

The Leverhulme Trust

LEVERHULME-FUNDED INTERNATIONAL NETWORK ON PRESERVING SAFETY AND NUTRITION OF INDIGENOUS FRUITS AND THEIR DERIVATIVES

NONG LAM UNIVERSITY, HCM CITY, VIET NAM

MINI RESEARCH

Added-value for cashew industry by producing reduced-fat cashew apple chips

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UMR QualiSud CITAA CIRAD

Objectives

(1) was to evaluate the changes in product quality attributes (PQA) such as **oil content**, **moisture content** and **sensory characteristics** on the de-oiling vacuum frying for cashew apple,

(2) was to analysis the **economic feasibility** of the investment of this technology at industrial scale.

Methodology

A. Frying experiments

1. Conventional atmospheric deep-fat frying

2. Vacuum frying coupled vacuum de-oiling



(1) vacuum fried samples + vacuum de-oiling (VF-VD)
(2) vacuum fried samples + atmospheric pressure de-oiling (VF-AD)
(3) vacuum fried samples + without de-oiling (VF-ND).

B. Product quality attributes

1. Oil content
2. Moisture content
3. Sensory analysis

C. Data evaluation

XLSTAT-Pro package for one-way analysis (ANOVA) and post-hoc Turkey's tests, at the P < 0.05 level.

Results




Figure 3. Cashew apple chips under (L) conventional atmospheric deep-fat frying. (R) vacuum frying

(L): the material undergoes chemical and physical transformation at a high temperature range of **140-180° C** which results in:

- starch gelatinisation,
- protein denaturation,
- aromatizing and colouring via Maillard reactions and finally oil uptake

Objective 1 Results

Table 1. Quality attributes of cashew apples chips at different experiments.

Exp ^a	Oil content (%)	Moisture Content (%)	Color	Texture	Overall quality
VF-ND	46.45 ^a	0.71 ^c	2.33 ^l	2.33 ^m	2.50 ^p
VF-AD	34.39 ^b	1.77 ^b	4.00 ^k	3.66 ⁿ	4.00 ^o
VF-VD	28.58 ^c	2.03 ^b	4.83 ^j	4.16 ^l	4.83 ^r
P-Ref	26.50 ^d	2.65 ^a	4.50 ⁱ	4.66 ^k	5.00 ^q
R ²	0.999	0.996	0.796	0.789	0.844
F	11132.070	1834.279	26.078	25.000	36.154
Pr > F	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001

^aValue with different superscripts arranged vertically is significantly different from each other (Tukey test, P < 0.05). VF-ND: vacuum fried samples without de-oiling. VF-AD: vacuum fried samples coupled atmospheric pressure de-oiling. VF-VD: vacuum fried samples coupled vacuum de-oiling. P-Ref: commercial potato chips. R²: coefficient of determination.

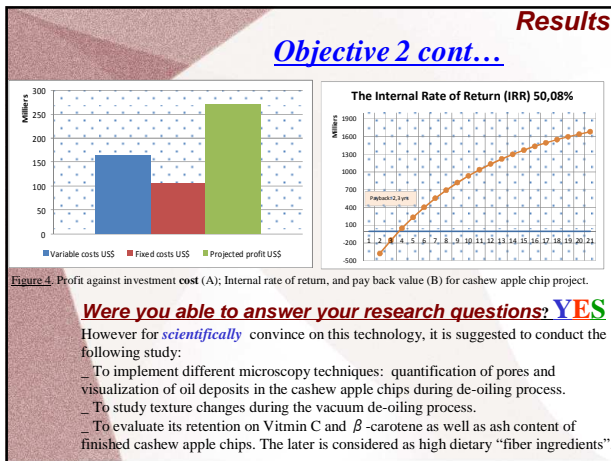
Objective 2 Results

Table 2. Equipment Cost at cashew apple chips factory.

Approximate cost of \$/year for each of equipment	Estimated cost	Quan	Price	Power
Conveyor belt	2091	1	2091	100 kg/h
Mangoes washer	12778	1	12778	100 kg/h
Cleaned belt conveyor	5000	1	5000	100 kg/h
Preparation tables	12778	1	12778	
Cooking machine	37171	1	37171	100 kg/h
Fryer	45057	1	45057	10 kg/h
Packer	107665	1	107665	10 kg/h
Cold storage room	16000	1	16000	
Blister printer	12453	1	12453	
Water filter	6150	1	6150	3m ³ /h
Air compressor	800	1	800	
Generator	10455	1	10455	50 kW
Total	286598			

Table 3. Material cost at cashew apple chips factory.

	Unit price	Consumption	Total
Fresh cashew apple	0.1 US\$/kg	1000 kg/day	25000
Sunflower oil	2.02 US\$/liter	100 liters/day	5000
Coalwood boxes 10 kg	0.51 US\$/unit	8 units/day	1000
Banana sachets 50 g x 1000 sachets	41.82 US\$/1000 sachets	1000 units/day	16728
Diesel	5.2 US\$/gallon	5.3 gal./day	6890
Water	0.18 US\$/m ³	0.042 m ³ /h	18.9
Electricity	0.19 US\$/kWh	28 kWh/h	13300
			FOYAL 113497



Can the findings be published?

Not at the moment, as the data collection and analysis were done on a small cashew apple sample. It needs to be repeated with **bigger samplings** and **online analysis of de-oiling process** and **further analysis on finished product biochemicals characters**.

Will you disseminate the information to suitable audiences? If so, how?

We have available detail Business Plan for the cashew apple chips that can share to the interested industry partner.

We are in contact with VINAMIT and/or D&TK, company who can be our potential clients of this technology transfer.

Has the research thrown up ideas for the development of a bigger proposal?

Valorisation of **under-utilized fruits and/or raw materials**, cashew apple fruits, by applying of **innovative processing technology** is a forwarding strategy in food industry as **raw materials** will be soon imbalanced with the increasing demands in the next 40 years (FAO estimates a 2 billion increase in world population by 2050), meaning that world food supply is facing a huge struggle to keep up with demand.

In-sufficient of supplying and demanding, prices explodes. The price fluctuation on the agricultural commodity markets has an impact on farmers, food-makers and consumers, including in the poorest countries.

Figure 5. Cashew apple chips with color fortified of dragon fruit's peel.

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