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Freeze-thaw Pre-treatment Optimization for Cassava Tubers to improve Peeling Efficiency

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Introduction

- Cassava peeling is a very important operation step in cassava processing.
- Different shapes and sizes of cassava tubers are the major challenges in cassava peeling.
- The main objective of this study was to investigate the effect of freeze-thaw pre-treatment (FTP) on the mechanical peeling process of cassava tubers.

Material and Methods

- The operational parameters were rotational speed of brushes (550 - 1150 rpm), peeling time (1 - 5 min), thaw temperature (50 - 90°C) and time of thawing (0 -120 s).
- Response surface methodology using central composite design was applied to optimize FTP to improve the cassava peeling process.

- Results reveal that PSA and PL were significantly (p < 0.05) influenced by rotational speed of the brushes, peeling time and incubation time (Fig. 2).
- Under optimal peeling conditions, rotational speed of 1000 rpm, peeling time of 3.4 min, thawing temperature of 59°C and incubation time of 90 s, the PSA and PL was 99.5 % and 19.0 %, respectively.
- It was found that the freeze-thaw pre-treatment had no negative effect on the quality of cassava tubers.



Peeling time (min)

• Peeled surface area (PSA) and peel loss (PL) were measured as the responses.



Fig.2. Surface plots indicating the effect of the peeling time (min) and incubation time (s) on the PL (%) and PSA (%).

37.5

Incubation time (s) $\frac{1}{30}$

PSA(%) 14.9

Peeling time (min)

97.7



Fig.3. Peeled cassava tuber with FTP at optimum conditions (left) and peeled cassava tuber without FTP (right)

Fig.1. The prototype cassava peeling machine.

Results

•After 30 runs in the central composite design, multivariate correlation was established through reduced cubic model with R² of 0.89 and 0.99 for PSA and PL, respectively.

Conclusions

60

Incubation time (s) 30°

4.2

PL (%)

- The results show that the application of FTP by optimizing the ratio of PSA and PL can improve the peeling process of cassava tubers.
- For further studies, the economic feasibility of the freeze-thaw pre-treatment for practical application should be studied.



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