

**STUDY THE EFFECTIVENESS IN PREPROCESSING  
OF CINNAMON CHIPS**

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OF CINNAMON CHIPS**

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Thesis submitted in partial fulfillment of the requirements for the degree Master of  
Science

Department of Chemical and Process Engineering

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Sri Lanka

May 2012

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## ABSTRACT

Drying process has been identified as one of the most important preprocessing techniques in cinnamon oil production industry. Drying at closed and controlled environment was selected as a solution to mitigate the drawbacks of conventional sun drying of cinnamon. The common drawbacks are long processing times, labor cost and the deterioration of the quality due to several factors such as dust, moisture and insects. Optimizing the drying operation can reduce the post harvesting losses. This research focuses on investigation of the drying behavior of cinnamon chips and the effect of drying on the yield and quality of cinnamon bark oil. Drying process was experimentally investigated using a tray dryer which provided convective drying with hot air. This dryer consisted of a stove, heat exchanging system and drying chamber and is driven by biomass. Hot air temperatures of 35°C, 40°C, 45°C and 50°C were selected while the air velocity was kept constant. The applicability of three commonly used mathematical models was evaluated by examining the best fit for drying at each tray of the dryer separately.

The particle size of cinnamon chips available in the market was having a large range from less than 1/8 inches to greater than 6 inches. However about 29.7% of cinnamon chips were in the range of 1 inch to 2 inches. The moisture content of cinnamon chips available in the market was found to be within a range of 14.12% to 28.56% with mean and standard deviation of 19.97% and 4.58% respectively. The common practice in the industry is to keep the cinnamon chips under wet conditions before drying until a considerable amount is collected. This process seriously affects the oil yield as mould and fungi develops under wet conditions. The maximum number of days in storage under wet conditions without affecting the quality of cinnamon chips was found to be 3 days.

The drying behavior of cinnamon chips in a tray dryer had well agreed with the existing drying models for thin layer drying. Considering the total drying time and the oil yield, drying temperature of 35°C was found to be the most suitable temperature for drying of cinnamon chips. Drying at temperatures above 35°C gave lower yield and the high volatile components had escaped during drying operation. Drying was not even within the tray dryer and results of the variation of moisture content at each tray clearly indicated the non-uniform drying behavior. Non-uniform drying had considerably reduced the yield which was significant when the drying temperature was maintained above 35°C.

**Keywords:** cinnamon chips, drying, cinnamon bark oil, tray dryer

## **DEDICATION**

This thesis is dedicated to my beloved **MOTHER** and **FATHER**

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## ABBREVIATIONS

Abbreviation	Description
Adj R Sq	Adjusted root square
CA	Cinnamic Aldehyde
CBOP	Cinnamon bark oil producer
CFD	Computational fluid dynamics
DEA	Department of Export and Agriculture
EAC	Export Agricultural Crops
EOA	Essential Oil Association
ERU	Economical Research Unit
FID	Flame ionization detector
GLC	Gas liquid chromatography
IR	Infrared
KP	Katta peelers
KT	Katta traders
MS	Mass spectroscopy
PSD	Particle size distribution
RH	Relative humidity
RI	Refractive index
RSME	Root means squared error
SCF	Super critical fluid
SG	Specific gravity
SLS	Sri Lankan Standards
SSR	Sum of squares of the regression
SSE	Sum of squares of errors
$M_0$	Initial moisture content
$M_t$	Moisture content at time $t$
$M_e$	Equilibrium moisture content

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