of vegetable is in Figure 5, It is highly possible for seaweed to produce supersulfide.

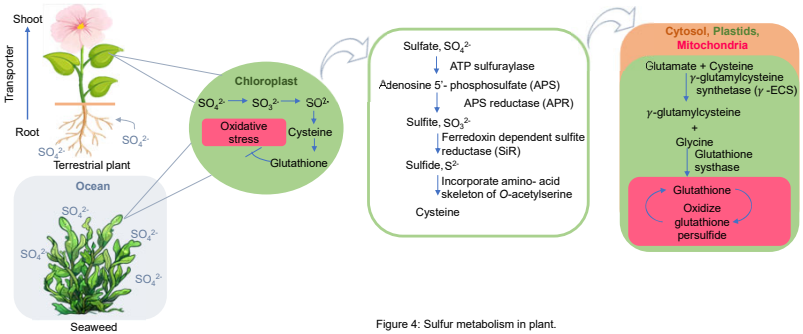



Figure 4: Sulfur metabolism in plant.

**This indicates seaweed might be producing unknown supersulfide molecules but there is no report**

## II. Study Purpose and Strategy

### Study Purpose:

This study focus on supersulfide derives from seaweed and to analysis its health promoting effects.

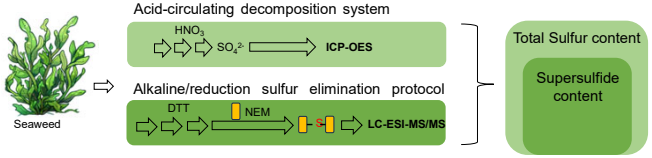
### Strategy:

This study is planed into four sections:

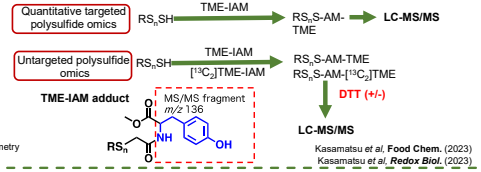

1. Supersulfide profiling
2. Synthetic reproduction
3. *In vitro* studies
4. *In vivo* studies

### 1. Supersulfide profiling

Supersulfide profiling of seaweed will be done by measuring total sulfur content and total supersulfide content of seaweeds.




To analyze the known and unknown supersulfide, below mentioned polysulfide omics analysis will be done




R, hydrogen or alkyl or cyclized polysulfides
ICP-OES, inductively coupled plasma optical emission spectroscopy
DTT, dithiothreitol. NEM, *N*-ethylmaleimide
LC-ESI-MS/MS, liquid chromatography-electrospray ionization-tandem mass spectrometry
TME-IAM, *N*-iodoacetyl tyrosine methyl ester

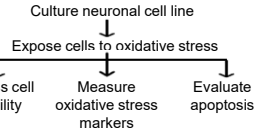
Kasamatsu *et al*, **Food Chem.** (2023)
Kasamatsu *et al*, ***Redox Biol.*** (2023)

### 2. Synthetic reproduction

Unique supersulfide will be produce by chemical reaction.

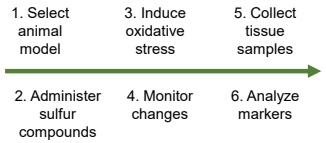
### 3. *In vitro* study

Neuroprotective study experimental procedure




### 4. *In vivo* study

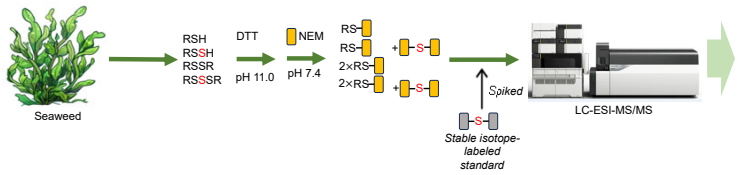
Evaluating sulfur compounds in oxidative stress




## III. Results

### Supersulfure content:

Supersulfide content was measured by following alkaline/reduction sulfur elimination protocol and the result shows in Figure 6.



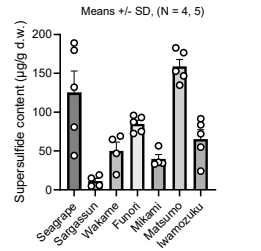




Figure 6: Total supersulfide content of seaweeds.

Photos of seaweed are used in this experiment (Figure 7) and source from ぼうずコンニャクの市場魚貝類図鑑 and AlgaeBase.


Figure 7: Identification of seaweeds used in this experiment

**This is the first report on supersulfide in seaweed.**

## IV. Expected outcome

This research will provide a deeper understanding of seaweed-derived sulfur compounds and their physiological roles. Ultimately, it aims to support the development of functional foods and preventive stratigies for oxidative stress-related diseases through natural marine-derived compounds.