Preserving freshness of processed vegetables using emerging processing technologies

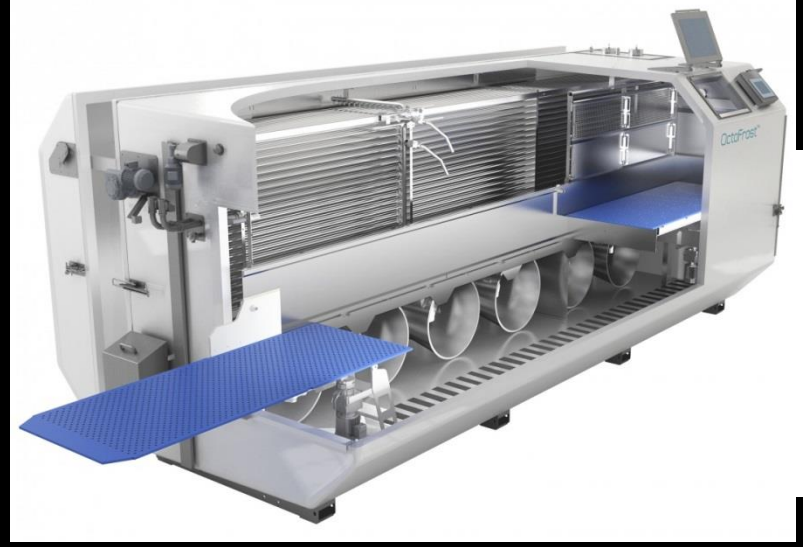
Federico Gómez Galindo

Food technology, engineering and nutrition

Lund University, Sweden

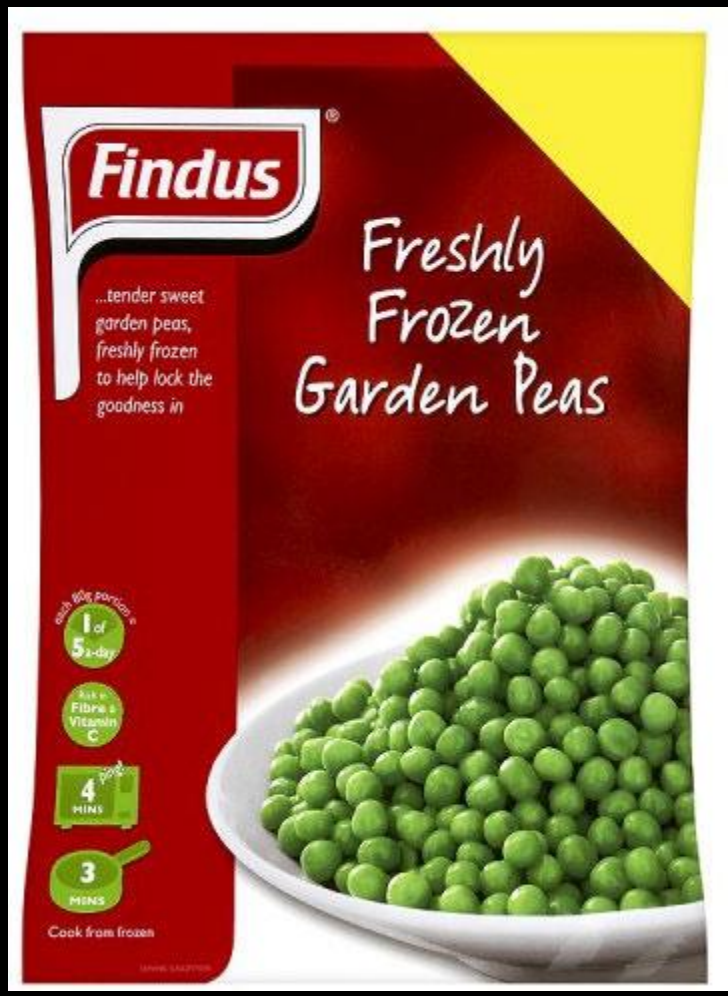
Freezing

1960’s



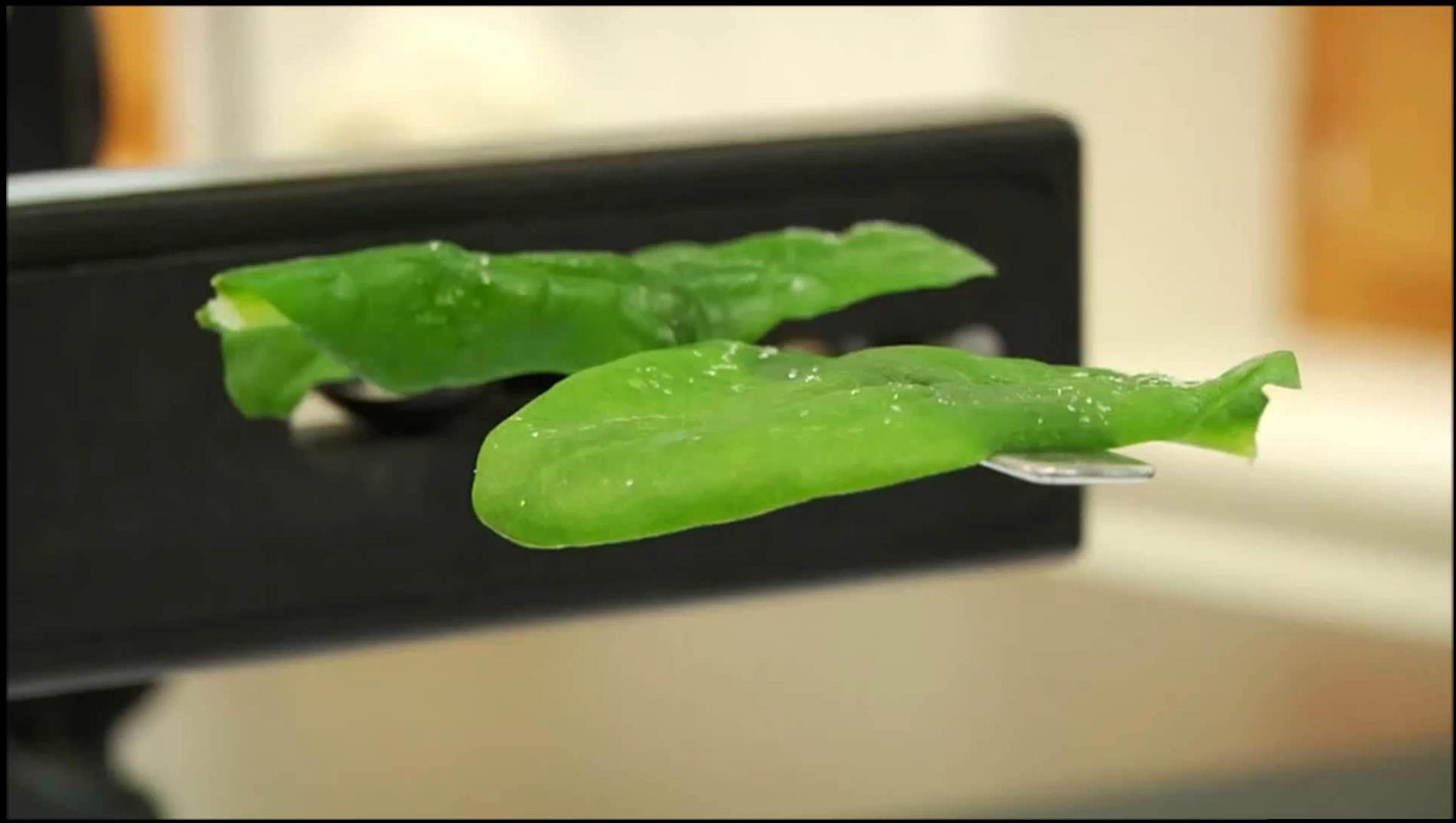
FRIGOSCANDIA

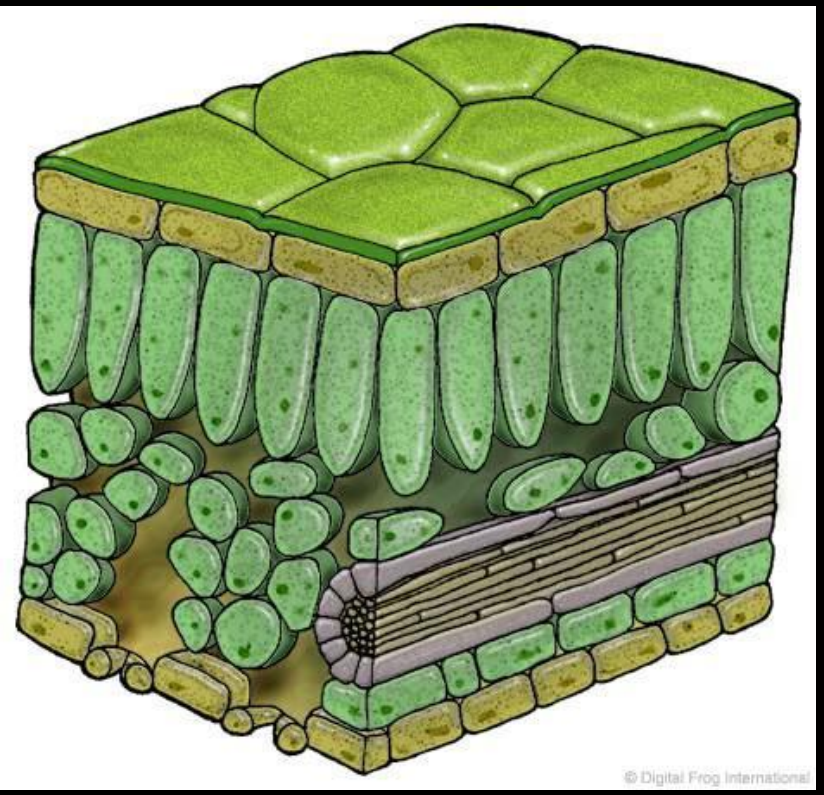
JBT FoodTech



Good quality after freezing and thawing due to tough structure

Good texture is kept after thawing by the cell wall of the cells in the vegetables

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Food Biophysics (2012) 7:28–34
DOI 10.1007/s11483-011-9239-7

ORIGINAL ARTICLE

Gas in Scattering Media Absorption Spectroscopy (GASMAS) Detected Persistent Vacuum in Apple Tissue After Vacuum Impregnation

Urszula Tylewicz · Patrik Lundin · Lorenzo Cocola · Katarzyna Dymek · Pietro Rocculi · Sune Svanberg · Petr Dejmek · Federico Gómez Galindo

Contents lists available at SciVerse ScienceDirect

Innovative Food Science and Emerging Technologies

journal homepage: www.elsevier.com/locate/ifset

Microscopic studies providing insight into the mechanisms of mass transfer in vacuum impregnation

Valentina Panarese [a,*], Petr Dejmek [b], Pietro Rocculi [a], Federico Gómez Galindo [b]

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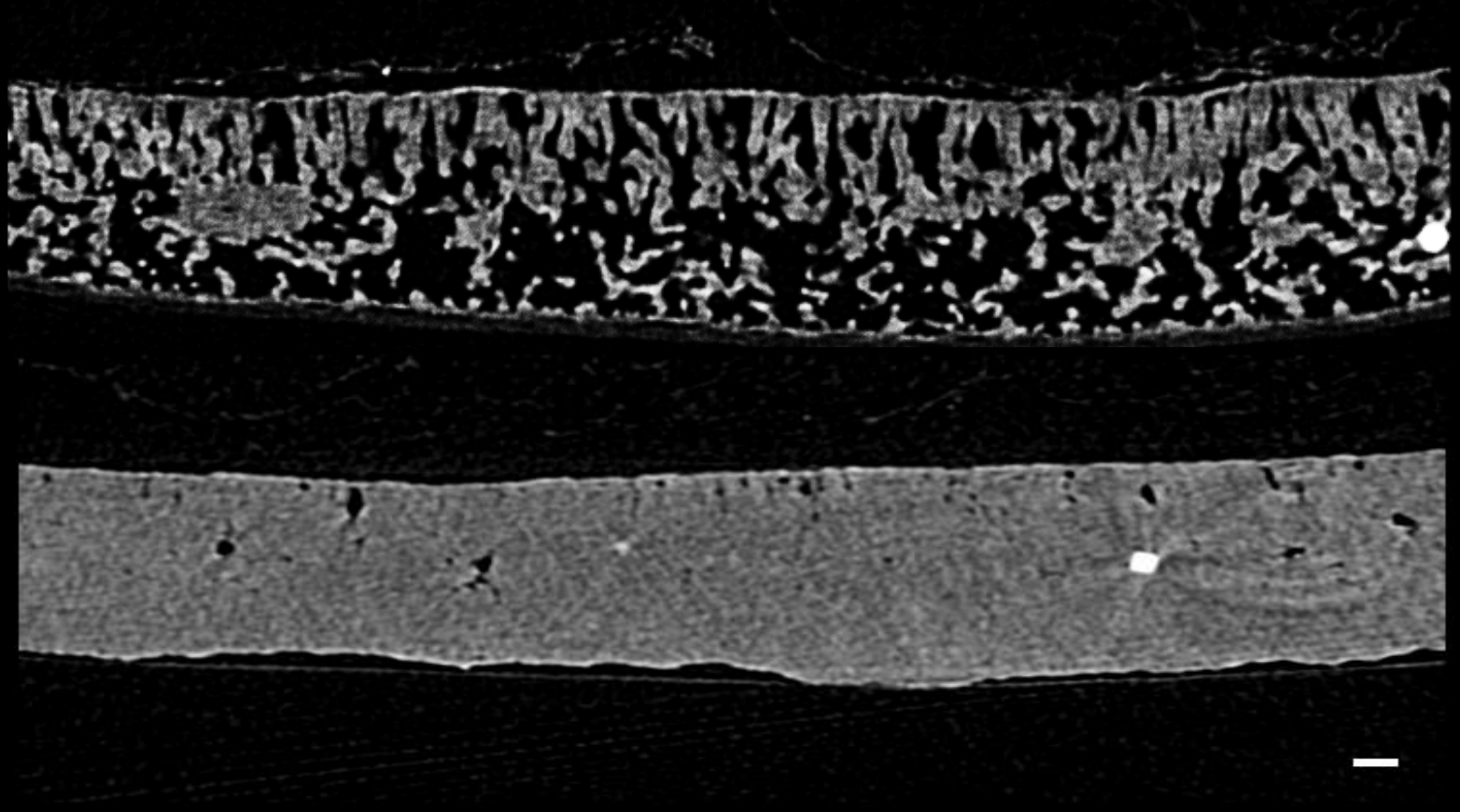
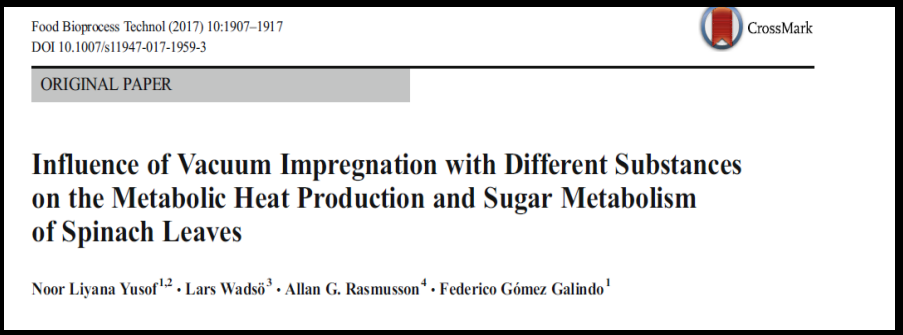
[b] Department of Food Technology, Engineering and Nutrition, Lund University, P.O. Box 124, SE-221 00 Lund, Sweden



Metabolic consequences of VI

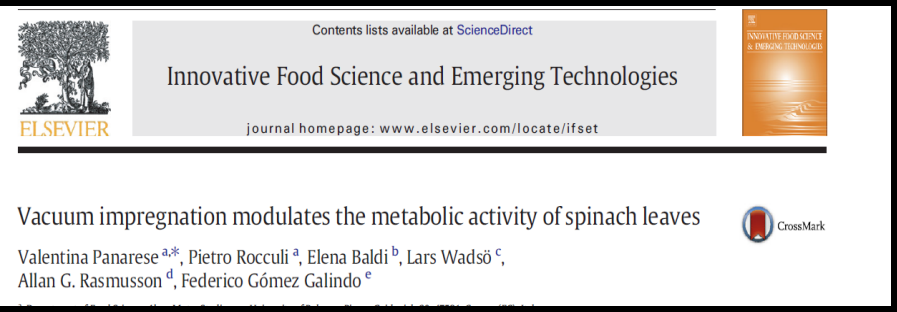


Food Bioprocess Technol (2017) 10:1907–1917
DOI 10.1007/s11947-017-1959-3

ORIGINAL PAPER

Influence of Vacuum Impregnation with Different Substances on the Metabolic Heat Production and Sugar Metabolism of Spinach Leaves

Noor Liyana Yusof[1,2] · Lars Wadsö[3] · Allan G. Rasmusson[4] · Federico Gómez Galindo[1]



Contents lists available at ScienceDirect

Innovative Food Science and Emerging Technologies

journal homepage: www.elsevier.com/locate/ifset

Vacuum impregnation modulates the metabolic activity of spinach leaves

Valentina Panarese[a,*], Pietro Rocculi[a], Elena Baldi[b], Lars Wadsö[c], Allan G. Rasmusson[d], Federico Gómez Galindo[e]

Food Bioprocess Technol (2016) 9:1358–1366
DOI 10.1007/s11947-016-1725-y

ORIGINAL PAPER

Reduction of the Nitrate Content in Baby Spinach Leaves by Vacuum Impregnation with Sucrose

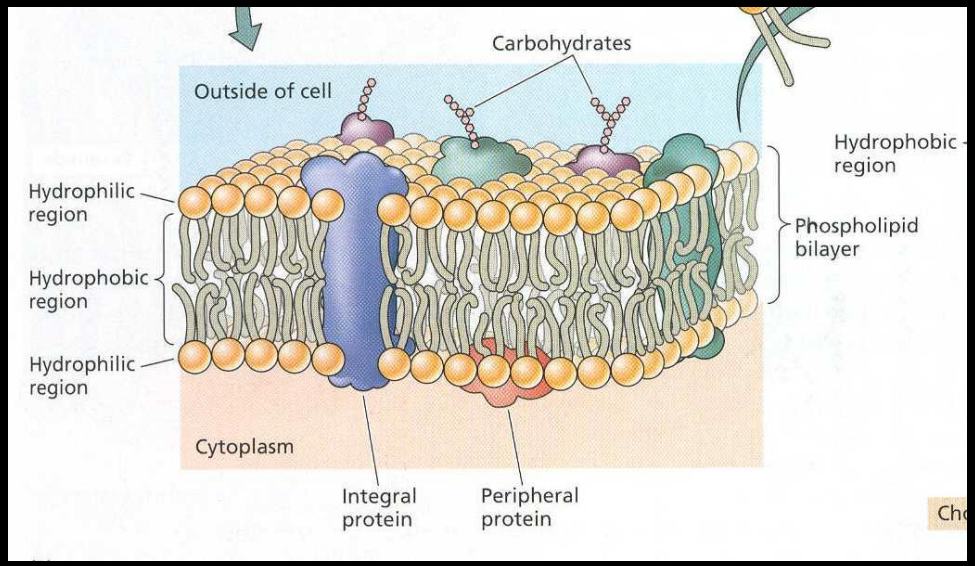
Noor Liyana Yusof[1,2] · Allan G. Rasmusson[3] · Federico Gómez Galindo[1]

Impregnated substances will be transported into the cells and influence their metabolism.

We may be able to target specific metabolic pathways with the substances that we impregnate (the sucrose-nitrates example)

Pulsed electric fields (PEF)

Apply electricity (voltages from 300 – 2000 V) to a biological system



Plant/animal cells/tissues

Microorganisms

Times ranging in miliseconds/microseconds or even nanoseconds

Low intensity PEF

Irreversible Reversible → Cells survives PEF

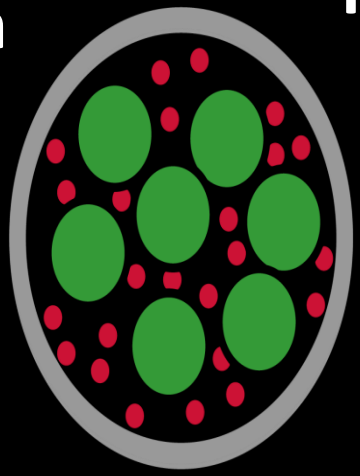
- Strength of electric field
- Duration of pulse electric field
- Number of pulses

↓

Stress

Vacuum impregnation

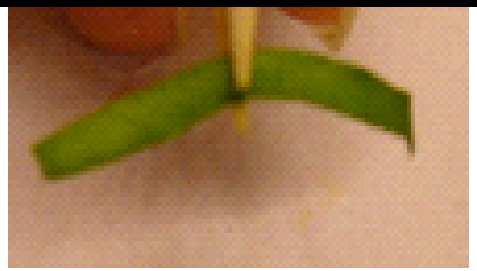
Pulsed electric field (PEF)

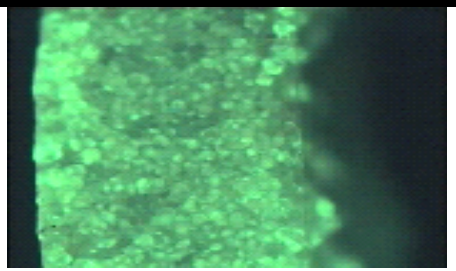


Cryoprotectant distributed in the extra- and intracellular spaces

Cryoprotectant distributed in the extracellular spaces

(a)



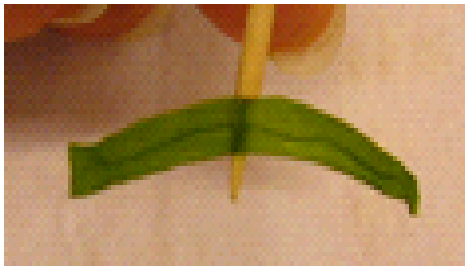


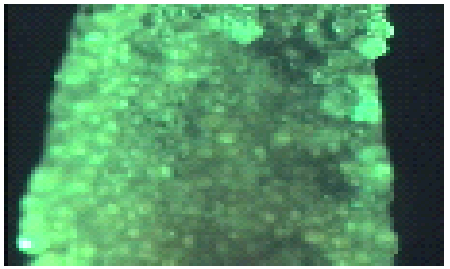
fresh

(b)

control

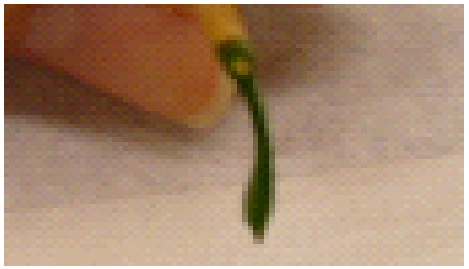
(c)





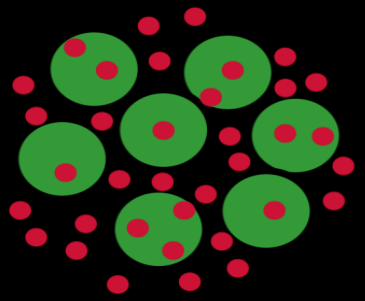
PEF + VI

(d)



Only VI

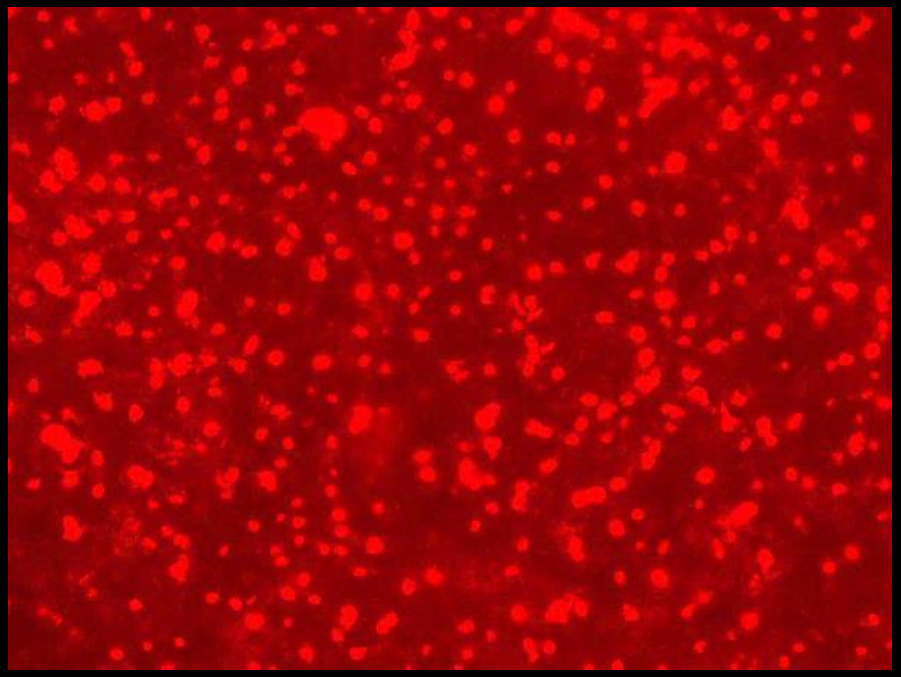
Role of PEF?



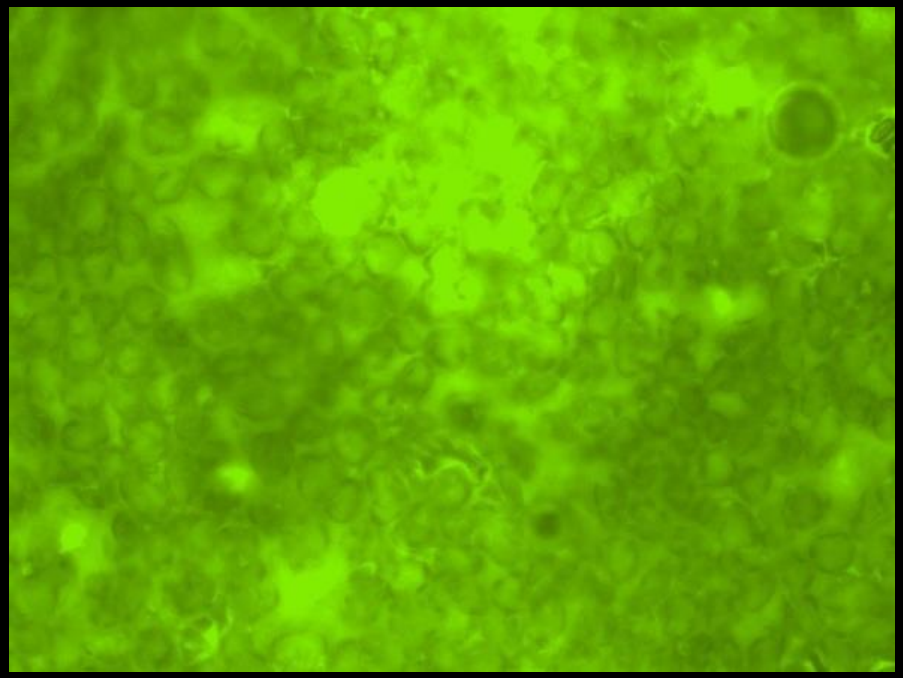
- PEF increases the intracellular concentration of the already existing cryoprotectant
- PEF effect is only due to stress
- PEF effect is both ways: concentration and stress

Improving quality of dried aromatic herbs

Reversible permeabilization

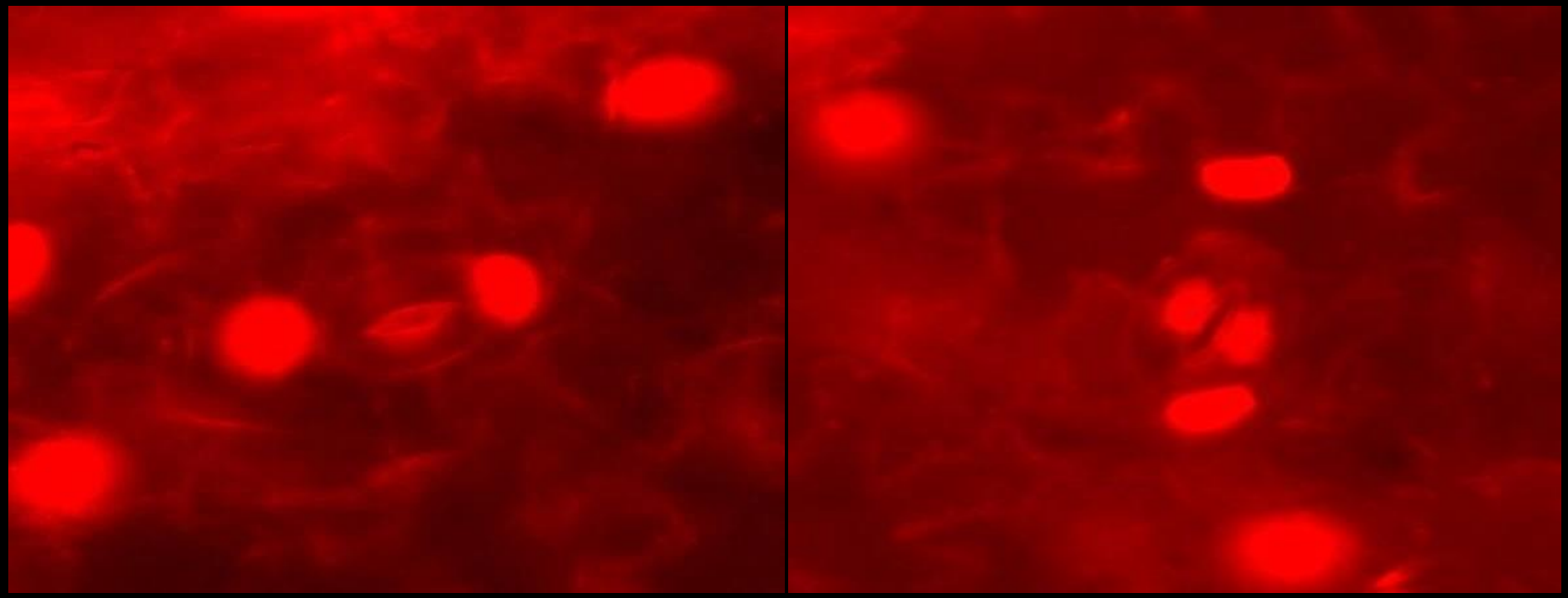


Propidium iodide



Fluorescein diacetate

600 – 650 V/cm; 150 µs width; 760 µs space between pulses; 65 pulses

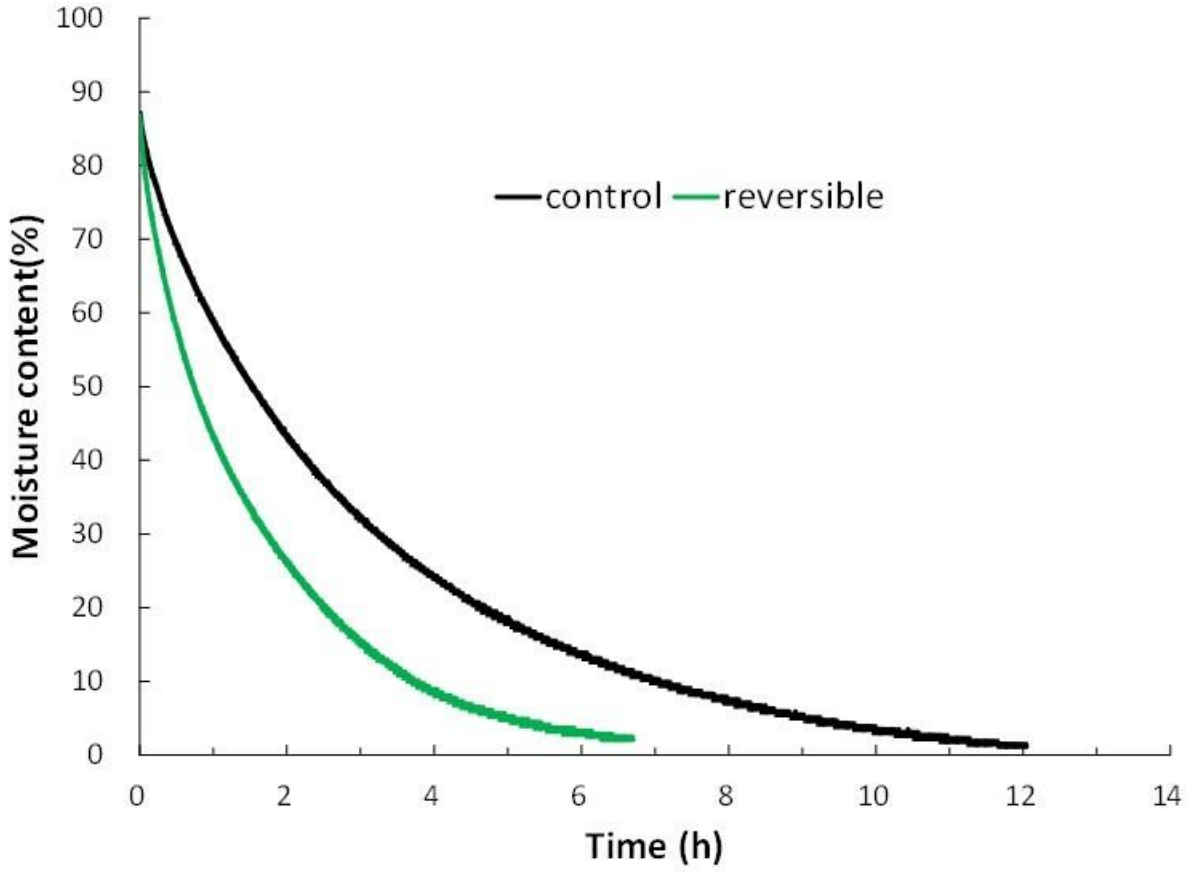


Darkness

Dehydration

Stomata with electroporated guard cells remain open

Kwao, Alhamimi et al., 2016


100
90
80
70
60
50
40
30
20
10
0
Moisture content(%)
control
reversible
0
2
4
6
8
10
12
14
Time (h)

40 °C

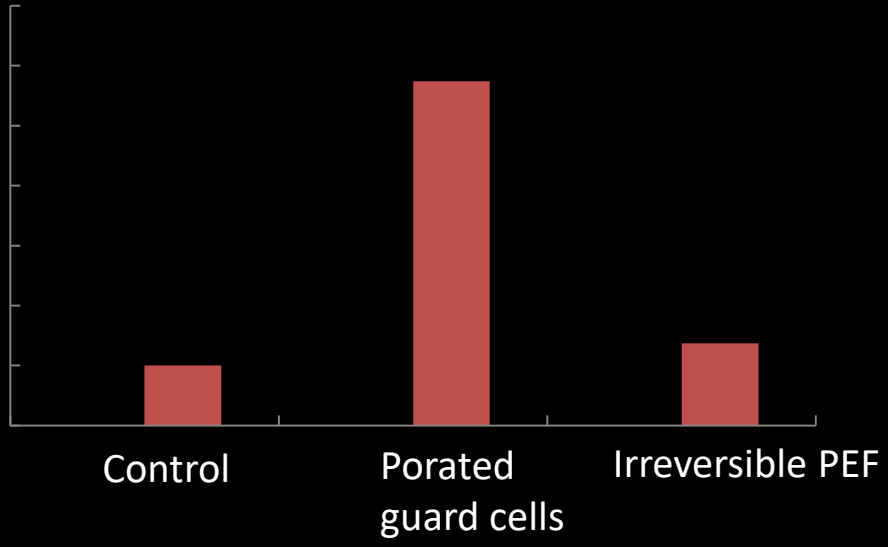
To 10 % moisture content

Untreated control: 420 min

Electroporated guard cells: 213 min

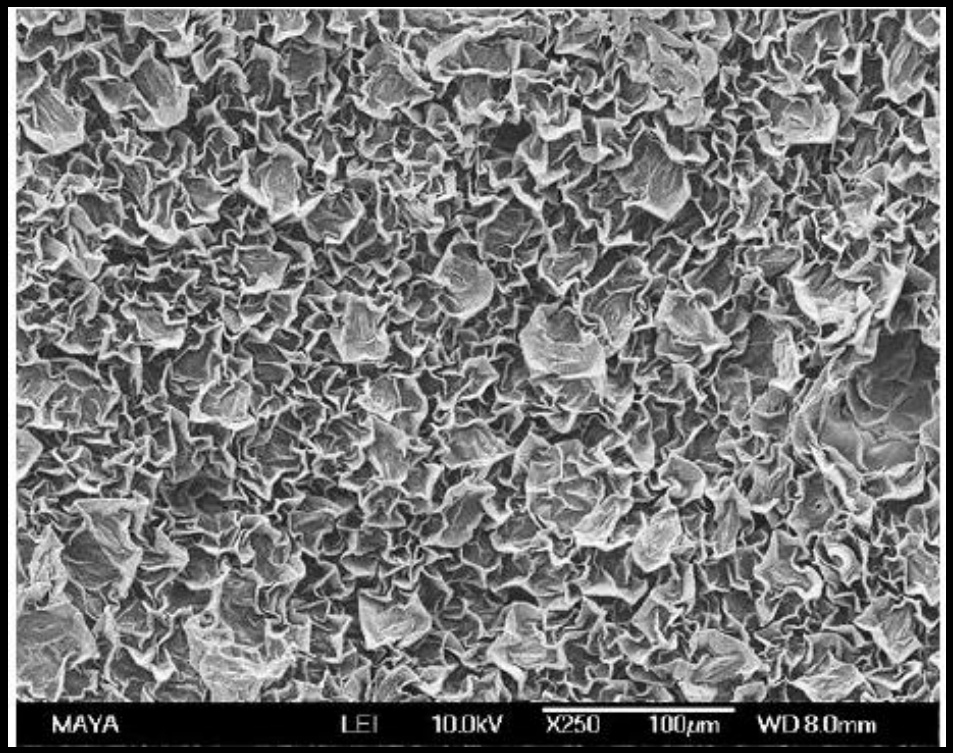
Fully disintegrated cells (using PEF): 67 min

Caryophellene

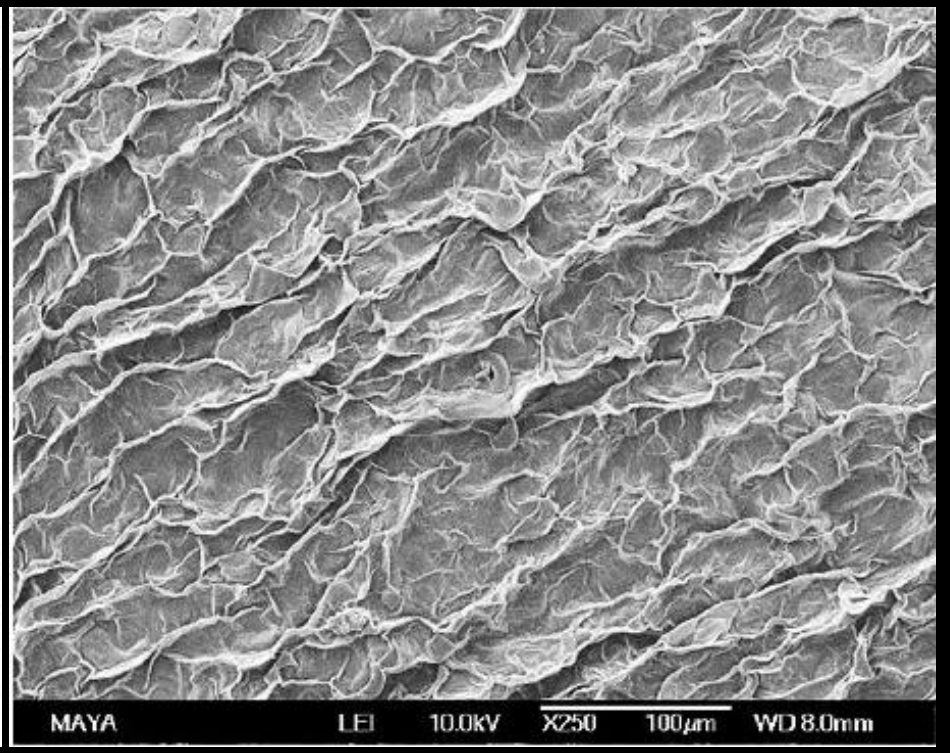


Farnesene

Structure (top surface of leaves)

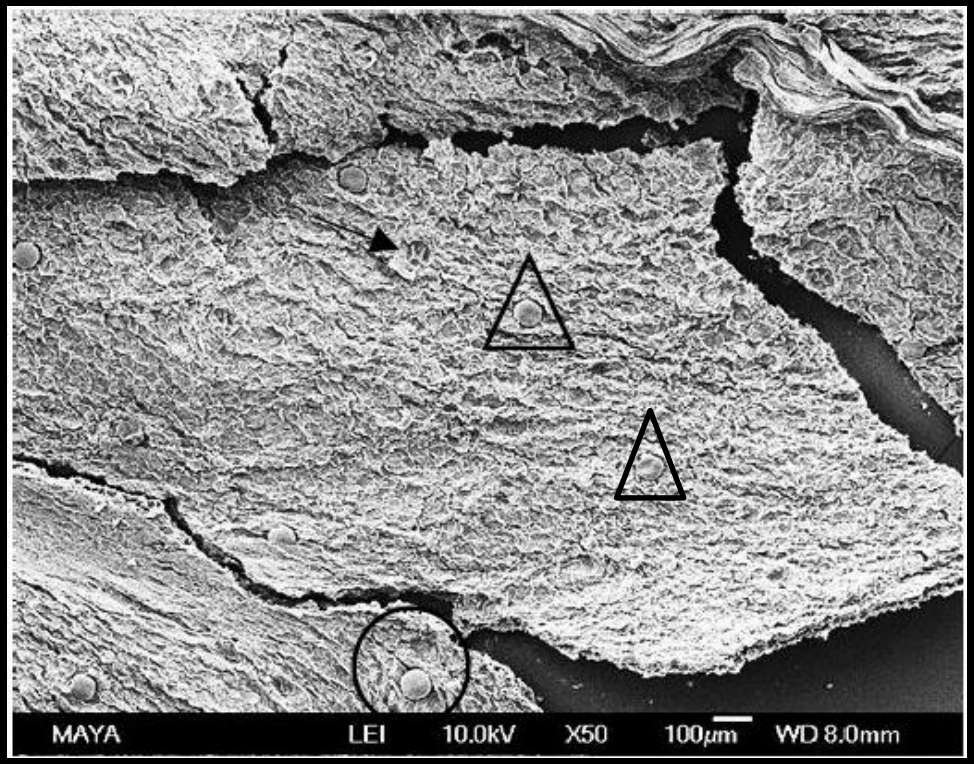


Control

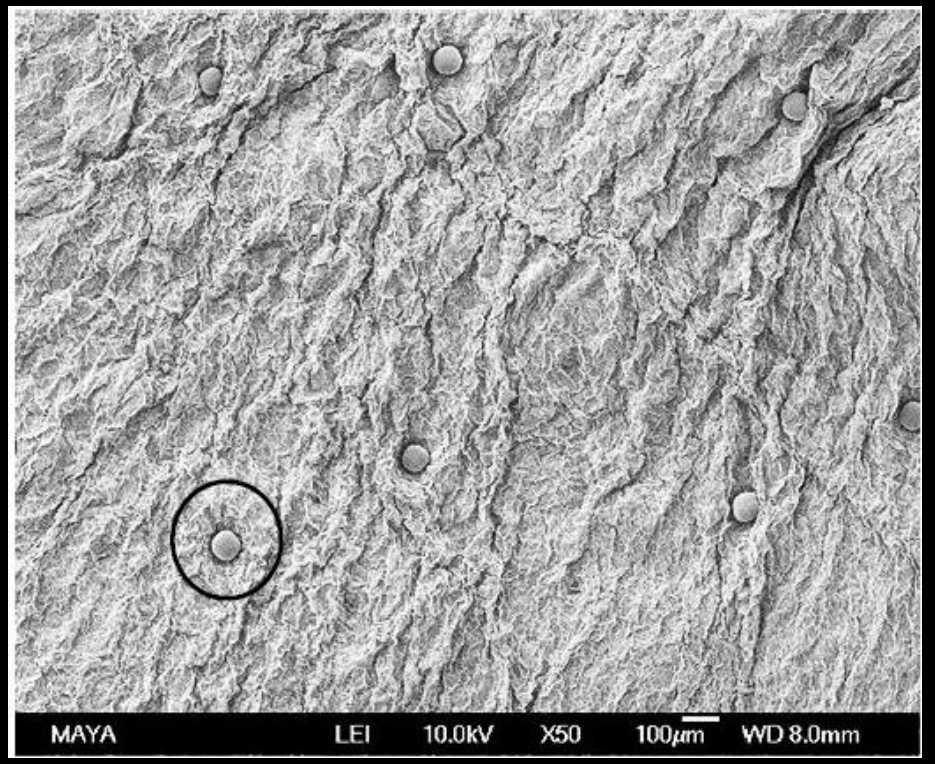


Reversible PEF

Structure (bottom surface of leaves)



Control



Reversible PEF

Weight after rehydration to constant values (as percentage of the weight of the fresh leaf)

Control	53.6 %
Electroporated guard cells	72.2 %
Irreversible permeabilization	57.1 %

*** (lightness)**

Fresh leaf:	35.7
Control:	32.7 *
Reversible PEF:	34.7
Irreversible PEF:	32.4 *

*** (greenness)**

Fresh leaf:	-9.45
Control:	-2.16 **
Reversible PEF:	-6.90 *
Irreversible PEF:	-3.30 **

- Dehydration of basil, at the studied conditions, can be aided by PEF

- When reversible PEF causes stomata to remain open, the product keeps a better colour, structure, increased rehydration capacity and retention of important aroma compounds than the control and leaves treated with irreversible PEF

40°C; reversible PEF

Commercial product


opti