CURDLAN

Basic information

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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 β1,3-Glucan and white odorless powder. And it is extremely 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.
Unique Basic Properties

~Water absorption~

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

The size of the Curdlan particle
Unique Basic Properties ②

~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.
Unique Basic Properties

〜Freeze-thaw stability

But, it will completely become another texture.

Curdlan gel does not denature by freezing.
Other basic properties

~Effect of Heating Temperature~

The higher temperature brings Stronger gel

The higher temperature brings Stronger gel
Effects of Concentration on Gel Strength

Other basic properties
~Curdlan concentration and gel strength

Temperature and Concentration is Key for Gel strength

Gel Strength (x 10^3, g/cm²)

Heating Temperature °C
(Heating time 30 min.)
Other basic properties

~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 time has a greater influence on gel strength at higher temperatures.
<table>
<thead>
<tr>
<th>Application</th>
<th>Benefits of adding curdlan</th>
<th>Advantages</th>
<th>Use level and method</th>
</tr>
</thead>
</table>
| Processed meat and poultry  | ♦ Texture modification  
♦ Water binding  
♦ Emulsion stabilization  
♦ Fat replacement and mimicking                                      | ✓ Maximum moisture retention at processing temperature  
✓ Minimized cooking and processing loss (yield increase)  
✓ Consistent firmness, juiciness, and elasticity  
✓ Heat and freeze-thaw stability                      | 0.1 to 1%  
Added dry or pre-dispersed in pickling or marinade |
| Batter and coating systems  | ♦ Texture modification  
♦ Water holding and entrapment  
♦ Film formation (water and oil barrier)  
♦ Viscosity agent                                      | ✓ Consistent tender and juicy texture of substrate  
✓ Improved batter pick-up and cooking loss  
✓ Heat and freeze-thaw stability                        | 0.1 to 1%  
Added dry or pre-dispersed                            |
| Noodles and pasta           | ♦ Texture modification  
                   | ✓ Improved firmness and elasticity  
✓ Minimized cooking loss and softening  
✓ Improved processing and shaping qualities                  | 0.2 to 1%  
Added dry or pre-dispersed/dissolved in alkali (oriental noodles) |
Basic property and its use

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)
Basic property and its use

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.

Normal chocolate  |  Curdlan added
Other suggestions

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.
## Texture variation (as the gelling agent)

Typical Food texture variation at different dosage levels

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

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 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.

<table>
<thead>
<tr>
<th>Curdlan concentration</th>
<th>Blank</th>
<th>T-1 Gum arabic</th>
<th>T-2 Starch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curdlan ST</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Gum Arabic</td>
<td>0</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Modified starch(tapioca)</td>
<td>0.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Water</td>
<td>95.0</td>
<td>94.9</td>
<td>93.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
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