COLOR FIXING EFFECT OF TANNIC ACID IN LAYER

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A combination of two specifically different pigments, phycoerythrine and chlorophyll, gives the laver shining black color. This shining black color is the dominant factor in deciding the quality of the dried product of laver (dried laver). Therefore, this experiment was carried out to know the effect of tannic acid as a pigment fixing agent. Raw laver, Porphyra spp., was treated with tannic acid solutions to prevent dissolution of biliproteins especially phycoerythrine in to the fresh water. This danger is mostly revealed when the chopped and shredded lavers are suspended in fresh water before the laver sheets are finally made. The influence of mechanical damage with different diameters of chopper plate on dissolution of the pigment was also mentioned.

The results obtained are as follows:

1. When the raw laver not yet chopped was stored for 3 days at 1~5°C in a dark place, the contents of chlorophyll and phycoerythrine decreased.

2. In the organoleptic test (Table 2, 3, 4), the dried laver with a good coloration and surface gloss was obtained from a chopper plate with 4 mm diameter than with 7 mm or 3 mm.

3. A tannic acid solution of 0.02% and 0.004% appeared effective in preventing dissolution of phycoerythrine.

序 言

Porphyra spp.의 商品価値를 支配하는것은 보통 食品의 共通性인 味. 味 보다는 그 色彩이 결정의 일 요인이 되기 때문에, 市販 藻片의 優秀品이 갖는 黑藻肉은 大器의 質感이며, 烘乾하면 아름다운 髒色으로 변한 담오기 小(box) 및 業面(1949) 등이 많았다. 葛士川及 相田(1933) 그리고 富士川(1936)는 乾海苔의 黑藻肉은 chlorophyll의 含量이 약간수록 그色彩이 良好하여 贅片에 있어서의 色彩 및 chlorophyll 含量의 減少와 密接케 關係를 가지고 있다고 하였다. 또한 田宮及 渡邊(1955a)等은 赤熱灯가 갑간 長波長의 光을 한가지 가진 풍산으로 海苔를 培養하면 藻体 中에 生産되는 phycoerythrine에 依하여 色은 黒藻肉으로 되나 赤熱灯가 갑간 長波長이 缺乏된 光線으로 培養하면 phycoerythrine가 보다 많이 生産되어, 藻体가 黒藻肉을 大大게 增大하고 黒藻肉은 chlorophyll과 phycoerythrine의 合併으로 乾海苔의 黑藻肉이 나타나지 않고 보 수 있는 것이다.

그러서 培養는 赤熱 海苔 縮取의 最優等 縮藻(葛士川及 相田, 1933; 富士川, 1953)과 乾海苔의 低溫縮藻(土 山及 渡邊, 1961)等에 依한 色澤向上 研究을 企圖해

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材料 및 方法

1. 試 料

본 실험은 주로 A. O. A. C. 및 オ・オ・ア・シ (1956)의 방법에 기하여 제조된 액체 염료를 사용하였다. 즉 chlorophyll은 실험에 사용한 오염한 혼합액에서 가열하여 100℃, 3분간, 진한Green을 얻고, 이 액체를 100ml로 주시한 후 spectrophotometer (Unicam sp 600 type)를 사용하여 염료의 흡광도를 측정하였다. 그러나 수확한 가열한 액체를 100ml로, 주시한 후 spectrophotometer (Unicam sp 600 type)를 사용하여 흡광도를 측정하였다.

2. 剛素方法

수확하여 근사한 생분포 1.5kg는 나무로 얇게 끓여서 30분간 암호하였다. 이것을 실험에 사용하는 액체로 용액을 만든다. 실험에 사용할 수확한 액체의 크기를 20ml로 하였다. 또한 체계가 생분포 액체에 흡광도를 측정하고, 각각 고정시킨다. 그 결과 흡광도는 100ml로, 주시한 후 spectrophotometer (Unicam sp 600 type)를 사용하여 흡광도를 측정하였다.

3. 考察

본 실험에 사용한 액체의 흡광도는 Table 1, 2, 3, 4와 같다.
### Table 1. Pigment loss in raw laver and dried product of laver made with different sizes of chopper mesh during storage

<table>
<thead>
<tr>
<th>Storage period (days)</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigment</td>
<td>Raw laver</td>
<td>M1P</td>
<td>M2P</td>
</tr>
<tr>
<td>Chlorophyll (%)</td>
<td>0.166 0.130 0.136 0.139 0.148 0.127 0.142 0.134 0.149 0.118 0.136 0.130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotene (%)</td>
<td>0.049 0.025 0.024 0.025 0.023 0.022 0.022 0.022 0.026 0.023 0.025 0.025</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phycoerythrine (%)</td>
<td>0.235 0.148 0.150 0.083 0.272 0.148 0.173 0.156 0.261 0.136 0.149 0.126</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Effect of tannic acid treatment for fixing pigment (a product made immediately after raw laver has been transferred to the laboratory—a product made after storing raw laver for 1 day)

<table>
<thead>
<tr>
<th>No.</th>
<th>Method of drying laver</th>
<th>Concentration of tannic acid in sea water (%)</th>
<th>pH</th>
<th>Soaking time (min)</th>
<th>Estimation of quality</th>
<th>Ranking of product quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D.D.H.T.</td>
<td>0.02</td>
<td>6.9</td>
<td>5</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.004</td>
<td>6.4</td>
<td>5</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
<td>7.4</td>
<td>5</td>
<td>bad</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>D.D.</td>
<td>0.02</td>
<td>6.9</td>
<td>5</td>
<td>bad</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.004</td>
<td>6.4</td>
<td>5</td>
<td>bad</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
<td>7.4</td>
<td>5</td>
<td>bad</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>D.T.</td>
<td>0.02</td>
<td>6.9</td>
<td>5</td>
<td>good</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.004</td>
<td>6.4</td>
<td>5</td>
<td>good</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
<td>7.4</td>
<td>5</td>
<td>bad</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>D.D.H.</td>
<td>0.02</td>
<td>6.9</td>
<td>5</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.004</td>
<td>6.4</td>
<td>5</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Control</td>
<td></td>
<td>7.6</td>
<td>5</td>
<td>good</td>
<td>2</td>
</tr>
</tbody>
</table>

Remark: Method of producing dried laver; by the ordinary method.

Note: D.D.H.T: Drain off excess water→Dry upside down→Half dry→Turn over the mat and dry
D.D.: Drain off excess water→Dry upside down continuously,
D.T.: Drain off excess water→Turn over the mat and dry continuously,
D.D.H: Drain off excess water→Dry in a hot air dryer.

The ordinary processing method of dried laver; the laver after spurious algae like green laver and other defects have been eliminated, were cut into shreds by chopper, and rinsed and suspended in water.

The suspension was poured into a wooden frame under which a mat of thin bamboo strips, slightly larger than the frame, was placed in order to provide a thin layer as a film of laver after the draining off of excess water.

The step of the processing requires a certain skill for yielding a uniform thickness of the laver. The thin layer on the bamboo mat is air dried upside down in the shade, or in the sun until the film of laver has separated itself from the mat.
### Table 3. Effect of tannic acid treatment for fixing pigment (a product made after storing raw laver for 2 days)

<table>
<thead>
<tr>
<th>No.</th>
<th>Method of preserving &amp; treating raw laver</th>
<th>Concentration of tannic acid in sea water (g/l)</th>
<th>pH</th>
<th>Quant. of raw laver (g)</th>
<th>Number of dried laver sheets</th>
<th>Estimation of quality</th>
<th>Ranking of product quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S. C. D</td>
<td>0.02</td>
<td>6.4</td>
<td>84</td>
<td>3</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.004</td>
<td>7.2</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>S. C. D</td>
<td>0.02</td>
<td>6.4</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0.004</td>
<td>7.2</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>S. C. D</td>
<td>0.02</td>
<td>6.4</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0.004</td>
<td>7.2</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Control</td>
<td>7.6</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>bad</td>
<td>4</td>
</tr>
</tbody>
</table>

Remark: Method of producing dried laver; by the ordinary method

Drying condition (by the hot air dryer); at 34°C and 12% humidity for 4 hrs.

Note: S.C.D: Store in sea water after soaking raw laver in tannic acid solution for 5 mins and squeezing it by gauze—Chop the raw laver—Dry
S.C.C.D: Store in dark and cold place after soaking raw laver in tannic acid solution for 5 mins and squeezing it by gauze—Chop the raw laver—Dry
S.S.C.D: Soak raw laver in tannic acid solution just before chopping, after stored raw laver as it is—Squeeze the raw laver by gauze—Chop the raw laver—Dry.

### Table 4. Effect of tannic acid treatment for fixing pigment (a product made after storing raw laver for 3 days)

<table>
<thead>
<tr>
<th>No.</th>
<th>Method of preserving &amp; treating raw laver</th>
<th>Concentration of tannic acid in sea water (g/l)</th>
<th>pH</th>
<th>Quant. of raw laver (g)</th>
<th>Number of dried laver sheets</th>
<th>Estimation of quality</th>
<th>Ranking of product quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S. C. D</td>
<td>0.02</td>
<td>6.5</td>
<td>84</td>
<td>3</td>
<td>good</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.004</td>
<td>7.5</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>S. C. D</td>
<td>0.02</td>
<td>6.5</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0.004</td>
<td>7.5</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>S. S. C. D</td>
<td>0.02</td>
<td>6.5</td>
<td>»</td>
<td>»</td>
<td>bad</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>0.004</td>
<td>7.5</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Control</td>
<td>7.6</td>
<td>»</td>
<td>»</td>
<td>»</td>
<td>worse</td>
<td>4</td>
</tr>
</tbody>
</table>
Fig. 1. Variation of pigment of raw laver according to storage period.

Fig. 2. Effect of tannic acid for fixing pigment in accordance with the product made with different sizes of chopper mesh (a product made after storing raw laver for 1 day).

Fig. 3. Effect of tannic acid for fixing pigment in accordance with the product made with different sizes of chopper mesh (a product made after storing raw laver for 2 days).

Fig. 4. Effect of tannic acid for fixing pigment in accordance with the product made with different sizes of chopper mesh (a product made after storing raw laver for 3 days).
meshを用いて製品化を試みたが、その結果Fig.2、3、4についての事実Mesh No.3製品（M3P）で色を含む物質が減少する傾向を示した。これは製品の乾燥温度が低いことが原因である。Mesh No.4製品（M4P）では、乾燥温度が最も低いことが原因である。Fig.5を示すように、乾燥温度が低いほど色を含む物質の減少が見られた。この結果は、乾燥温度が低いほど色を含む物質が減少することを示している。}

3) phycoerythrineの吸収增强に0.02%及び0.004%の_meaning_の効果的である。

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