Analysis of changes in moisture levels in broccoli during long-term storage

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Abstract. This paper examines the effect of long-term storage on the moisture content of broccoli. To determine the effect of the long-term storage process on the moisture content of broccoli, this study analyzed the moisture content of several batches of broccoli before and after the long-term storage stage. The measurement was carried out using the method of drying to constant weight at a temperature of 105 °C. The measurement was carried out in three batches of broccoli collected from different agricultural fields. The results obtained allow us to evaluate the level of influence of long-term storage on the change in the % moisture content of broccoli. The results of the study are relevant for further research in the field of improving the quality and environmental friendliness of agricultural products, including through the optimization of long-term storage processes, and can also be used in conducting broader research in the field of agriculture and ecology.

1 Introduction

Transportation is one of the main factors affecting the quality of agricultural products. Including the indicator of moisture content in broccoli. Long-term storage processes may include, inter alia, freezing and several stages of reloading. The storage duration can reach several tens of days, especially during intercontinental transportation. The most common types of long-term storage at the moment are refrigeration or freezing. During long-term storage, food products lose moisture, which affects their quality, so changing this indicator is an important area of research in the field of preserving the quality of food products.

2 Materials and Methods

- Drying to constant weight at a temperature of 105 °C;
- Accelerated drying at 130 °C for 0.5–1.5 hours;
- Vacuum drying at 60 °C with dry air passing over the sample.

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freeze-drying under vacuum at low temperatures, followed by removal of residual moisture by drying in a vacuum desiccator over a desiccant.

To identify the effect of long-term storage on the moisture content of broccoli, this study used the method of drying to constant weight at a temperature of 105 °C; the accepted norm for moisture content in broccoli is 86 grams per 100 grams of weight.

To calculate the moisture content as a percentage of the weight of the product, the following formula was used:

\[
W = \left( \frac{q_1 - q_2}{q_1} \right) \times 100
\]

where \(W\) is the percentage presence of moisture in the sample; \(q_1, q_2\) – sample weight in grams before and after drying.

The duration of the storage stage is 15 days. A total of three batches of broccoli from different agricultural producers were studied. The analysis included two stages (Table 1).

Table 1. Experiment matrix.

<table>
<thead>
<tr>
<th>Steps to measure moisture</th>
<th>Moisture Content of Broccoli</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First batch</td>
</tr>
<tr>
<td>Before long-term storage (first stage)</td>
<td>...</td>
</tr>
<tr>
<td>After long-term storage (second stage)</td>
<td>...</td>
</tr>
</tbody>
</table>

To collect and process data obtained from analyzing changes in moisture content in broccoli before and after long-term storage, various methods were considered, including used in works [1-23].

3 Results and Discussion

3.1 Results of analysis of moisture content in broccoli before and after long-term storage

3.1.1 Measuring the moisture content of broccoli before and after long-term storage (first batch)

The results of measuring the moisture content of broccoli before and after long-term storage in the first batch are presented in Figure 1. The result is the average value for 9 measurements taken in each batch.
3.1.2 Measuring the moisture content of broccoli before and after long-term storage (second batch)

The results of measuring the moisture content of broccoli before and after long-term storage in the second batch are presented in Figure 2. The result is the average value for 9 measurements taken in each batch.

3.1.3 Measuring the moisture content of broccoli before and after long-term storage (third batch)

The results of measuring the moisture content of broccoli before and after long-term storage in the third batch are presented in Figure 3. The result is the average value for 9 measurements taken in each batch.
Fig. 3. Results of measuring the moisture content of broccoli before and after long-term storage (third batch).

3.2 Discussion

The obtained results of the influence of the long-term storage process on the moisture content of broccoli, obtained on the basis of measuring the moisture content of broccoli before and after long-term storage in three different batches of broccoli, allow us to conclude that such an influence exists (Table 2).

<table>
<thead>
<tr>
<th>Steps to measure moisture</th>
<th>Moisture Content of Broccoli</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First batch</td>
</tr>
<tr>
<td>Before long-term storage (first stage)</td>
<td>77</td>
</tr>
<tr>
<td>After long-term storage (second stage)</td>
<td>73</td>
</tr>
</tbody>
</table>

The average of broccoli moisture content measurements before and after long-term storage from three different batches of broccoli is shown in Figure 4.

Fig. 4. Average of moisture content measurements in broccoli before and after long-term storage.
From the data obtained (Figure 4) it follows that the moisture content before and after long-term storage in broccoli was: before long-term storage – 76.6%, after long-term storage – 73%.

4 Conclusions

This study provides data regarding the effect of long-term storage on the moisture content of broccoli. To determine the effect of long-term storage on the moisture content of broccoli, the present study analyzed the moisture content of several batches of broccoli before and after long-term storage. The measurement was carried out using the method of drying to constant weight at a temperature of 105 °C. The measurement was carried out in three batches of broccoli collected from different agricultural fields. The results obtained allow us to evaluate the level of influence of long-term storage on the content of broccoli. From the data obtained it follows that the moisture content in broccoli before and after long-term storage was: before long-term storage – 76.6 mg/kg, after long-term storage – 73 mg/kg. These results confirm that long-term storage influences the change in % moisture content of broccoli. The results of the study are relevant for further research in the field of improving the quality and environmental friendliness of agricultural products, including through the optimization of long-term storage processes, and can also be used in conducting broader research in the field of agriculture and ecology.

References

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