TICA
Thailand International Cooperation Agency

80th Anniversary SILPAKORN UNIVERSITY

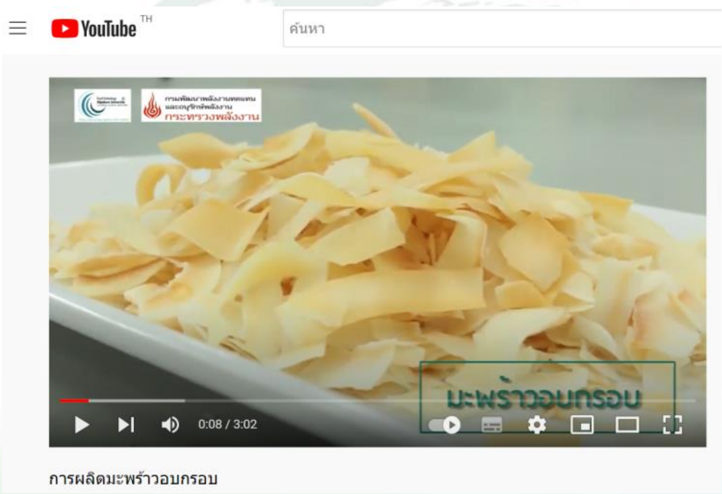
Annual International Training Course (AITC) 2023

The application of a parabolic greenhouse solar dryer together with raw material preparation techniques to extend shelf-life and enhance quality of agricultural products

24 April – 5 May 2023

Demonstration 2_27 April 2023

Production of osmotic dehydration fruits using a solar dryer and a tray dryer and impact of raw materials and processing on their shelf-life



https://www.youtube.com/watch?v=8Zv1-I6XuoI

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General Process of production of osmotic dehydrated fruits

Raw materials: Fruits

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Raw materials preparations: Selection, Cleaning, Washing, Sanitization (peroxyacetic acid), Peeling, Trimming, Slicing,

Pretreatment: dipping in pretreatment solution such as calcium chloride, acid and or sulfiting agents, blanching and sugaring by dipping fruit slices into osmotic solution

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Drying or Dehydration: Greenhouse Solar dryer or tray dryer

↓

Osmotic dehydrated Products

↓

Packaging and Storage

Impact of raw materials and processing on product's shelf-life

Degree of ripeness





Unripe

Half-ripe

Impact of raw materials and processing on product’s shelf-life

Degree of ripeness

Over-ripe

Ripe

Impact of raw materials and processing on product's shelf-life

Degree of ripeness

Unripe

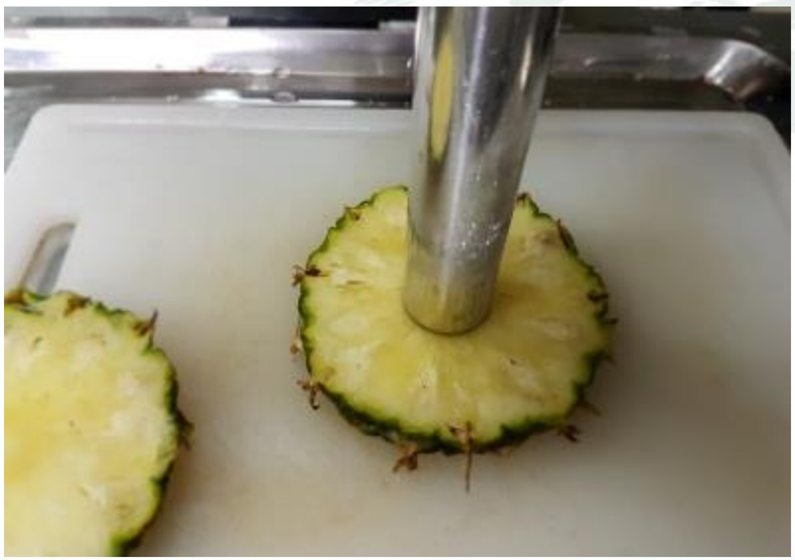
Half-ripe

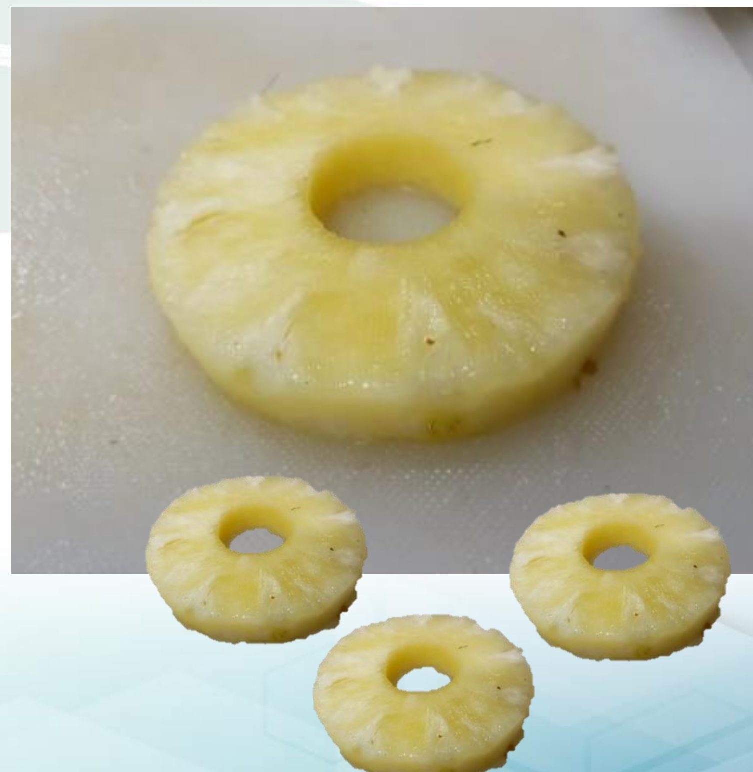
Ripe

Over-ripe

Impact of raw materials and processing on product's shelf-life

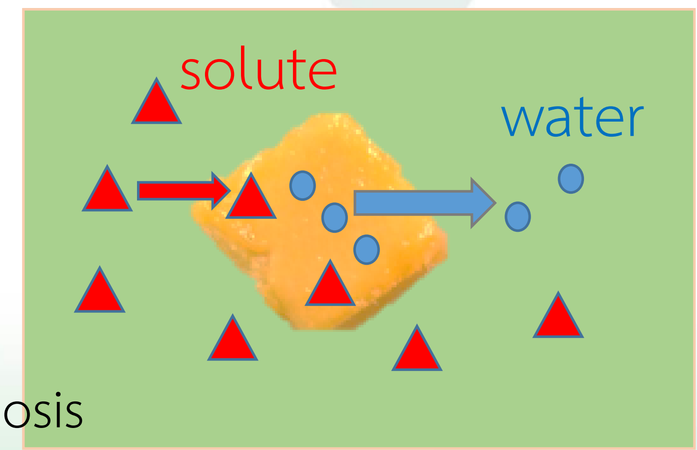
Degree of ripeness





Osmotic Dehydration

Osmotic dehydration (OD), which comprises two major counter flows i.e. inflow of solute into food and outflow of water from plant tissues (Khubber et al. 2020).



Osmosis

Equilibrium (immersion time)

Ripe mango flesh (plant tissue)

TSS = **16-17 °Brix** (sucrose and fructose)

Moisture content = 80%

Osmotic solution (OS)

for example sucrose solution at a concentration of **50 °Brix**

(for 500 g of OS, water = 250 g sucrose 250 g

Impact of raw materials and processing on product's shelf-life

Osmotic solutes

Sugars – sucrose, fructose, glucose

Sugar alcohol; sorbitol, mannitol, glycerol etc.

Honey

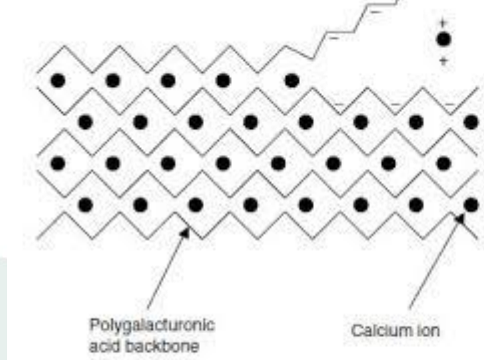
Maltodextrin

<u>Salt</u>

Reduce water activity in mango flesh

Impact of raw materials and processing on product's shelf-life

Pretreatment

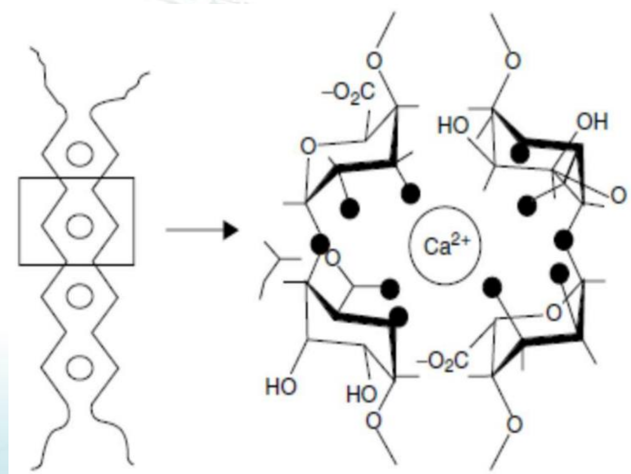


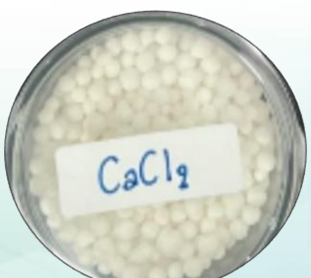
Accelerate the mass transfer – increase water loss and solid gain

Blanching, ultrasonic, vacuum etc.

Calcium ion, Ca^{2+} (Calcium chloride, calcium lactate)

- Pectin is the most structurally complex polysaccharide in plant cell walls. It has a significant influence on fruit softening.
- Fruit softening involves changes of the structural properties of pectin





Source: https://www.mdpi.com/1420-3049/23/4/942

Impact of raw materials and processing on product's shelf-life

Pretreatment

Enzymatic browning reaction

PPO

active at

pH 5-7

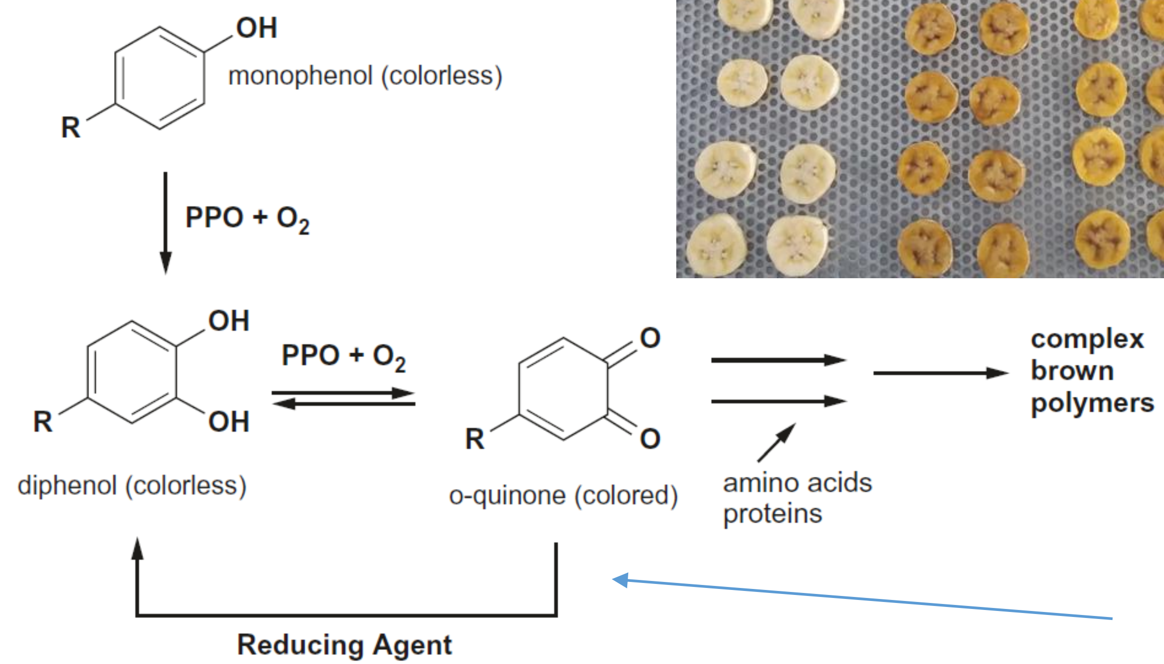
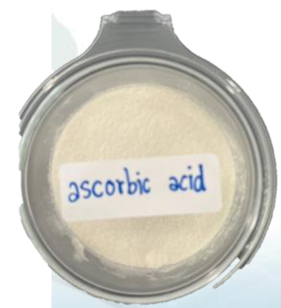


Fig. 6.1 The reaction catalyzed by polyphenol oxidase (Mayer and Harel 1979)



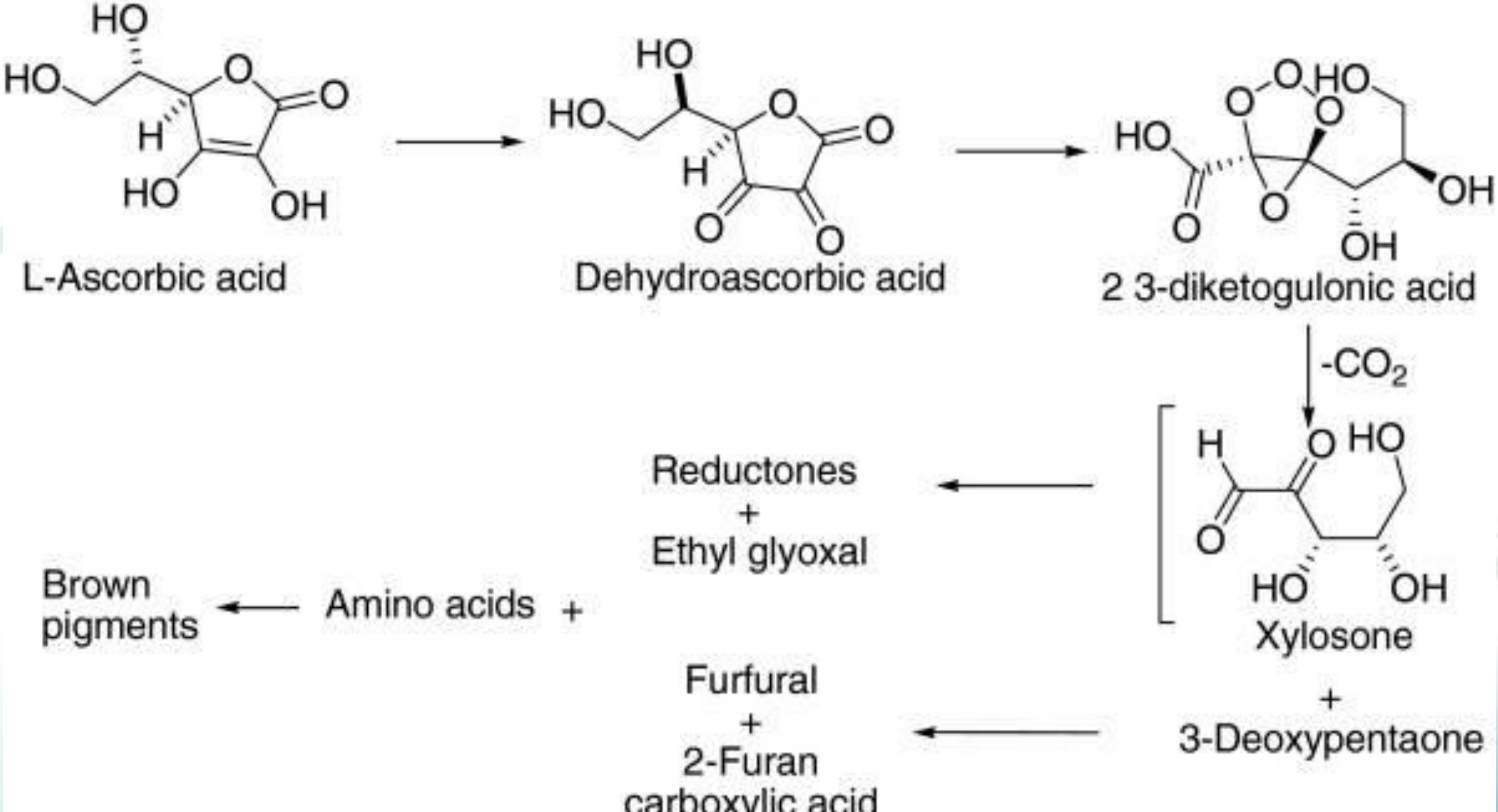
Reducing agents

https://doi.org/10.1007/978-981-10-5747-2_6

Impact of raw materials and processing on product's shelf-life

Pretreatment

Ascorbic acid degradation



https://dx.doi.org/10.1007%2Fs13197-012-0718-8

Sulfite agents

Sulphur dioxide

Sodium sulphite

Sodium bisulphite

Sodium metabisulphite

Potassium metabisulphite

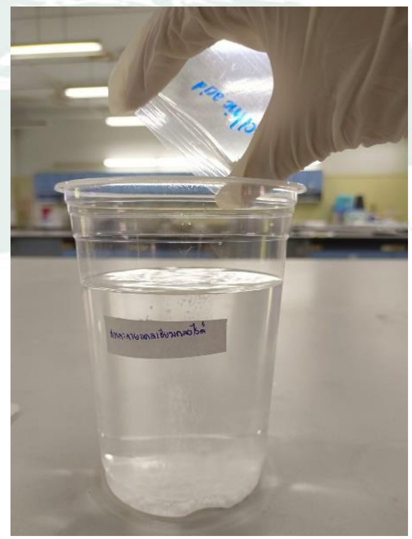
Potassium bisulphite

Potassium sulphite

No SO_2 with SO_2

Production of crispy coconut

Preparing of the pretreatment solution



Ingredients

1) Drinking water 600 mL
2) 1% Calcium Chloride = 6 g
3) 0.2% Citric acid = 1.2 g

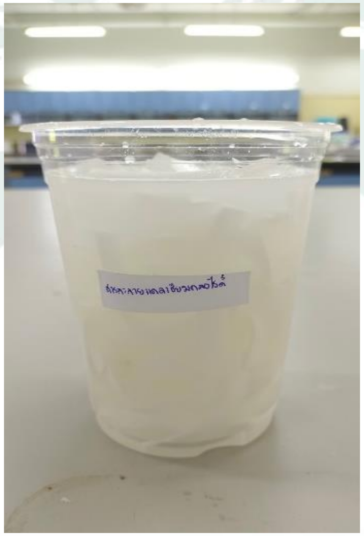
Immersion time 30 min

Production of crispy coconut

Preparing of coconut slices

Production of crispy coconut

Immersion in the pretreatment solution



Immersion time 30 min at ambient temperature approx. 30°C

Production of crispy coconut

Preparing osmotic solution



Sucrose solution at 35°Brix 1.5 L

Drinking water 975 mL sucrose 525 g salt 4.5 g heat up to 60°C and hold at this temperature for 5 min.

Production of crispy coconut

Blanching of coconut slices

Blanching in boiling water for 20 min. and cool down the slices to room temp.

Production of crispy coconut

Immerse in osmotic solution

Immerse for 1 hour

Production of crispy coconut

Drying of osmosis coconut slices

Dried using tray dryer at 70°C for 5 hour or solar dryer for 1 day

Production of crispy coconut

Baking dried coconut slices at 170°C for 2 min

Crispy coconut

Osmotic dehydration

Osmotic dehydration

Jackfruit

See video

https://www.youtube.com/watch?v=ftGgPM2xt8I

YouTube Channel Food Technology Silpakorn University

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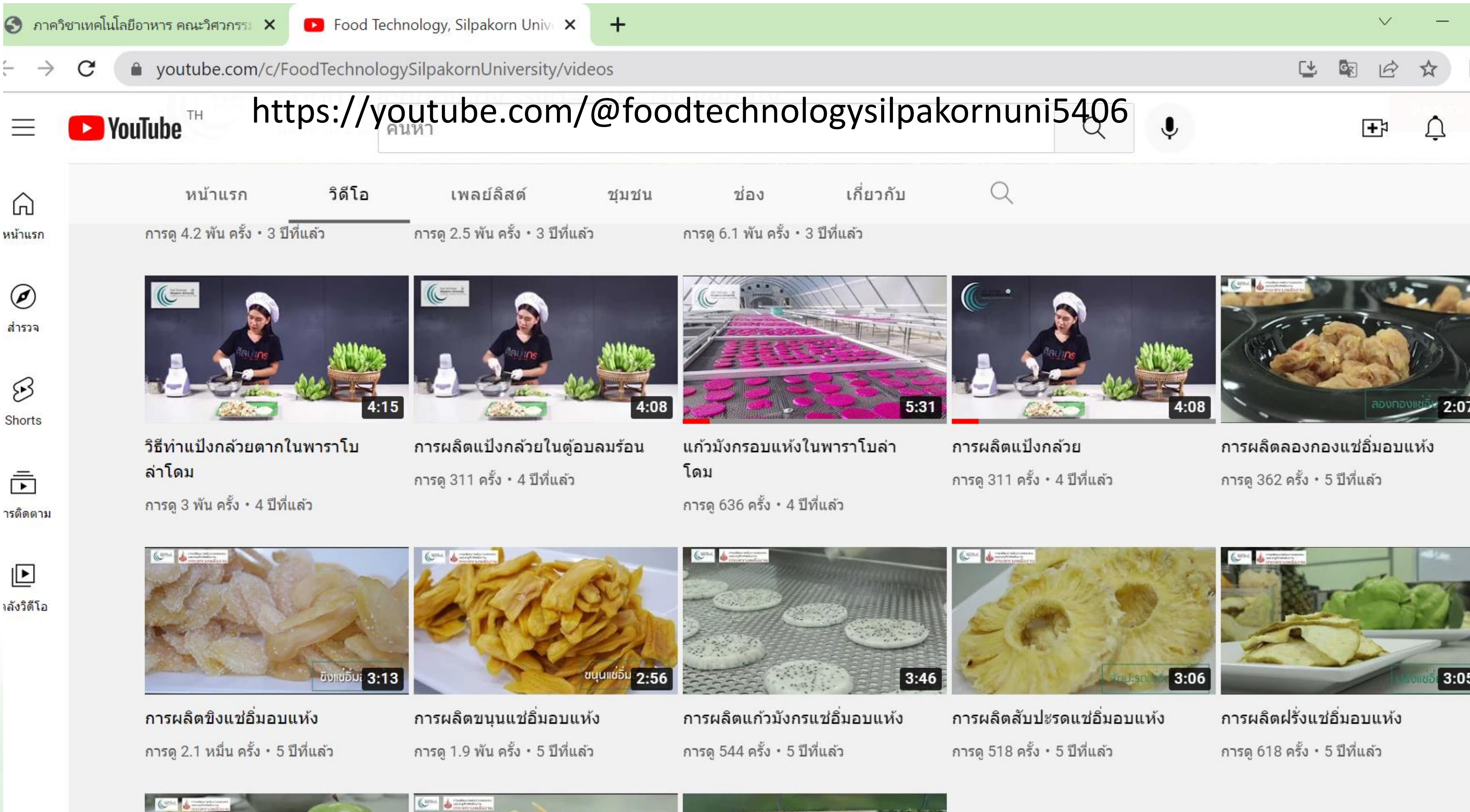

YouTube Channel Food Technology Silpakorn University

REFERENCES

Khubber, S., Chaturvedi, D., Gharibzahedi, S.M.T., M.S. Cruz, R.M.S., Lorenzo, J.M., Gehlot, R., Barba, F.J. (2020). Non-conventional osmotic solutes (honey and glycerol) improve mass transfer and extend shelf life of hot-air dried red carrots: Kinetics, quality, bioactivity, microstructure, and storage stability. LWT, 131, 109764.

THANK YOU FOR YOUR ATTENTION