HTWG

Hochschule Konstanz
University of Applied Sciences

Optimizing the Drying Parameters for Hot Air Dried Potato Slices

By

Addisalem Hailu

Advisors: Prof. Dr.-Ing. Werner Hofacker and

Prof. Dr. sc. agr. Oliver Hensel

Content

1. Brief discussion about drying and agricultural material
2. Introduction
3. Material and method
4. Result and discussion

Agricaltural 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

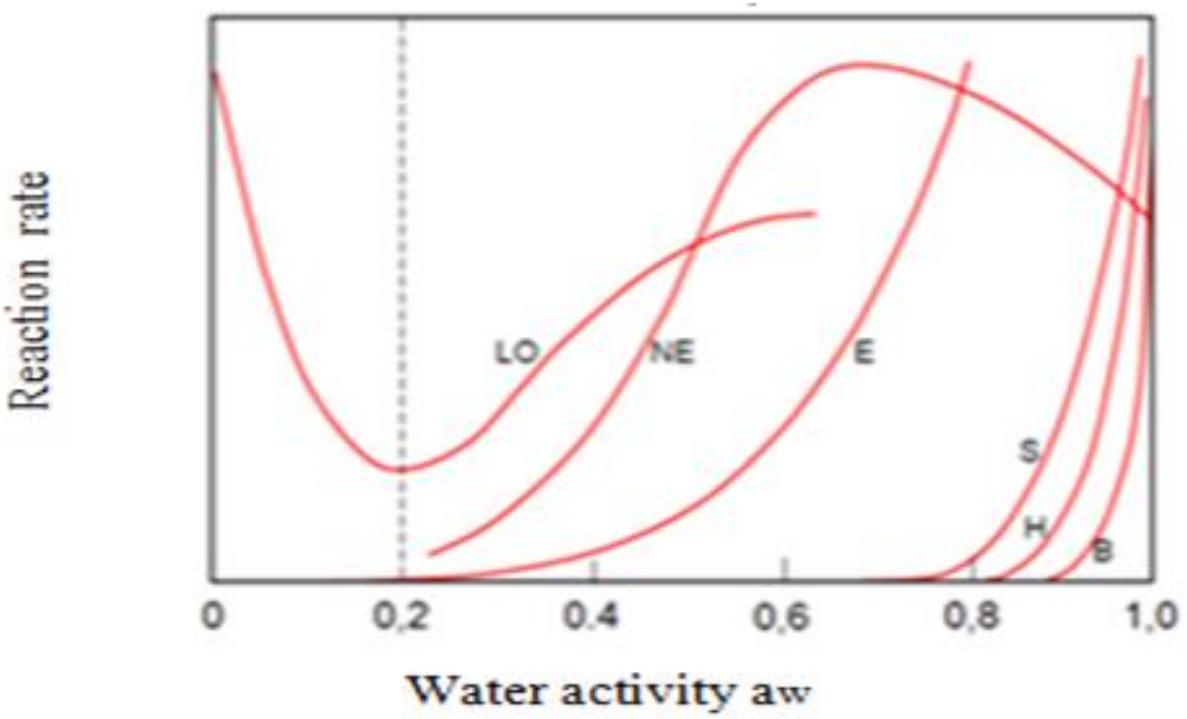
- Those related to processing conditions
- Those related to nature of food
- Those related to drier design

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

Materials and Methods

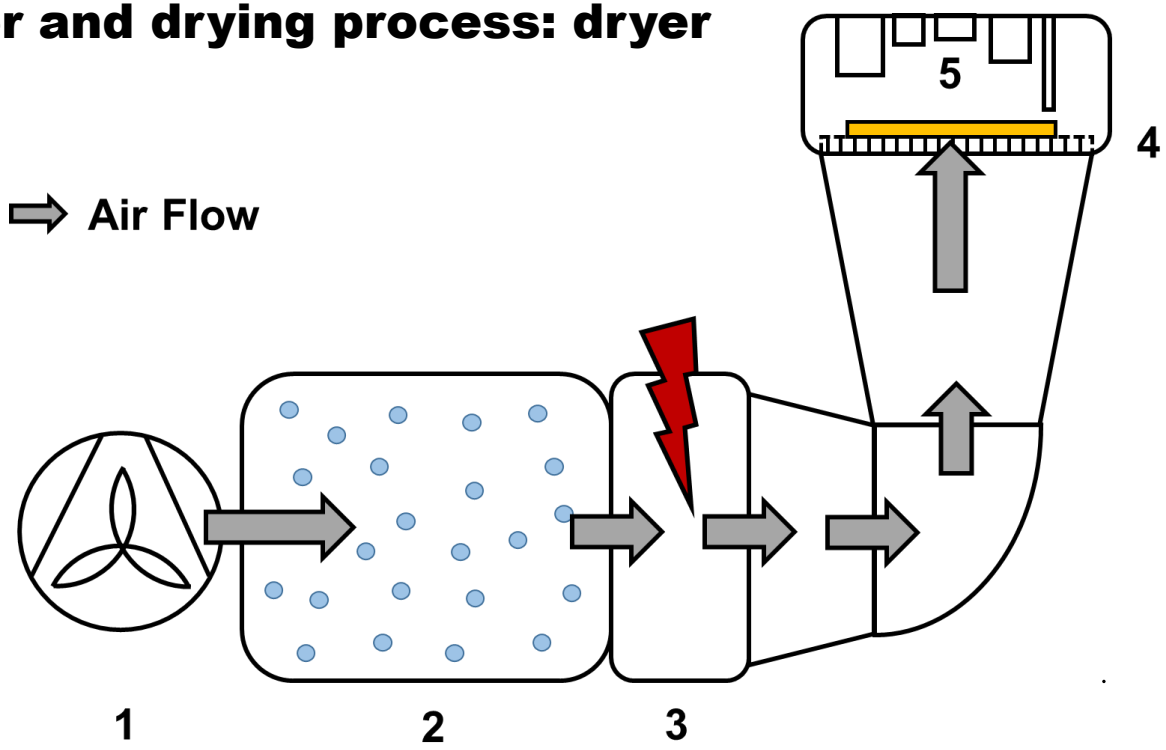
Belana variety of potatoes was used.

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

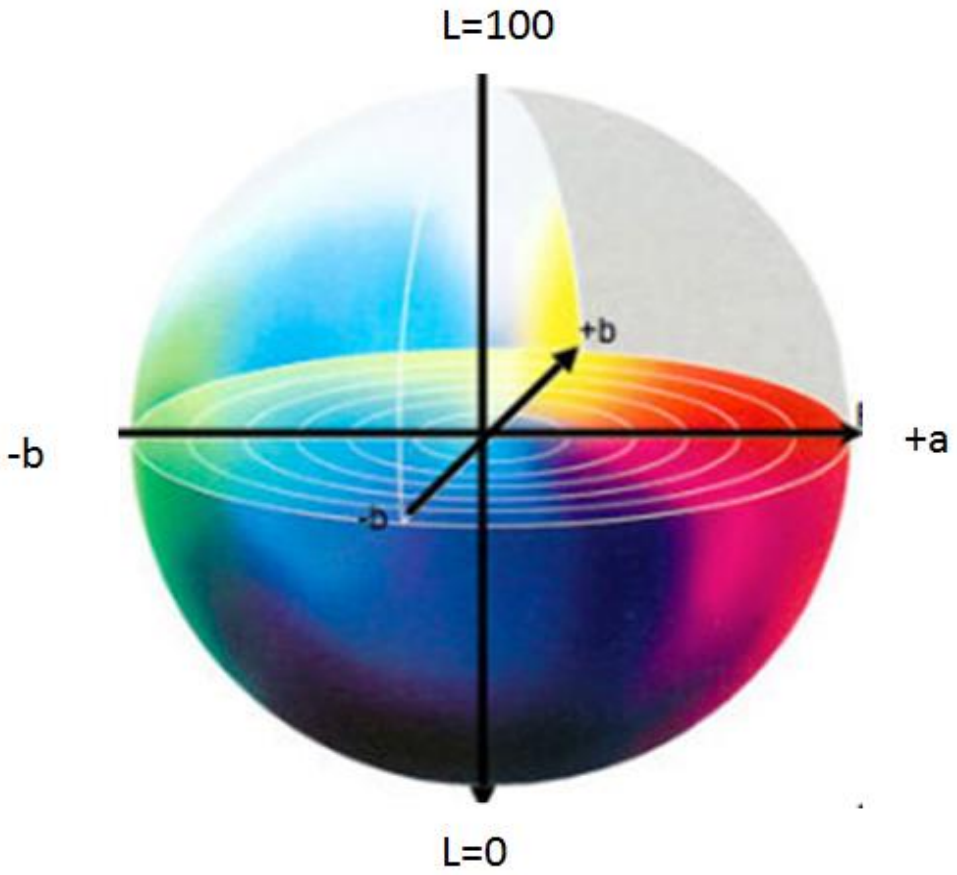
Materials and Methods

Quality parameters

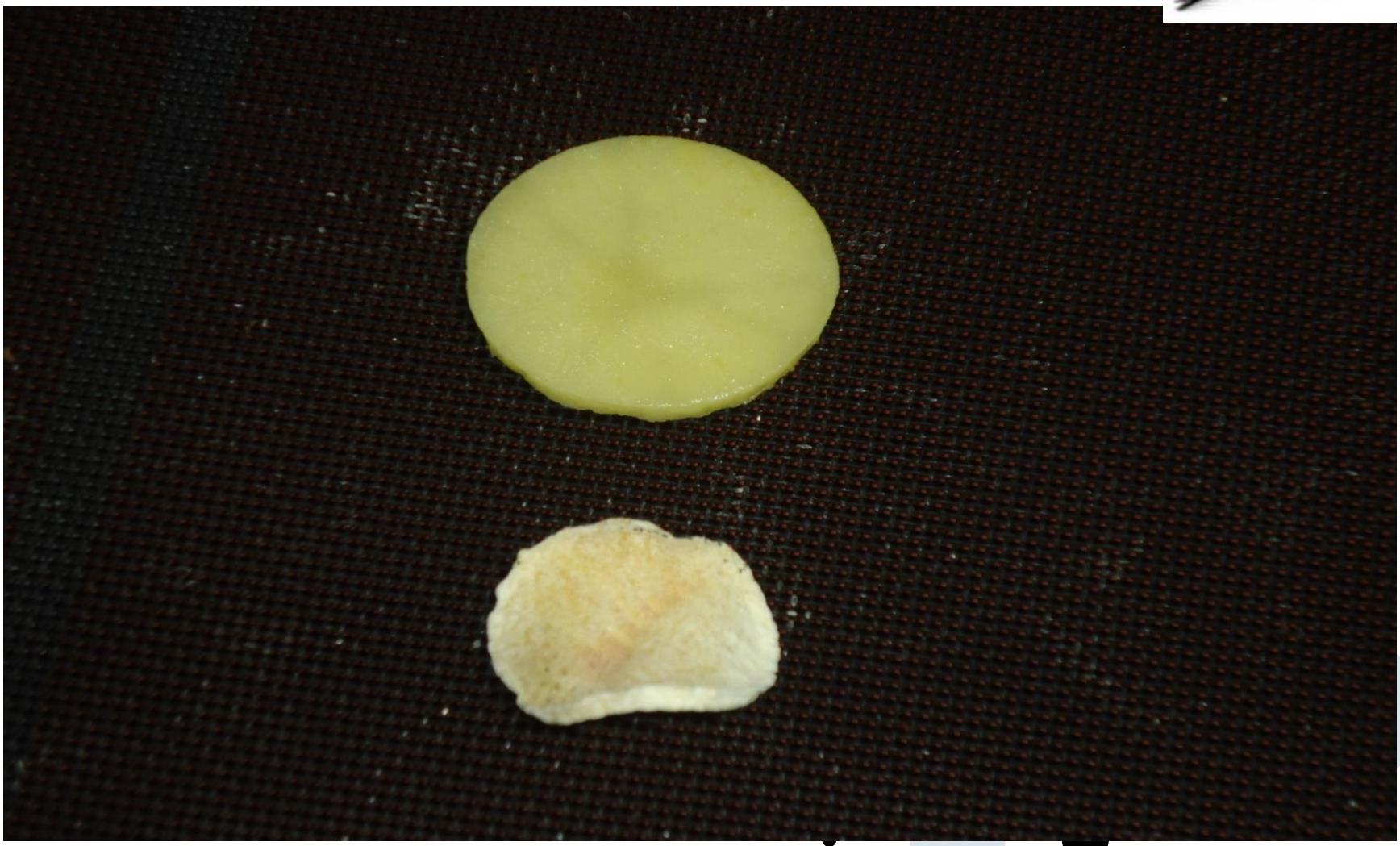
$$S = (1 - \frac{A}{A_o}) * 100$$

$$TCD(-) = \sqrt{\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}}$$

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)

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

- Where A, B, C are the coded values of the independent variables; βo, β_1, β_2, β_3, β_4, β_5, β_6, β_7, β_8 and β_9 are the regression coefficients

Materials and Methods

- Optimization of drying process was performed using Design Expert software.
- Desired goals for independent and dependent variables

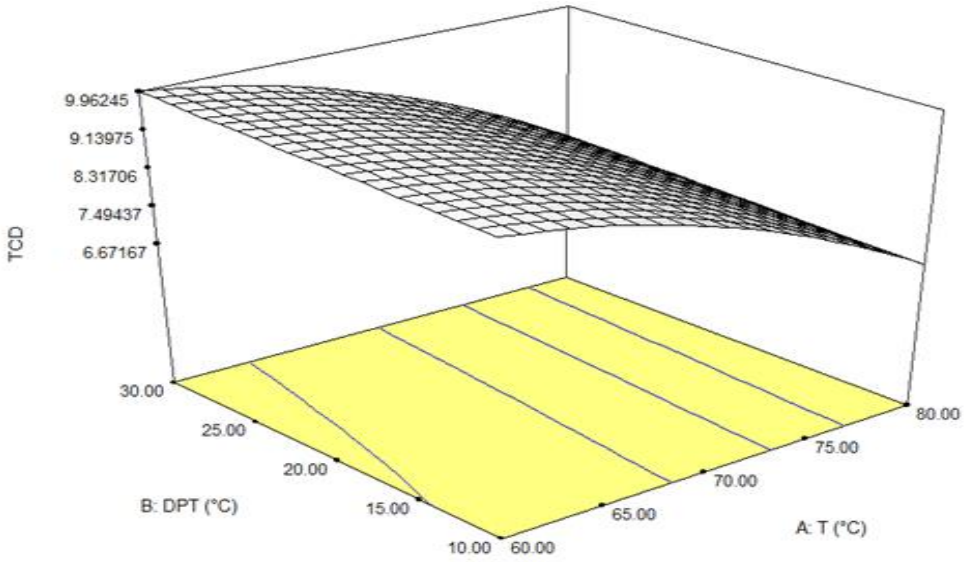
Dependent and independent variables	Goal	Importance (1= least important,...5= very important
T (°C)	is in the range	3
DPT (°C)	is in the range	3
V (m/s)	is in the range	3
TCD (-)	to minimize	5
S (%)	to minimize	5
Time (min)	to minimize	5

Results and Discussion

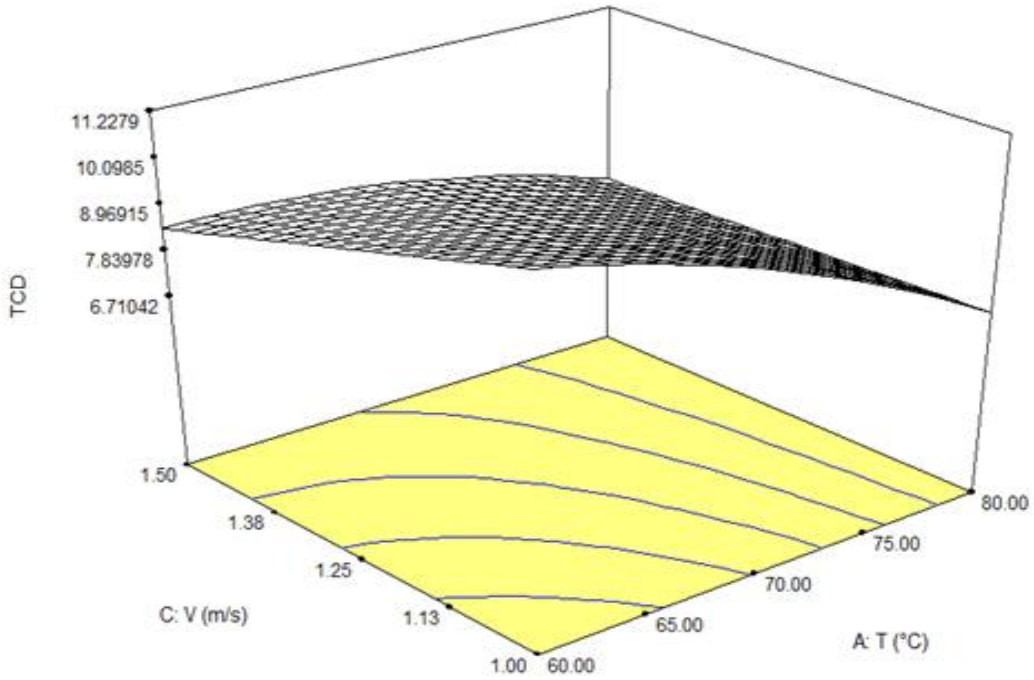
– Effect of drying condition on change in total color difference

$$TCD\,(-) = +8.82 - 1.50A + 0.15B - 0.76C - 0.50A^2 + 0.65AC \text{----------} (2)$$

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



Results and Discussion

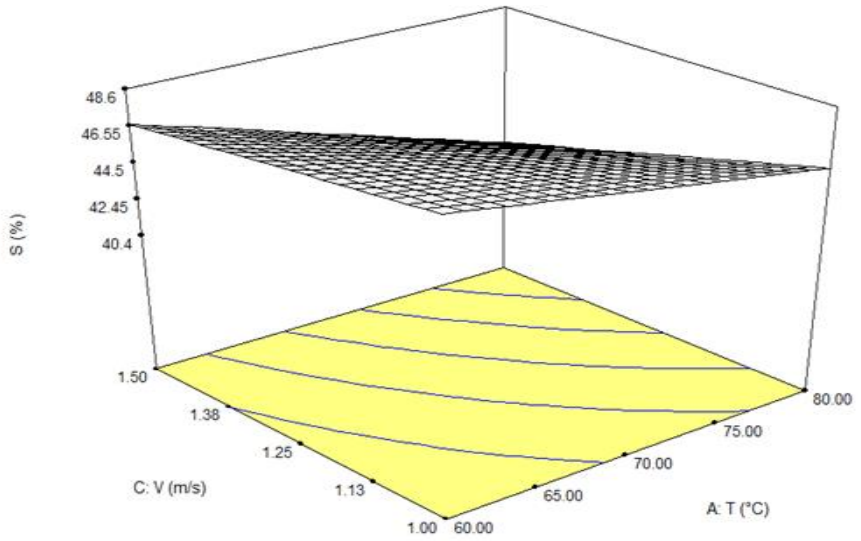


Results and Discussion

Effect of drying condition on shrinkage

$$S(\%) = +45.25 - 2.40A - 1.70C - 0.75AC \quad \text{----------(3)}$$

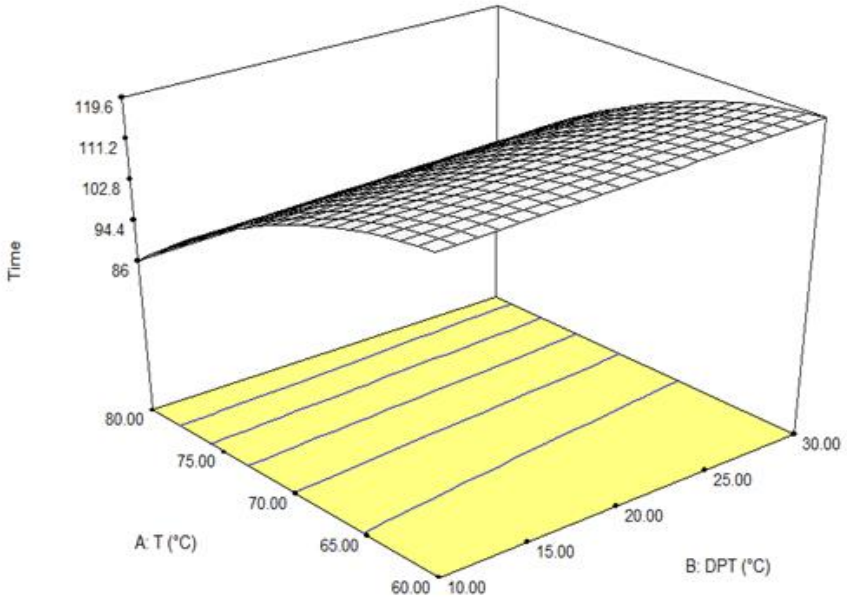
Percent of surface area shrinkage of potato slices



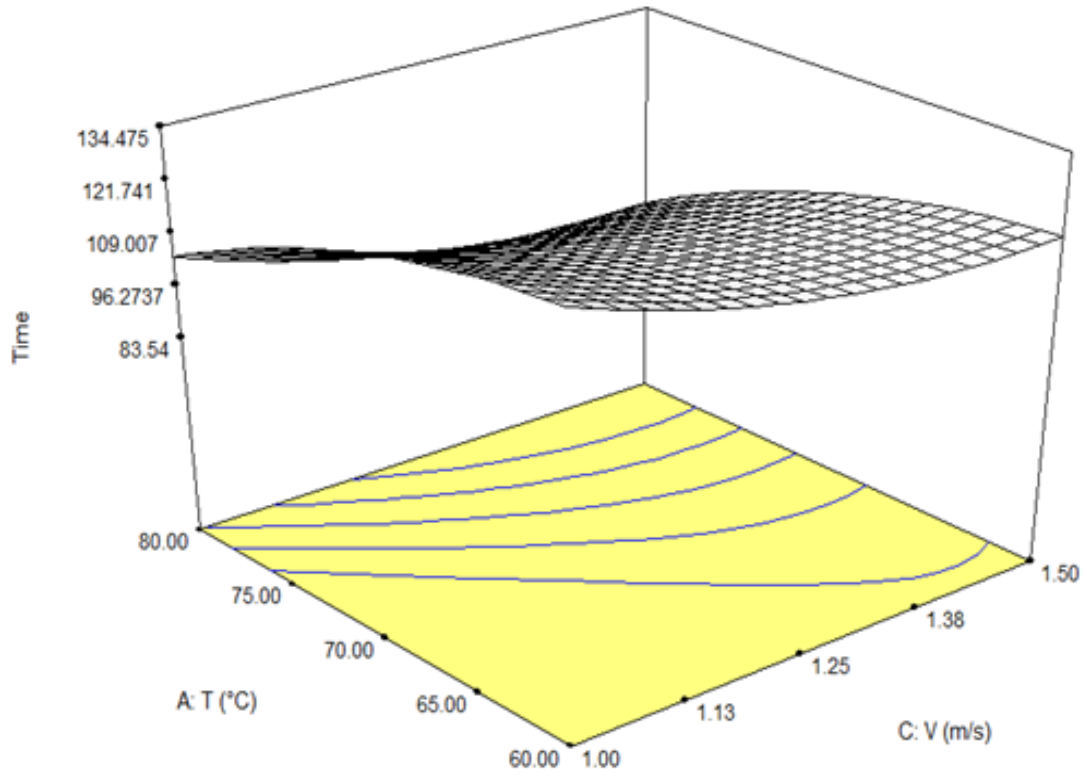
Results and Discussion

$$\text{Time (min)} = +108.92 - 15.50\,A + 1.30\,B - 9.80\,C - 6.13A^2 + 6.35C^2 \text{----------(4)}$$

Response surface plots of drying time potato slices

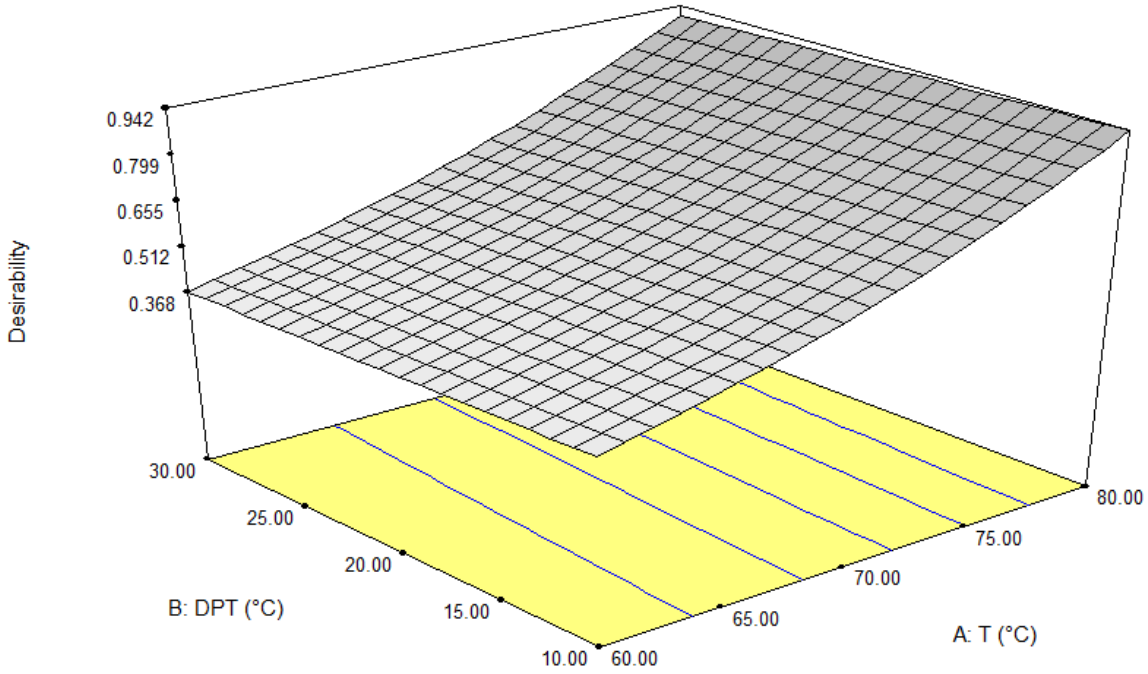


Results and Discussion



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!