Optimizing the Drying Parameters for Hot Air Dried Potato Slices

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Content

1. Brief discussion about drying and agricultural material
2. Introduction
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Agricultural materials

- Perishable
  
  - There is a lack of appropriate storage
  
  - The losses of root and tuber crops in the world ranges from 30% to 60% (FAOSTAT, 2004).
  
  - Drying is the process of removal of water or any other solvent by evaporation from a solid, semi-solid or liquid material
The purpose of drying

- Extend the shelf life of foods
- Reduce weight and bulk volumes
- Convert perishable products to stable forms
- Produce ingredients and additives for industrial transformation
- Obtain particular convenience foods
Drying applied to

- Low hydrated agricultural products
- Highly hydrated agricultural products
- Intermediate products from industrial processes
- Industrial by-products
Factors control rate at which foods dry

- Those related to processing conditions
- Those related to nature of food
- Those related to drier design
Why drying is necessary

The basic objective in drying food products is
✓ The removal of water
✓ at which microbial spoilage and
deterioration chemical reactions are greatly minimized
✓ To meet consumer interest
✓ maintaining their quality
Stability diagram

LO = lipid oxidation, NE = non-enzymatic browning, E = enzymatic reactions, S, H, B spoilage by mold fungi, yeasts, bacteria
Introduction

— Potatoes are the fourth most important vegetable crop
— Perishable
— Processing condition
— optimization
Materail and Methods

Belana variety of potatoes was used.

Drying experiment was conducted

- Air temperature of 60, 70 and 80°C
- Dew point temperature of 10, 20 and 30°C
- Air velocity of 1, 1.25 and 1.5 m/s
Materials and Methods

- **Dryer and drying process: dryer**
Materials and Methods
Materials and Methods

Quality parameters

\[ S = (1 - \frac{A}{A_o}) \times 100 \]

\[ TCD(-) = \sqrt{\Delta L^*^2 + \Delta a^*^2 + \Delta b^*^2} \]
Materials and Methods
Materials and Methods
Materials and Methods

Experimental Design

- The RSM was used to design the drying experiments
- The basic model used to describe the dependent or response variable \( Y \) involves the linear or main interaction and curvature effects as shown in Eq. (1)

\[ Y = \beta_0 + \beta_1 A + \beta_2 B + \beta_3 C + \beta_4 AB + \beta_5 BC + \beta_6 AC + \beta_7 A^2 + \beta_8 B^2 + \beta_9 C^2 \ldots \ldots (1) \]

- Where \( A, B, C \) are the coded values of the independent variables; \( \beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8 \) and \( \beta_9 \) are the regression coefficients
— Optimization of drying process was performed using Design Expert software.
— Desired goals for independent and dependent variables

<table>
<thead>
<tr>
<th>Dependent and independent variables</th>
<th>Goal</th>
<th>Importance (1= least important,...5= very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (°C)</td>
<td>is in the range</td>
<td>3</td>
</tr>
<tr>
<td>DPT (°C)</td>
<td>is in the range</td>
<td>3</td>
</tr>
<tr>
<td>V (m/s)</td>
<td>is in the range</td>
<td>3</td>
</tr>
<tr>
<td>TCD (-)</td>
<td>to minimize</td>
<td>5</td>
</tr>
<tr>
<td>S (%)</td>
<td>to minimize</td>
<td>5</td>
</tr>
<tr>
<td>Time (min)</td>
<td>to minimize</td>
<td>5</td>
</tr>
</tbody>
</table>
Results and Discussion

— Effect of drying condition on change in total color difference

\[ TCD(-) = +8.82 - 1.50A + 0.15B - 0.76C - 0.50A^2 + 0.65AC \]  

Response surface plots of change in the total color difference of potato slices
Results and Discussion
Results and Discussion

Effect of drying condition on shrinkage

\[ S(\%) = +45.25 - 2.40A - 1.70C - 0.75AC \] (3)

Percent of surface area shrinkage of potato slices
Results and Discussion

Response surface plots of drying time potato slices

\[ \text{Time (min)} = +108.92 - 15.50A + 1.30B - 9.80C - 6.13A^2 + 6.35C^2 \]
Results and Discussion
Results and Discussion

Surface plot of the desirability index for the optimal drying condition at $V = 1.5$ m/s
Thank you for your attention!