Comparison of Freeze-thaw and Enzymatic Pre-Treatments to Improve Peeling Process of Cassava Tubers

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Problem and Objective

- Peeling is still considered as a main problem of cassava processing due to irregular shapes and sizes of cassava tubers.
- The main objective of this study was to investigate and to compare the effect of two different pre-treatments including freeze-thaw and enzymatic pre-treatment on the peeling process of cassava tubers.

Material and Methods

- A prototype cassava peeling machine constructed at the University of Hohenheim was used to peel cassava tubers.
- Response surface methodology (RSM) was applied to optimize the freeze-thaw and enzymatic pre-treatment to increase the peeling performance.

Table 1. Independent variables of RSM.

<table>
<thead>
<tr>
<th>Freeze-thaw pre-treatment</th>
<th>Enzyme pre-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thaw temperature (°C)</td>
<td>Enzyme dose (ML g⁻¹)</td>
</tr>
<tr>
<td>50–90</td>
<td>0.5–1.2</td>
</tr>
<tr>
<td>Thaw incubation time (s)</td>
<td>Incubation time (h)</td>
</tr>
<tr>
<td>30–90</td>
<td>1.5–6.5</td>
</tr>
<tr>
<td>Peeling time (min)</td>
<td>Peeling time (min)</td>
</tr>
<tr>
<td>1–5</td>
<td>1.5–4.5</td>
</tr>
</tbody>
</table>

- Peeled surface area, PSA (%) and peel loss, PL (%) were determined as the main responses.

\[
PSA = \frac{A_1}{A_2} \times 100
\]

- PSA: peeled surface area (%) after peeling process
- \(A_1\): area of the removed peel on cassava tuber surface (cm²)
- \(A_2\): area of whole cassava tuber surface (cm²)

\[
PL = \frac{m_1 - m_2}{m_1} \times 100
\]

- PL: peel loss (%) after peeling process
- \(m_1\): mass of unpeeled cassava tuber (g)
- \(m_2\): mass of peeled cassava tuber (g)

Results

- Under an optimal peeling condition, the PSA and PL was 94.9% and 21.7% for freeze-thaw and 89.5% and 24.6% for enzymatic pre-treatment, respectively.
- Freeze-thaw pre-treatment could result in a higher PSA than enzymatic pre-treatment, but also lead to a syneresis phenomenon that influenced the quality of the tubers in terms of texture and water content.
- Enzymatic pre-treatment could increase the detoxification of the peels by hydrolysis.

Conclusions

- Application of both freeze-thaw and enzymatic pre-treatment can be effective to improve the peeling process of cassava tubers.
- The feasibility of these methods at industrial scale should be further investigated.