WORKSHOP: VALORISATION OF TRADITIONAL PROCESSING OF INDIGENOUS AND UNDERUTILISED FRUITS

Institute of Technology of Cambodia, Phnomenh, Cambodia
January 14-16, 2013.

The workshop is funded under the project "International network on preserving safety and n utrition of indigenousfruits and their derivatives", by the Leverhulme Trust, UK

Evaluation of some innovative process for extraction of functional extract from cashew apple waste (*Anacardium occidentale*, L.)

AUTORS :

Fernando Antonio PINTO DE ABREU (phD research work), Embrapa Brezil
Manuel Dornier, Claudie Dhuique, Fabrice Vaillant ,Max Reynes

presented by Max Reynes

UMR (Research Unit)CIRAD-QUALISUD

INTEREST of the presentation For this seminary (1)

-PRESENTATION OF A EXTRACTION AND PURIFICATION PROCESS WAY FOR ANY OTHER FUNCIONAL MOLECULE

-TECHNOLOGY PRESENTED HAVE
*TO BE COUPLED WITH OTHERS TECHNOLOGIES

* TO BE EVALUATE FOR OTHER RAW MATERIALS

INTEREST of the presentation For this seminary (2)

THIS PROCESS IS ACTUALLY EVALUATED FOR VALORISATION OF OTHER INDOGENOUS FRUITS:
-STEVIA (stevioside& sweeetener)
-ELAGITANIN (fruits rich in polifenols)
-??
- COLORANT MOLECULES WITH HIGHT POTENTIAL MARKET :
- RED. GREEN etc...

- HEALTHY MOLECULES AGAINST TRIGLICERIDES? ANTI-INFLAMATORY, ANTIGLYCEMIA? ANTI OBESITY

* TO BE EVALUATE FOR OTHER RAW MATERIALS

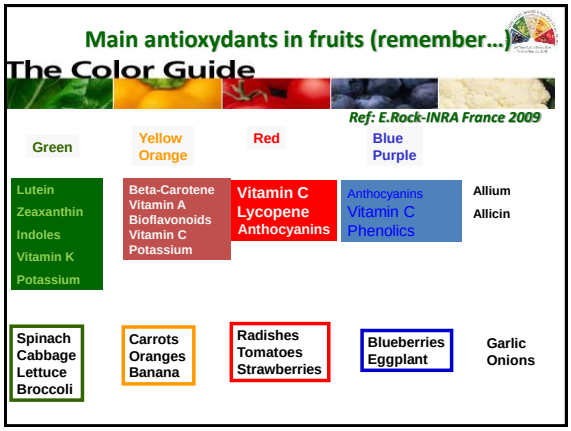
INTEREST of the presentation For this seminary (3)

-- COLORANT MOLECULES WITH HIGHT POTENTIAL MARKET / RED. GREEN

- HEALTHY MOLECULES AGAINST TRIGLICERIDES? ANTI-INFLAMATORY, ANTIGLYCEMIA? ANTI OBESITY

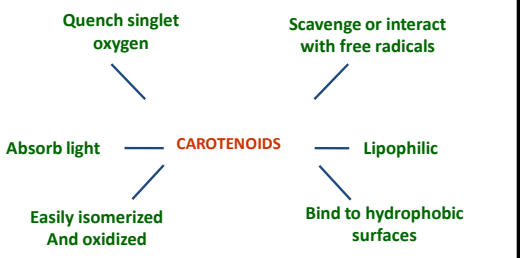
-IN EACH COUNTRY? WHATS IS THE TRADITIONAL KNOW HOW?

Main antioxydants in fruits (remember...)



IMPORTANT PHYSICAL AND CHEMICAL PROPERTIES OF CAROTENOIDS

Kimura, M. & Rodriguez-Amaya, D.B. (1999), Brazi



OBJECTIVES OF THE RESEARCH WORK PRESENTED

GENERAL

EVALUATE A INNOVATIVE PROCESS FOR EXTRACTION AND PURIFICATION OF CAROTENOIDS EXTRACTS FROM CAHEW APPLE WASTE FOR A COLORANT USE

WITHOUT ANY SOLVANT WITHOUT HEAT

SPECIFICS

CARACTERIZE AND QUANTIFY CAROTENOIDS CONTENTS AN THE Cahew apple WASTE EXTRACTS

OPTIMISE PROCESS PARAMETERS FOR EXTRACTION CARTENOIDES COUPLING MACERATION AND ENZIMATIC TREATEMENT AND PRESS

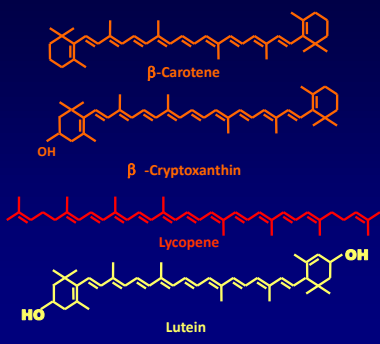
EVALUATION OF TANGENTIAL MICROFILTRATION OF THE OBTAINED CAROTENOIDS EXTRACTS FOR CONCENTRATION AND DIAFILTRATION PROCESS FOR PURIFICATION

07

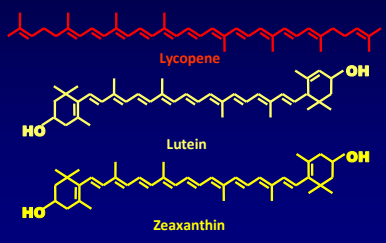
The molecules……

07

PRINCIPAL CAROTENOIDS IN FOODS



CAROTENOIDS CONSIDERED IMPORTANT TO HUMAN HEALTH



The indogenous fruit……

07

cashew varieties : view of CCP 76 - EMBRAPA

Cashew apple "fruit"

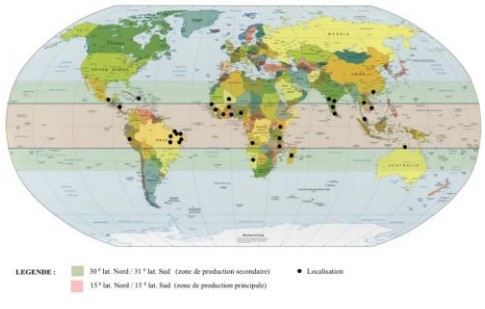
Nuts (fruit)

Cashew apple

02

Area of cashew growth in the word

Mainly in Viet Nam , India , etc... Nigeria , Côte d'Ivoire , Brésil



LEGENDE : 30 ° lat. Nord / 31 ° lat. Sud (zone de production secondaire) 15 ° lat. Nord / 15 ° lat. Sud (zone de production principale) • Localisation

* In the world → 3.350.929 tons of nuts :year

* Exemple of Brésil : 220.505 tonnes

It is 2 millions of tons of cahew apple by year

03

The raw product

Use of waste? → DIFFICULT TO TAKE OFF

CASHEW APPLE ON THE TREE

CASHEW APPLE

APPLE PRESS

WASTE

NOIX DE CAJOU

CASHEW JUICE

09

The process

Cashew apple

Juice extraction with press → Raw juice

Apple waste

Carotenoids EXTRACTION maceration → fibers

EXTRAIT BRUT (Emulsion)

CONCENTRATION Microfiltration

Extract concentrated

PURIFICATION Diafiltration

Purified extract

08

The process.....

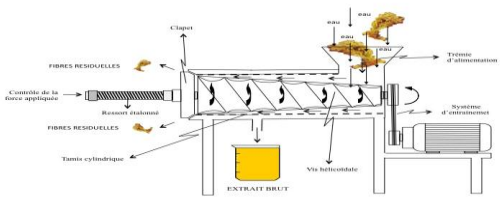
07

CAROTENOIDS EXTRACTION

MACERATION → PRESSURAGE

ENZYMES (pectinase / amylase
DOSIS)
TEMPERATURE
TIME

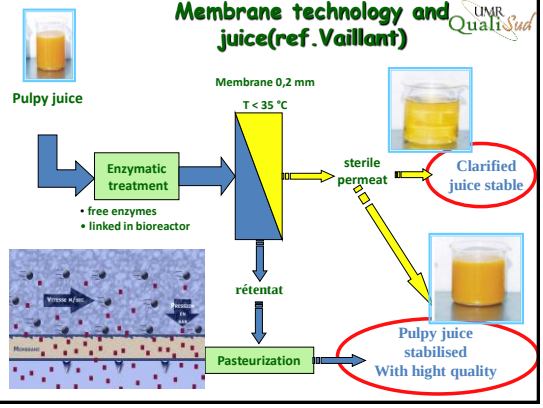
RATIO EAU / FIBRES
FORCE APPLIQUÉE
VITESSE DE
ROTATION



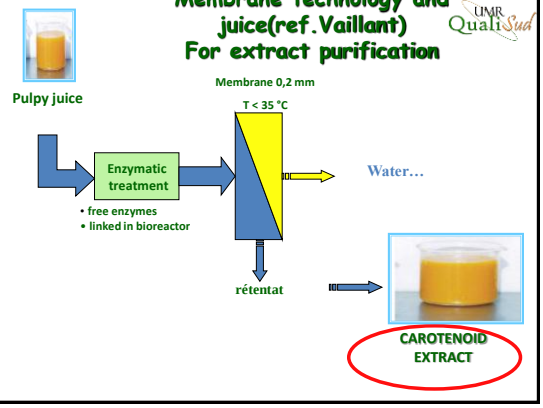
SCREW PRESS VUE

10

Membrane technology and juice(ref. Vaillant)

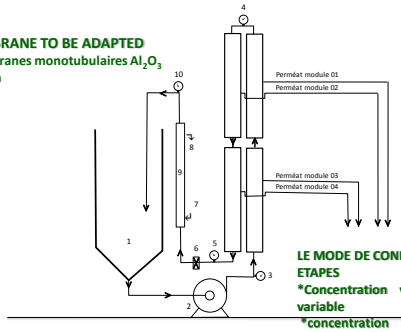


Membrane technology and juice(ref. Vaillant) For extract purification



MICROFILTRATION PILOT ESSAY

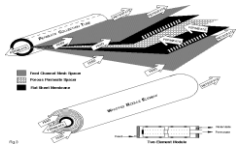
MEMBRANE TO BE ADAPTED
-Membranes monotubulaires Al_2O_3
-0.2 µm



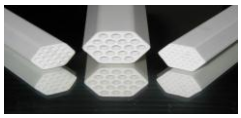
LE MODE DE CONDUITE : 3 ETAPES
*Concentration volume not variable
*concentration volume variable
*Diafiltration volume constant

11

Tangential Microfiltration: various membranes

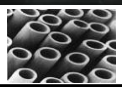


Tubular multichannel (ceramic)



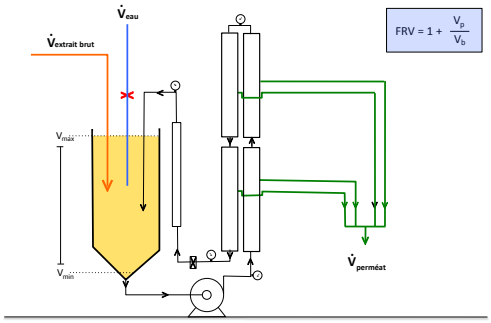
1 cm

Hollow fibers (organic)



1 mm

CONCENTRATION using same VOLUME

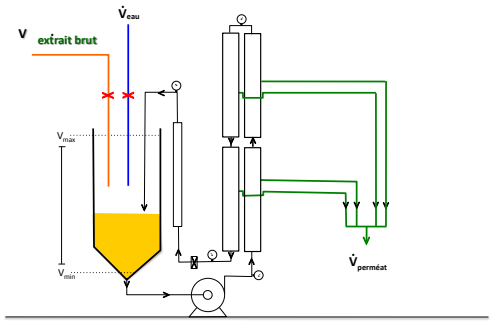


$FRV = 1 + \frac{V_p}{V_b}$

$\dot{V}_{extrait\ brut} = \dot{V}_{perméat}$; $\dot{V}_{eau} = 0$

12

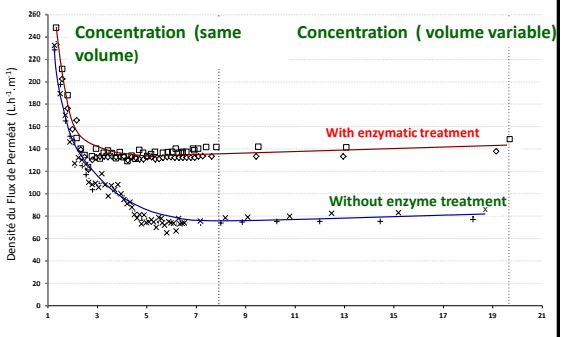
CONCENTRATION using VOLUME VARIABLE



$\dot{V}_{extrait\ brut} = 0$; $\dot{V}_{eau} = 0$

13

EVOLUTION FRV (PTM = 3,2 BAR)



29

CONCENTRATION and PURIFICATION OF THE EXTRACTS

Pressage CYCLE NUMBER
Microfiltration à FRV 1 — Optimisation extraction

Pressage CYCLE NUMBER
Microfiltration à FRV 5 et 10 — Impact : enzyme, Number of cycles, Pressure transmembrane

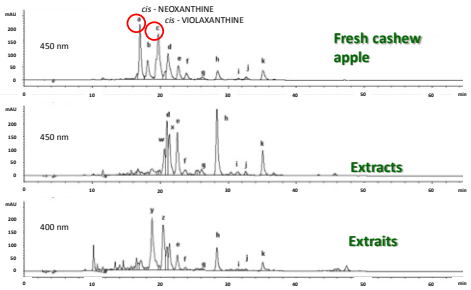
Pressage CYCLE NUMBER
Microfiltration à FRV maximal — Impact FRV

Pressage CYCLE NUMBER
Purification par diafiltration — Impact on the quality extracted evaluated

16

CARACTERISATION CAROTENOIDES CONTENTS PROFILE

(HPLC-DAD)

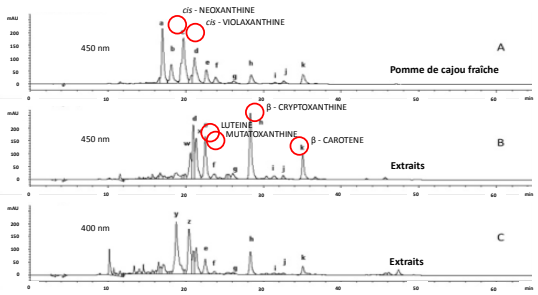


19

The molecules extracted quality……

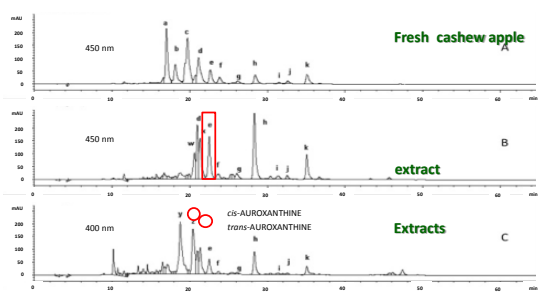
07

CARACTERISATION DU PROFIL DES CAROTENOIDES



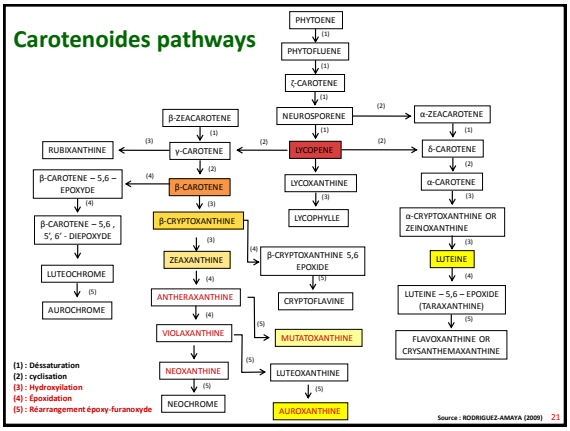
19

CARACTERISATION CAROTENOIDES CONTENTS PROFILE



19

Carotenoides pathways



Source : RODRIGUEZ-AMAYA (2009) 21

CARACTERISATION CAROTENOIDES CONTENTS PROFILE

* PROFILES BETWEEN INTIAL AND CONCENTRATED EXTRACTS IDENTICAL

* SOME CAROTENOIDES NOT IDENTICAL BETWEN CAHSEW APPLE AND EXTRACTS

EXTRACTION TECHNOLOGY CAN MODIFY MOLECULES EXTRACTED……

20

IMPACT of the PROCESS ON THE EXTRACT QUALITY

11 caroténoïdes identified et quantified par HPLC – DAD - MS
Auroxanthines *cis* et *trans* (40%) ; lutéine (20%) ; β-cryptoxanthine (17%)

Factor of Concentration - Fc	19,1
Total Caroténoïdes content - Cc ($mg.kg^{-1}$)	72
Raw carotenoid content - p ($g.kg^{-1}$)	3,8

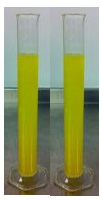
CONCLUSIONS

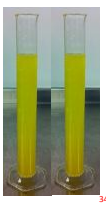
Extract Caracterization

Liquid, yellow

- Easy to disolve in water
- Rich in caroténoïdes

Industrial use as natural colorant with hight value





34

PERSPECTIVES (1)

PATENT Cirad/Embrapa :BR 10 2012 0097610) 26/04/2012
(research during 3 years; 1 PHD)

Orientation for future research actions for Preserving functional activities:

*technologies without temperature, free of solvant

* screening of functional activities
example with cashew: research actual running

But for all the other indogenous fruits?,,,

35

PERSPECTIVES (2)

EVALUATION SOCIO ENOMIC OF THE INDOGENOUS FRUITS AND EVALUATION OF THE ALREDAY TRADITIONAL KNOW HOW

MAIN CONDITIONS TO START SUCH RESEARCH

- specific laboratories with innovative equipments for extraction, purification with or not membrane:
.microwave, resins, CO2 sp., etc

- functionality analysis
or chemical molecules (for use as pesticides subsitute)
or healthy products (screening of healthy actions)

35

Merry Christmas and Happy New year!!