

# CURDLAN

## Basic information

15-Apr-19

 Mitsubishi Corporation  
Life Sciences Limited

Food Material & Food Additives Division

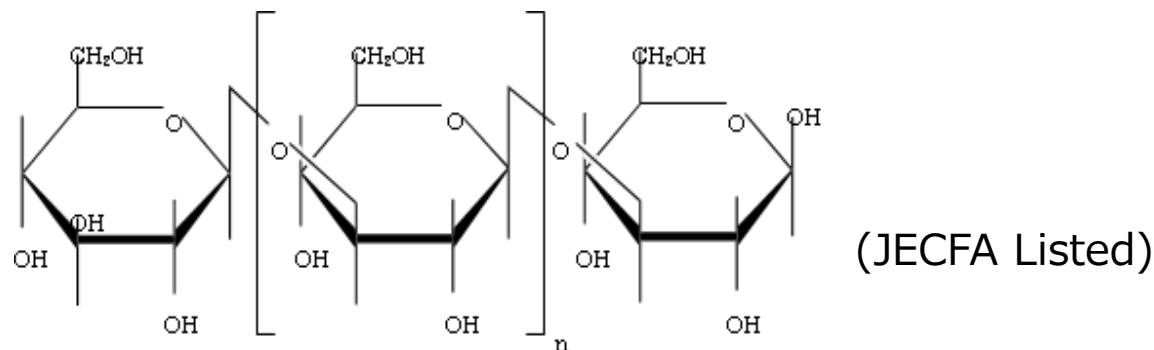
# What is Curdlan ?

**Curdlan** is one of the **polysaccharide** produced through **glucose fermentation** by the microorganism *Agrobacterium biovar 1*.

Its structure is **linear  $\beta$ 1,3-Glucan** and white **odorless powder**.

And it is **extermely stable in dry state**.

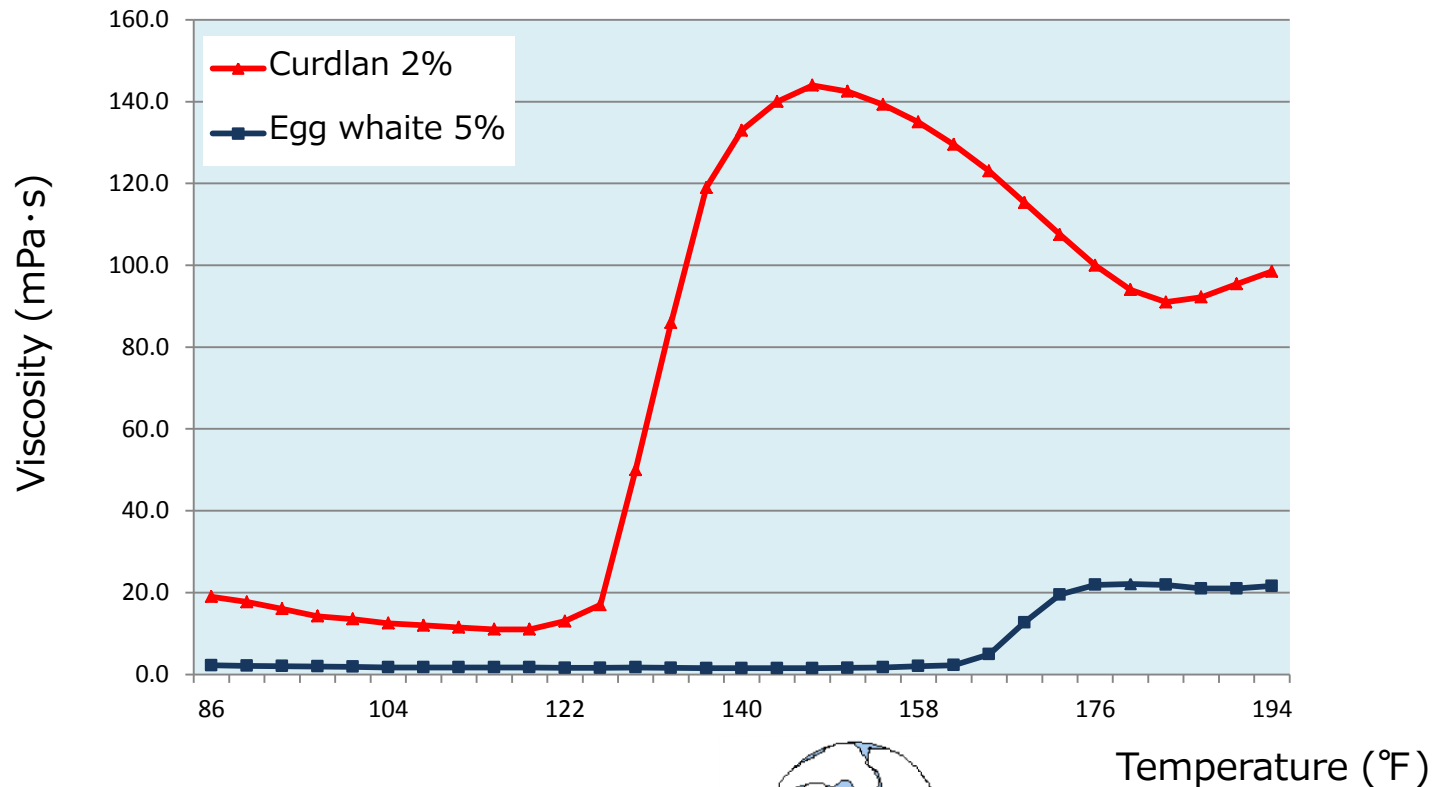
Nutritionally inert, water-insoluble **dietary fiber**. **Insoluble in water**, alcohol, but **soluble in alkaline solutions** ( > pH 12)



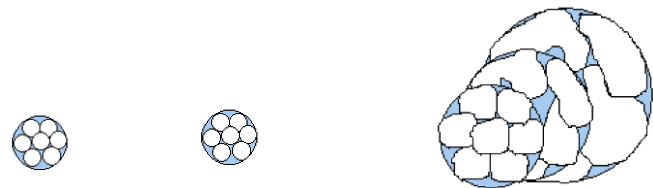
## Unique basic properties

- ① **Curdlan** can retain water 30-50 times of its own weight at 120-140°F.
- ② **Curdlan** forms elastic gel when **heating** the aqueous suspension.
- ③ **Curdlan gel** maintains its original texture even after freeze-thaw processes.

## ~Water absorption



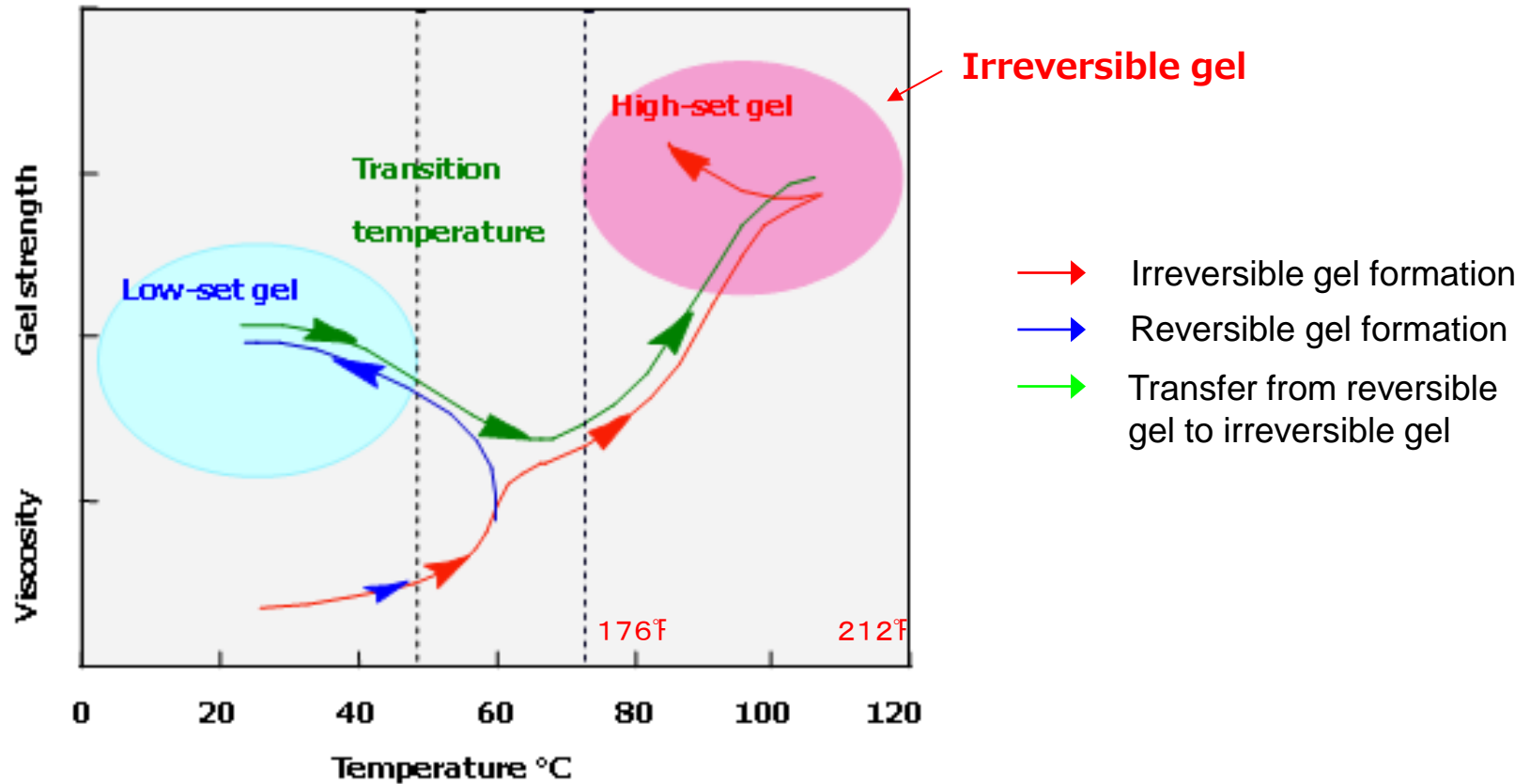
The size of the Curdlan particle



**Curdlan swells rapidly when absorbs water at 125-145°C, and increases its viscosity.**

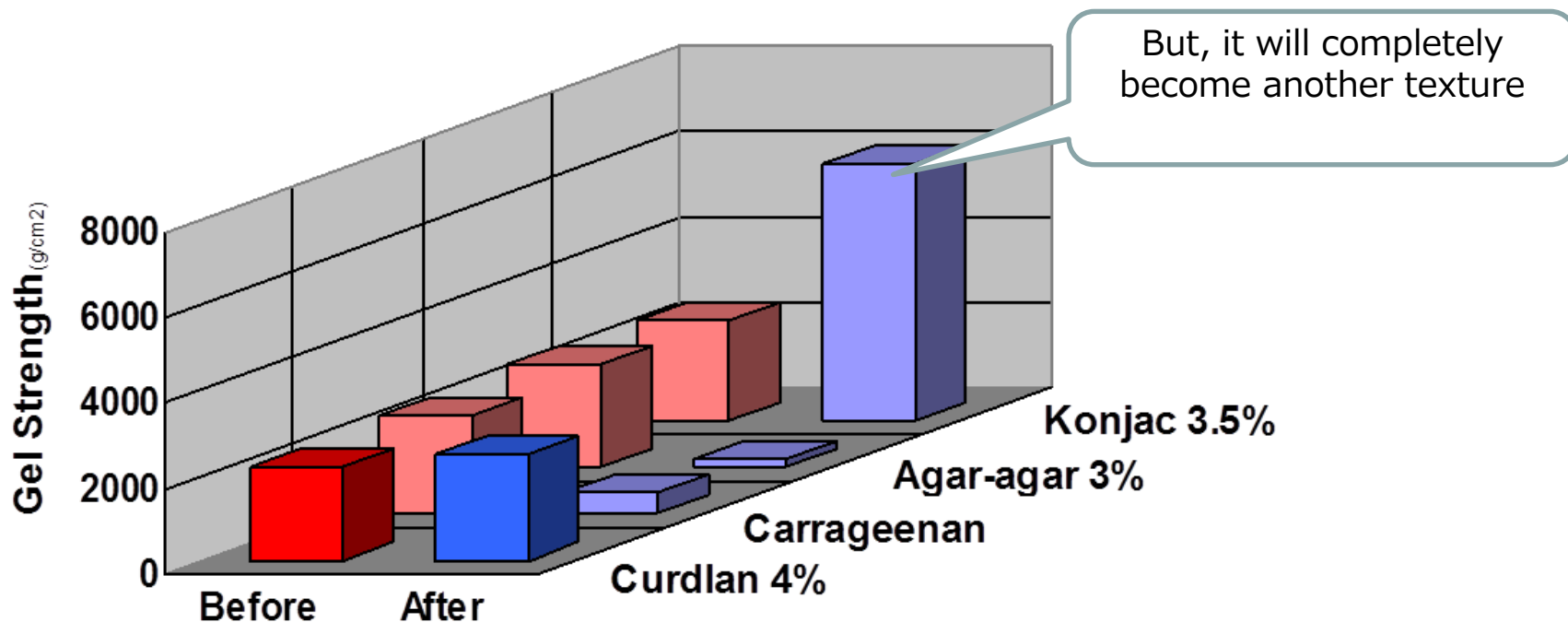
## ~Gel Formation

**Curdlan** forms **thermo reversible** and **irreversible gels** depending on the preparation methods & conditions.



Heating at around 170°F or more, Curdlan will form a thermally irreversible gel.

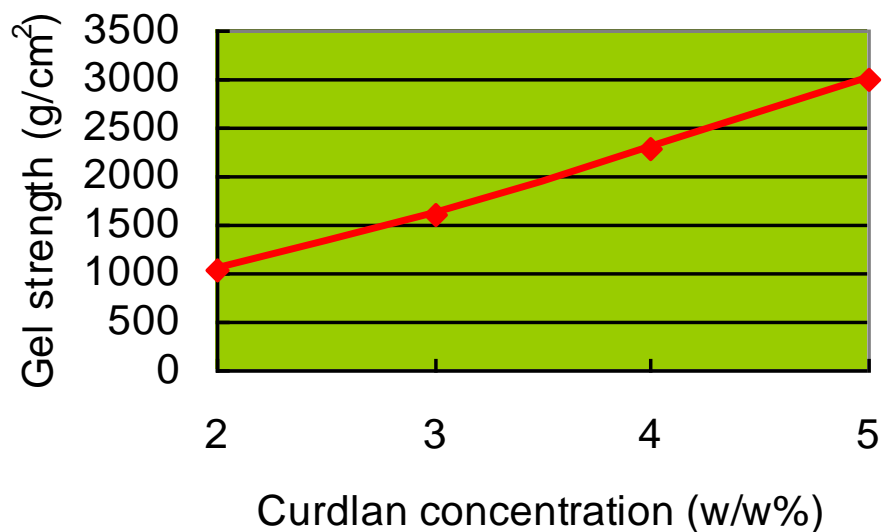
## ~Freeze-thaw *stability*



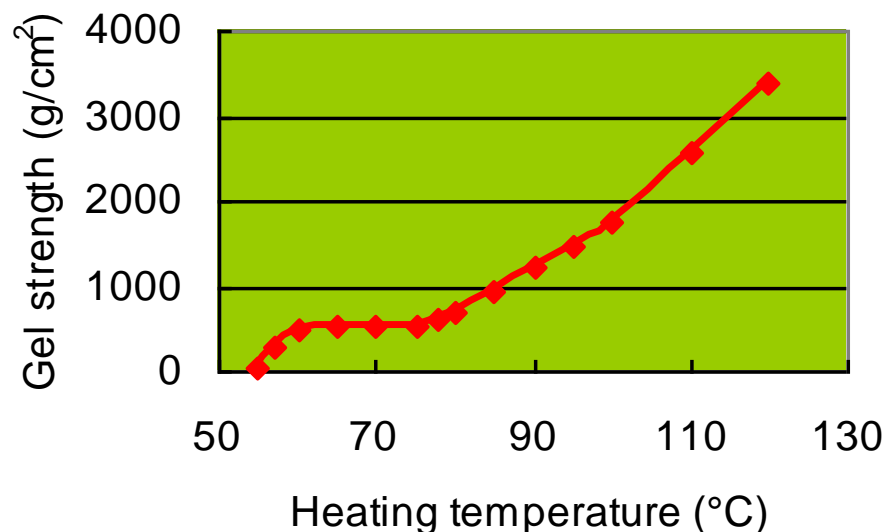
**Curdlan gel does not denature by freezing.**

## ~Effect of Heating Temperature

Effect of curdlan concentration on gel strength (100°C, 10 min.)



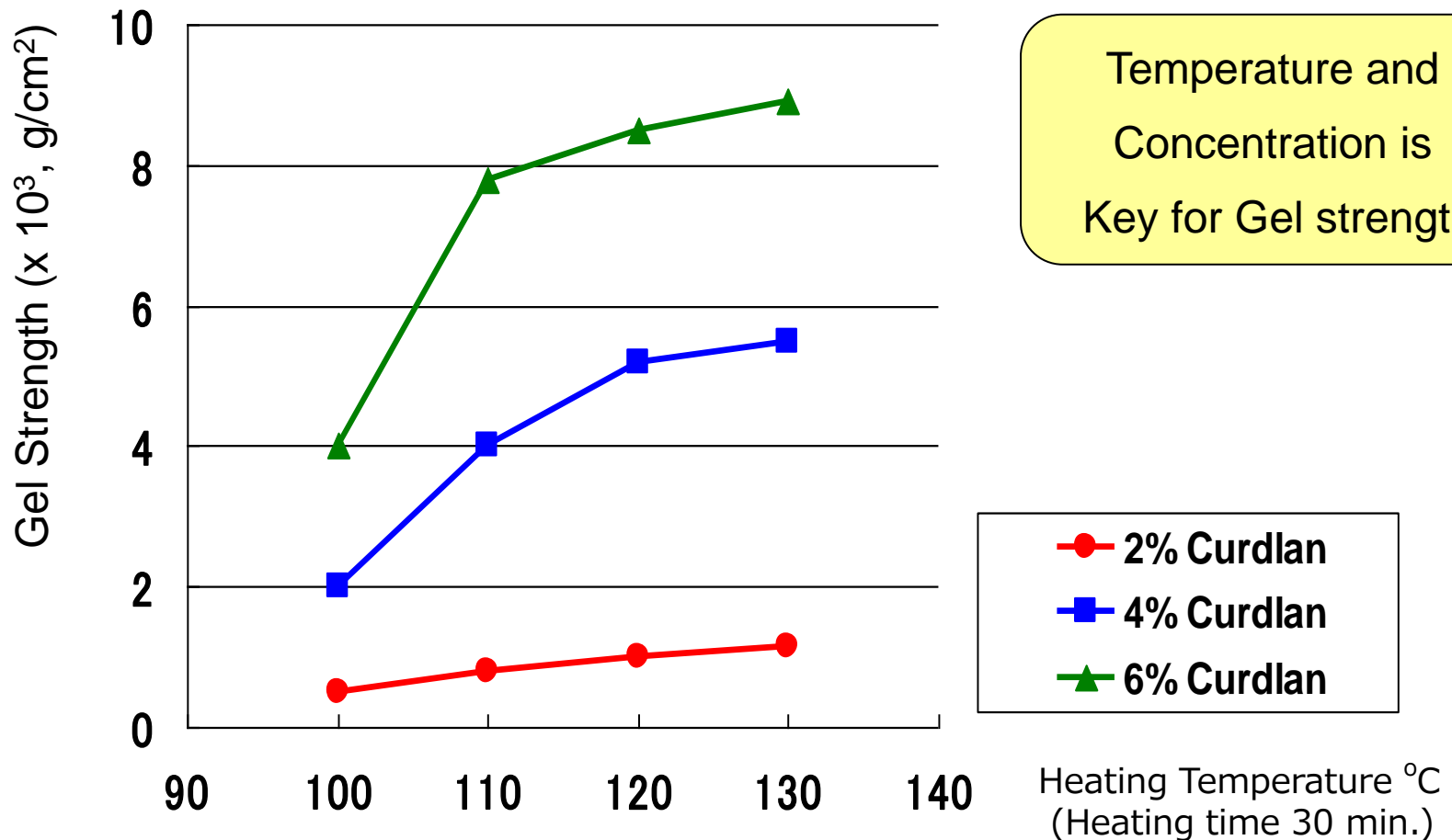
Effect of heating temperature on curdlan gel strength (3%, 10 min.)



The higher temperature brings Stronger gel

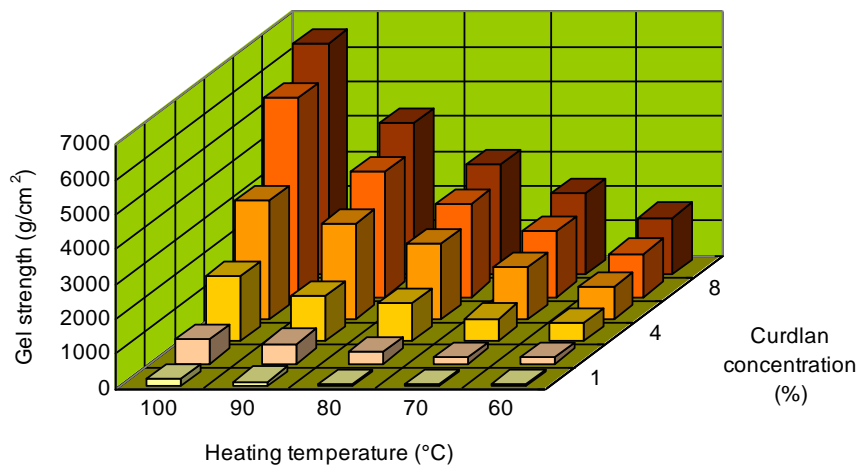
## ~Curdlan concentration and gel strength

### Effects of Concentration on Gel Strength

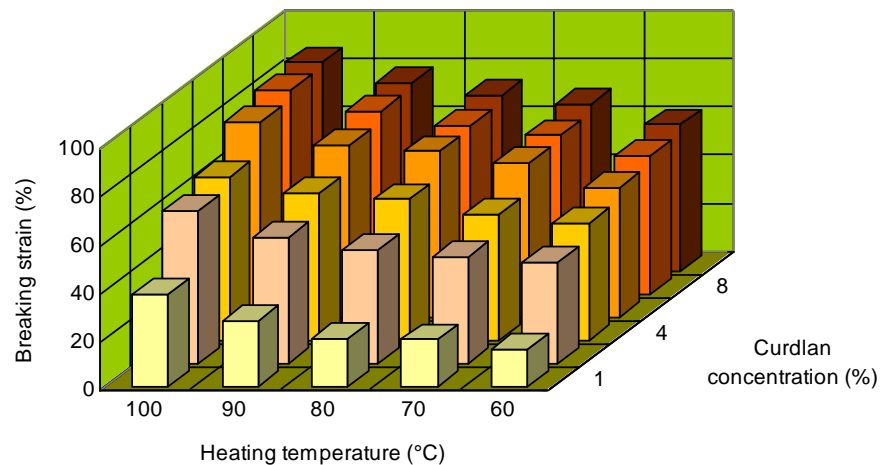


## ~The strength and elasticity of curdlan gels

Effect of curdlan concentration and heating temperature on gel strength



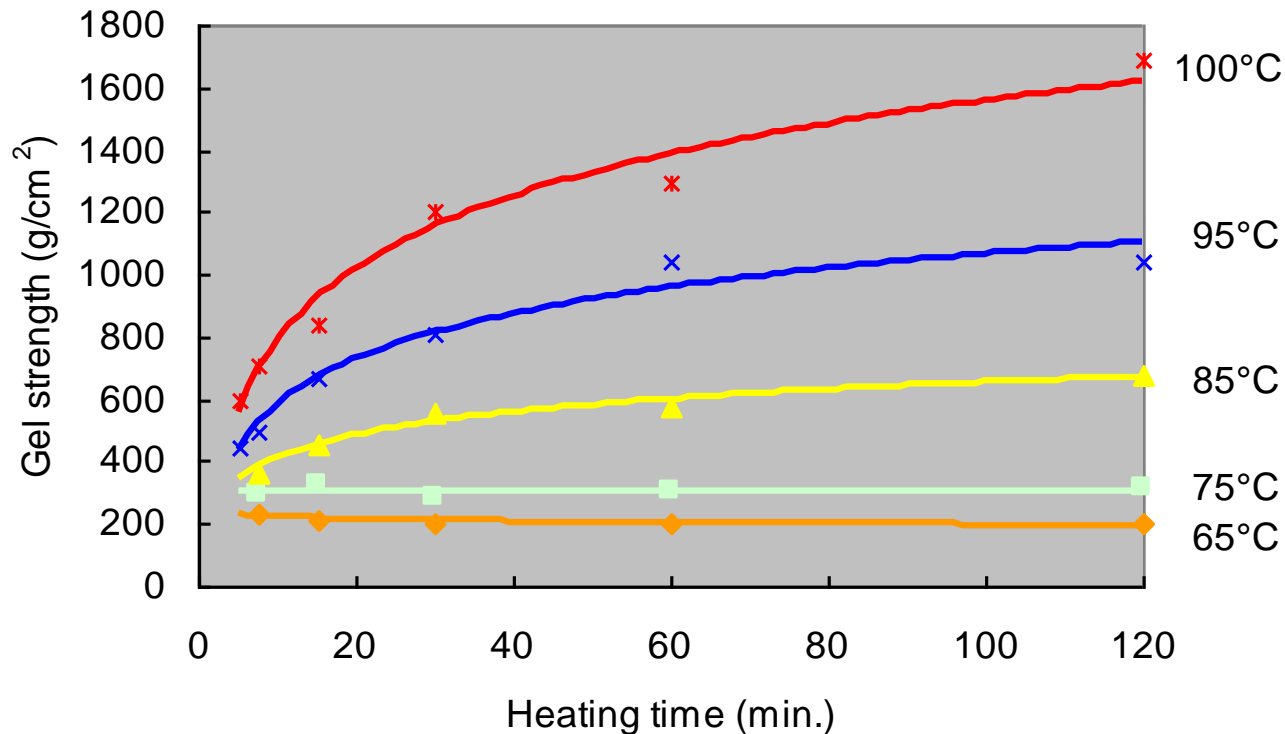
Effect of curdlan concentration and heating temperature on breaking strain



\*Breaking strain is a measure of the elasticity of the gel. It represents the degree of gel deformation at breakage upon applying consistent pressure.



## Heating temperature and time



Heating time has a greater influence on gel strength at higher temperatures.

| Application                | Benefits of adding curdlan  |  | Use level and method   |
|----------------------------|---|--|--|
|                            | Direct function   | Advantages   |  |
| Processed meat and poultry | <ul style="list-style-type: none"> <li>✧ Texture modification</li> <li>✧ Water binding</li> <li>✧ Emulsion stabilization</li> <li>✧ Fat replacement and mimicking</li> </ul>                  | <ul style="list-style-type: none"> <li>✓ Maximum moisture retention at processing temperature</li> <li>✓ Minimized cooking and processing loss (yield increase)</li> <li>✓ Consistent firmness, juiciness, and elasticity</li> <li>✓ Heat and freeze-thaw stability</li> </ul> | 0.1 to 1%<br>Added dry or pre-dispersed in pickling or marinade                |
| Batter and coating systems | <ul style="list-style-type: none"> <li>✧ Texture modification</li> <li>✧ Water holding and entrapment</li> <li>✧ Film formation (water and oil barrier)</li> <li>✧ Viscosity agent</li> </ul> | <ul style="list-style-type: none"> <li>✓ Consistent tender and juicy texture of substrate</li> <li>✓ Improved batter pick-up and cooking loss</li> <li>✓ Heat and freeze-thaw stability</li> </ul>   | 0.1 to 1%<br>Added dry or pre-dispersed  |
| Noodles and pasta          | <ul style="list-style-type: none"> <li>✧ Texture modification</li> </ul>  | <ul style="list-style-type: none"> <li>✓ Improved firmness and elasticity</li> <li>✓ Minimized cooking loss and softening</li> <li>✓ Improved processing and shaping qualities</li> </ul>  | 0.2 to 1%<br>Added dry or pre-dispersed/dissolved in alkali (oriental noodles) |

## Water absorption ability

Curdlan absorbs 30 to 50 times more water by heating to around 140°F.  
On further heating to above 160 °F, the curdlan forms a thermally irreversible gel while retaining water.

### **Benefits:**

increasing the yields / enhance juiciness / retaining moisture

⇒ **For meat processed foods / surimi products / dumpling skins etc.**

**Retains moisture inside foods and increases production yields**

## Food applications

Ham / Sausage / Hamburg / Dumpling(meet or fish)



## Why Curdlan is used in surimi products and other applications?

### Stable gel against heating / freezing-thawing

Curdlan forms an irreversible gel when heated above 80°C.  
Curdlan gel has tolerances for heating and freezing

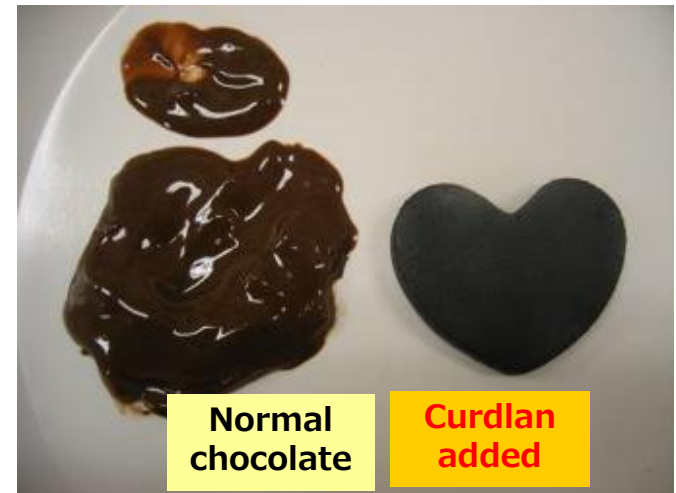
Keeps original texture



Prevents disforming during cooking.



Heat stable  
Curdlan- chocolate



Stored at 40°C for 30 min.

## As a gelling agent

- Creates structure and texture
- No allergy / No gluten
- Tasteless / Odorless

Food Applications - Vegetarian foods, Tofu products, New functional foods

### Benefits

- Can copy structure and texture of original material
- Can create new function tofu products (heat stable and freezable tofu, tofu noodle).
- Gives excellent heat resistance . Can create heat stable chocolate, cheese etc.



Vegetarian  
Prawn



Vegetarian  
Abalone



Vegetarian  
burger

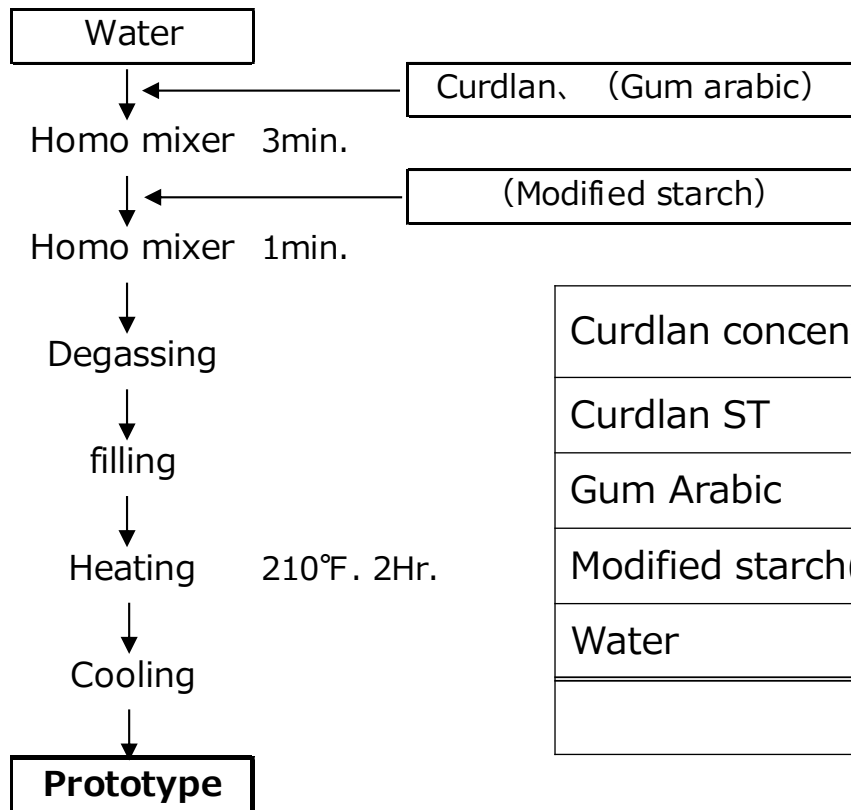
## Typical Food texture variation at different dosage levels

| <i>Curdlan dosage levels</i> | 0.5%                               | 1.0%                | 3.0%                                 | 5.0%                        | 7.0%                                  |
|------------------------------|------------------------------------|---------------------|--------------------------------------|-----------------------------|---------------------------------------|
| <i>Typical food texture</i>  | Soft and Smooth jelly like texture |                     | Elastic and firm noodle like texture |                             | High gel strength and elastic texture |
| <i>Applications</i>          | Tofu product (0.8%)                | Jellied fish (1.5%) | Vegetarian squid (3.7%)              | Vegetarian Crab meat (4.2%) | Vegetarian abalone (8.0%)             |
|                              | Vegetarian pudding                 | Hot Jelly           | Tofu noodle (3.5%)                   | Imitation fish ball (5%)    | Imitation kamaboko (7.0%)             |

Curdlan forms gels of various textures, in combination with its concentration and other polysaccharides.

# Characteristics of curdlan gel

Curdlan, by itself, forms hard and elastic gel, but it releases water over time. With a small amount of addition of starch and other polysaccharides, it is possible to suppress water separation. However, the gel strength of Curdlan decreases as these additions increase.



| Curdlan concentration    | Blank | T-1<br>Gum arabic | T-2<br>Starch |
|--------------------------|-------|-------------------|---------------|
| Curdlan ST               | 5.0   | 5.0               | 5.0           |
| Gum Arabic               | 0     | 0.1               | 0             |
| Modified starch(tapioca) | 0.0   | 0.0               | 2.0           |
| Water                    | 95.0  | 94.9              | 93.0          |
| Total                    | 100.0 | 100.0             | 100.0         |