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“Filling gaps and removing traps  
for sustainable resource management”

## Freeze-Thaw Pre-Treatment Optimisation for Cassava Tubers to Improve Peeling Efficiency

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### Abstract

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. In this study, the effect of freeze-thaw pre-treatment (FTP) on the peeling process of cassava tubers was investigated. A prototype cassava peeling machine was used with five rotating cylindrical abrasive brushes. Frozen cassava tubers purchased from a local market in Stuttgart were used for this study. The length and weight of the cassava tubers varied from 200–280 mm and 500–900 g, respectively. 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 optimise FTP to improve the peeling process of cassava tubers. Peeled surface area and peel loss were measured as the responses. Additionally, the quality of peeled cassava tubers after freeze-thaw pre-treatment in terms of starch content and structure of the starch granules was investigated. After 30 runs in the central composite design, multivariate correlation was established through reduced cubic model with  $R^2$  of 0.85 and 0.99 for peeled surface area and peel loss, respectively. Results reveal that peeled surface area and peel loss were significantly influenced by rotational speed of the brushes, peeling time and thawing time ( $p < 0.05$ ). Under optimal peeling conditions, rotational speed of 1000 rpm, peeling time of 3 min, thaw temperature of 60°C and thawing time of 90 s, the peeled surface area and peel loss was around 94.9% and 21.7%, respectively. It was found that the freeze-thaw pre-treatment had no negative effect on the quality of cassava tubers. The results show that the application of FTP by optimising the ratio of peel loss and peeled surface area can improve the peeling process of cassava tubers.

**Keywords:** Cassava root peeling, central composite design, freeze-thaw treatment, peel loss, response surface method