



*foodwest*

**PAKASTEKUIVATUT AINESOSAT  
ELINTARVIKETEOLLISUUDEN JA FOOD SERVICE-  
SEKTORIN KOMPONENTTEINA**

**HARRI LATVA-MÄENPÄÄ  
INNOVAATIOJOHTAJA, FT  
FOODWEST OY**

**19.11.2020**

# FOODWEST OY

Elintarvikealan kehitysyhtiö, perustettu 1995

01

Toimipaikat Seinäjoki, Tampere ja Helsinki

02

Omistajina Etelä-Pohjanmaan alueen kunnat ja kaupungit sekä joukko yrityksiä

03

Liikevaihto n. 3 m€

04

Henkilöstöä n. 40

05

# FOODWEST OY. TIMANTTITEHDAS.



Ideamyly



Kuluttaja-  
ymmärrys

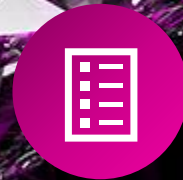


Tuotekehitys



Laatu- ja  
elintarvike-  
turvallisuus

04



Tuotetieto-  
palvelu



Valmistus



## ESITYKSEN SISÄLTÖ

Kuivausprosessit

Pakastekuivattujen  
ingredienttien markkinat

Raaka-aineet ja applikaatiot

# KUIVAUSPROSESSIT

Review (2020)

## Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs

”Drying is known as the best method to **preserve fruits, vegetables, and herbs**, decreasing not only the raw material volume but also its weight. This results in **cheaper transportation and increments the product shelf life, limiting the food waste**. Drying involves the application of energy in order to vaporize and mobilize the moisture content within the porous products. During this process, the heat and mass transfer occurs simultaneously.

The quality of dehydrated fruits, vegetables, and aromatic herbs is a key problem closely related to the development and optimization of novel drying techniques.....The quality parameters under study include **color, bulk density, porosity, shrinkage, phytochemicals, antioxidant capacity, sugars, proteins, volatile compounds, and sensory attributes**. In general, drying leads to reduction in all studied parameters. However, the behavior of each plant material is different. On the whole, the optimal drying technique is different for each of the materials studied and specific conditions must be recommended after a proper evaluation of the drying protocols.

However, a novel or combined technique must assure a high quality of dried products. Furthermore, the term quality must englobe the **energy efficiency and the environmental impact** leading to production of sustainable dried products.”



foodwest

# KUIVAUSPROSESSIT

Review (2020)

## Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs

Foods 2020, 9, 1261

8 of 27

Table 1. Characteristics of selected conventional drying methods.

Drying Method	Drying Agent	Feed Type	Mechanism	Advantages	Disadvantages	Application	References
Convective drying (CD)	hot drying air	Solids—fruits, vegetables, fruit and vegetable pomace	Moisture exchange between the food product and the hot air flowing through the drying chamber	Long shelf-life, simple design; Easy operation; Low cost	High inlet gas temperature or very dry gas; Long drying time, exposure to oxidation; Generates off flavors; Crust formation on the product surface due to the high temperatures	Food industry; Vegetable and fruit dry products; Pomace processing—functional ingredients production	[31,37–40]
Spray drying (SD)	hot drying gas (usually air)	Liquid—i.e., juices, purée, solutions, vegetable milk	Transformation of liquid product into dry powder form in one-step processing operation	Low moisture content and high-quality products; Long shelf-life; Similar size and shape of dried material; Continuous operation Lower cost than freeze-drying	Might lead to bioactive compounds loss and stickiness due to the high temperature, equipment size, products with large fat content require a defat process, high installation cost	Powder production; Microencapsulation; Production of instant powders	[41–44]
Freeze-drying (FD)		All types of food	Two steps process: (1) freezing the water from the raw material; (2) heating of the frozen solid to induce the moisture sublimation	Prevents oxidation damages; Minimize chemical compounds changes; Minimal shrinkage and shift of soluble solids; Retention of volatile compounds; Maintenance of porous structure	Very high facilities cost; Slow and expensive process	Production of heat-sensitive compounds i.e., vitamins, microbial cultures, and antibiotics; Production of high-quality products with high final cost: exotic fruits, vegetables, soup ingredients, mushrooms, and juices	[1,2]
Osmotic dehydration (OD)	sugar, salt (sodium chloride) solutions, concentrate juices, polyols solutions	Fruits, vegetables	Moisture reduction by immersion of the raw material in a high osmotic pressure solution → moisture transfer from the food to the solution driven by the difference in osmotic pressure	Maintenance of the physicochemical and sensory parameters; When carried out in concentrated juices might enhance product quality	High final moisture content; Usually needs further drying; High content of sugar or salt in the product when dehydrated in this type of solution; Difficulty in predicting final chemical composition when dehydrated in concentrated juices	Fruit chips production; Production of dried fruits i.e., plums as a pre-treatment before further drying	[45–48]
Intermittent drying	hot air, microwave power, vacuum and infrared	Fruits, vegetables	Intermittent microwave heating is led by applying microwave energy as sequential pulses, where power ratio has an important role in drying kinetics	Protect bioactive compounds, color, texture; reduce the browning effects and enhance the shelf life.	Higher power ratio can damage important compounds such as ascorbic acid.	Plant-based food material; Fruits: kiwi, papaya, banana, guava, carrot, etc.	[33,35,36]

# KUIVAUSPROSESSIT

Review (2020)

## Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs

All types of food	Two steps process: (1) freezing the water from the raw material; (2) heating of the frozen solid to induce the moisture sublimation	Prevents oxidation damages; Minimize chemical compounds changes; Minimal shrinkage and shift of soluble solids; Retention of volatile compounds; Maintenance of porous structure	Very high facilities cost; Slow and expensive process	Production of heat-sensitive compounds i.e., vitamins, microbial cultures, and antibiotics; Production of high-quality products with high final cost: exotic fruits, vegetables, soup ingredients, mushrooms, and juices
-------------------	---	--	---	--

Table 2. Effects of drying methods on the quality of dried materials.

Drying Method	Color	Structural Properties	Polyphenols Content	Antioxidant Activity	Volatile Compounds	Essential Oil (EO) Content	Sensory
Convective drying (CD)	color changes, generally darkening of the product (blueberries, black mulberries) improved color in case of blackcurrant powder	product hardening, high shrinkage, dense structure, low porosity, high bulk density; when combined with ultrasounds—higher capacity of dehydration in mushrooms, Brussel sprouts, cauliflowers	reduction of TPC in i.e., chokecherries, chokeberry, chokeberries, moringa leaves, and mango cubes	high reduction of antioxidant activity in many products (chokecherries, blueberries, chokeberries, mango cubes)	generally high loss of volatiles; higher content than for other methods on the studies on shitake mushrooms and chanterelle	higher yield of essential oil than during MD of herbs (rosemary and basil)	generate off flavors, decrease of fresh, floral, herbaceous attributes
Microwave drying (MD)	better preservation of color than CD	high porous materials in the studies in potato and carrots decreased porosity in the studies on apple and banana	retention of polyphenols in moringa leaves	retention of antioxidants in moringa leaves	high loss of volatiles, but lower than CD	better yield and preservation in basil and coriander	-
Vacuum drying (VD)	-	high porosity in the studies on apple and banana low porosity on the studies of potato and carrot	retention of polyphenols in moringa leaves	retention of antioxidants in moringa leaves	-	-	-
Vacuum-microwave drying (VMD)	Improved color in case of blackcurrant powder	low shrinkage in comparison to CD but higher than FD, porous structure, better than CD in the studies on chokeberries, faster reconstitution, lower bulk density than CD	higher than CD in the studies on sour cherries	higher than CD in the studies on sour cherries	higher loss of some compounds than CD	increased EO yield in garlic, higher loss of EO than CD of rosemary	decrease of fresh, floral, herbaceous attributes, increase of sweetness, bitterness and adhesiveness
combined convective drying followed by vacuum-microwave drying (CD-VMD)	Slight degradation of color (better than CD and VMD); Improved color in case of blackcurrant powder	lower bulk density than CD	higher than CD and VMD in the studies on sour cherries, chokecherries	higher than CD and VMD in the studies on sour cherries, Saskatoon berries, chokecherries	higher retention in the studies on chanterelle than other drying methods	increased EO yield in thyme, oregano, and rosemary	-
Freeze-drying (FD)	good preservation of natural color in many studies (i.e., black mulberries)	no shrinkage, no collapse, highest porosity, loss of elasticity, viscous material, lower bulk density than CD	preservation of TPC (black mulberry, chokeberries)	preservation of antioxidants	major loss in drying of parsley, low loss of flavor and aroma	preservation of most EOs	-
Osmotic dehydration (OD)	good preservation of color, change of color due to the osmotic solution properties (when concentrated juice is used as osmotic solution)	when combined with FD—strengthen the material structure when used as a pre-treatment before CD or CD-VMD—increase porosity lower bulk density than CD	increase when dehydrated in chokeberry, sour cherry solution, degradation in the studies on sour cherries	degradation in the studies on sour cherries increase when carried out in concentrated pomegranate and chokeberry juices	-	-	-
Heat pump drying (HP)	improved color in rosemary and parsley brown areas when applied on nuts	good preservation of the structure in some herbs than other drying methods	good preservation of polyphenols in drying of herbs	good preservation of polyphenols in drying of herbs	volatiles retention on the studies on ginger	-	-
Fluidized bed drying (FB)	good color retention	-	no significant reduction in kafir leaves	no significant reduction in kafir leaves	-	-	-
Refractance window drying (RW)	decreased browning reaction in pomegranate leather	positively affected	retention of polyphenols high content in pestil pomegranate	retention or improved antioxidant activity in the studies on asparagus, sweet corn and tomatoes high content in pestil pomegranate	-	-	-
Intermittent drying	reduce the color degradation	maintain the product microstructure obtaining a porous structure similar to the fresh sample	Retention of polyphenols	retention of ascorbic acid, carotenoids, and so increasing in the antioxidant activity	retains the lower volatile compounds (due to microwave energy penetration which accelerates the disruption of the cell membranes that ultimately releases the volatile compounds faster)	-	protect cells from oxidative injury, providing better sensory quality





Review (2020)

## Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs

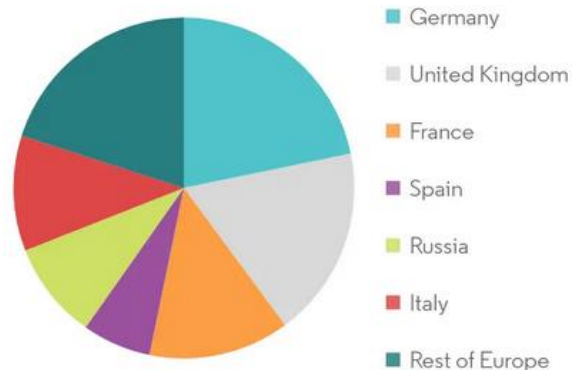
Freeze-drying (FD)	good preservation of natural color in many studies (i.e., black mulberries)	no shrinkage, no collapse, highest porosity, loss of elasticity, viscous material, lower bulk density than CD	preservation of TPC (black mulberry, chokeberries)	preservation of antioxidants	major loss in drying of parsley, low loss of flavor and aroma	preservation of most EOs	-
--------------------	---	---	--	------------------------------	---	--------------------------	---

# PAKASTEKUIVATTUJEN INGREDIENTTIEN MARKKINAT

- Europe Freeze-Dried Food Market - Growth, Trends, and Forecasts (2020 - 2025): <https://www.mordorintelligence.com/industry-reports/europe-freeze-dried-food-market>

Freeze-dried Fruits  
Freeze-dried Vegetables  
Freeze-dried Beverages  
Freeze-dried Coffee and Tea  
Other Freeze-dried Beverages  
Freeze-dried Meat and Seafood  
Freeze-dried Dairy Products  
Prepared Foods

Freeze Dried Food Market Share (%), Europe, 2019



Source : Mordor Intelligence



Market Summary  
CAGR 8.27 %



Source : Mordor Intelligence



foodwest

# PAKASTEKUIVATTUJEN INGREDIENTTIEN MARKKINAT

- **Global Freeze Dried Food Market (2017):** <https://www.marketresearch.com/Mordor-Intelligence-LLP-v4018/Global-Freeze-Dried-Food-11241068/>
- “The global freeze-dried product market is valued at **USD 46.94 billion in 2016** and is expected to grow at a CAGR of 7.4% by 2023. Companies such as Kellogg’s use freeze-dried ingredients (strawberries, banana, etc.) in their breakfast cereal products, giving rise to the freeze-dried ingredient market.”
- “Nestle, Asahi Group, Mondelez International, Unilever, Dohler and Tata Coffee dominate the global freeze dried food market. They occupy a total market share of 59% in the freeze-dried food market.”
- “**The restraining factor for the market is the availability of other drying techniques** such as spray drying, and fluid bed drying, which is relatively low-cost than freeze-drying. Freeze-drying equipment is **comparatively costlier than other** dryers, which is a major drawback for the small and medium scale industries.”



# PAKASTEKUIVATTUJEN INGREDIENTTIEN MARKKINAT

- <https://www.newfoodmagazine.com/news/106236/food-producer-reports-huge-rise-in-sales-of-freeze-dried-ingredients/>



Food producer reports huge rise in sales of freeze-dried ingredients

European Freeze Dry, which provides freeze-dried ingredients to the food and beverage sector, has cited changing consumer demands as the reason for such a rapid rise, with sales of ingredients such as brown lentils and red kidney beans driving the increase.

During the first six weeks of 2020, European Freeze Dry reportedly increased sales of its freeze-dried vegetables and pulses over the same time period in 2019 by an increase of 1,783 percent. Sales of vegetables and pulses in the first six weeks of 2020 have already outsold the first nine months of 2019 for European Freeze Dry.

“Consumer demands are changing significantly and quickly, and food producers are adapting to that new market with quality alternative products, such as plant proteins,” said Diana Morris, Country Manager for European Freeze Dry.

By Sam Mehmet (New Food)

27 February 2020

# PAKASTEKUIVATUT INGREDIENTIT

- <https://www.newfoodmagazine.com/news/105353/research-shows-freeze-dried-berry-powders-act-as-ice-cream-stabilisers/>

## Research shows freeze-dried berry powders act as ice cream stabilisers

By **Sam Mehmet** (New Food)

18 February 2020



Researchers from the US Department of Agriculture's (USDA) **Agricultural Research Service (ARS)** have shown some freeze-dried berry powders – especially freeze-dried strawberry powder – can act as outstanding stabilisers in **ice cream** and other frozen dairy desserts.

Freeze-dried strawberry powder is said to be so effective as a stabiliser that frozen dairy desserts with it included will maintain their shape even after reaching room temperature, according to **ARS** Research Food Technologist, Cristina Bilbao-Sainz.



foodwest

# PAKASTEKUIIVATUT INGREDIENTIT

RAAKA-AINEITA

MARJAT

HEDELMÄT

KASVIKSET

LIHA

KALA

KANANMUNA

SIENET

ÄYRIÄISET

MAUSTEET

AROMIT-  
JUTTEET

BIOAKTIIVISET  
JUTTEET

MAITO

MAITOHAPPO-  
BAKTEERIT

# PAKASTEKUIVATUT INGREDIENTIT



Blackcurrants



Blueberries



Caramelised Red Onion



Grilled Mixed Peppers



Cranberries



Raspberries



Red Kidney Beans



Cooked Brown Lentils



Cooked Diced Beef



Cooked Minced Beef



Langoustine



Shrimp



Cooked Diced Chicken - 6mm



Cooked Diced Chicken - 7-9mm



Diced Tuna



Vongole



Red Leicester Grated



Cheddar Grated



Mozzarella Grated



Omelette Diced

# PAKASTEKUIIVATUT INGREDIENTIT

TUOTEAPPLIKAATIOITA JA -KATEGORIOITA

VALMISRUOAT

JUOMAT,  
SMOOTHIT

LEIVÄT,  
LEIVONNAISET

LIHAN JA KALAN  
MAUSTAMINEN

LISÄ-  
KOMONENTTINA  
(SALAATIT,  
MUSLIT, JUGURTIT)

SNACK-  
TUOTTEET,  
MAKEISET

FINE  
DINING

FOOD  
SERVICE-  
RUOKALISTAT

KOSMETIIKKA

RAVINTO-  
LISÄT

FUNKTIO-  
NAALISET  
ELINTARVIKKEET

ELÄIN-  
TUOTTEET

OUTDOOR-  
TUOTTEET



# PAKASTEKUIVATUT INGREDIENTIT



Ready Meal Dishes



Noodle Cup



Crisp Flavouring



Pizza Ingredients



Cereals



Savoury Crackers



Savoury Bakes



Smoothies



Cold Beverage



Salad Toppers



# PAKASTEKUIVATUT INGREDIENTIT

[www.freeze-dry-ingredients.com](http://www.freeze-dry-ingredients.com)

[www.europeanfreezedry.com](http://www.europeanfreezedry.com)



*foodwest*

# TUOTEKEHITYS JA VALMISTUS

KAUPALLINEN TUOTEKEHITYSPROSESSI

raaka-aineet

valmistusteknologia

volyymi

**UUDEN  
TUOTTEEN  
KEHITTÄMINEN**

säilyvyystavoite

hinta/  
kannattavuus

ravitsemuksellisuus

lainsäädäntö

aistittavat ominaisuudet





Ideointi

Reseptikehitys

Raaka-  
ainetestaus

Aistivarainen  
arviointi

Säilyvyystestaus

Hyvä idea alkaa kukoistaa vasta, kun **tuotekehityksessä** huomioidaan loppuasiakas, tuotanto ja kauppa.

# SUKELLA KULUTTAJAN MAAILMAAN



Kuluttajatesti 1

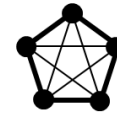
Kuluttajatesti 2

PERINTEINEN  
TUOTEKEHITYS

kuluttaja mukana harvoin ja tietyssä vaiheissa

TUOTEKEHITYS KULUTTAJAN KOTONA

*foodwest* 24/7



Kuluttajat aktiivisesti mukana verkossa tuoteideoinnista lanseeraukseen asti.



Digitaalisen alustan kautta tuotekehittäjät ovat kuluttajien kodeissa 24/7.



Vahva elintarvikealan ja kuluttajien ymmärrys, johdettu kuluttajan osallistaminen.

# PAKASTEKUIIVATUT INGREDIENTIT

## POHDITTAVIA ASIOITA I

- Lisäarvotekijät
  - säilyvyys ja helppokäyttöisyys (vrt. helposti pilaantuvat tuoretuotteet ja pakasteet)
  - kuivausmenetelmän hellävaraisuus (vitamiinit, lämpötilaherkät ainesosat)
  - intensiivinen maku, tuoksu ja väri
  - ulkonäkö
  - rakenne, suutuntuma, tekstuuri
  - erittäin monipuoliset käyttömahdollisuudet sekä kuluttajatuotteiden että Food Service-sektorin raaka-aineena
  - HUOM! Onko lisäarvotekijät edelleen relevantteja lopputuotteen prosessoinnin jälkeen (mahdolliset lämpökäsittelyt yms.)?
- Hinta mahdollisesti haasteena
  - sopivat tuoteryhmät ja –kategoriat löydettävä markkinoilta
  - mahdollinen korkeampi hinta pystyttävä perustelemaan lisäarvotekijöillä

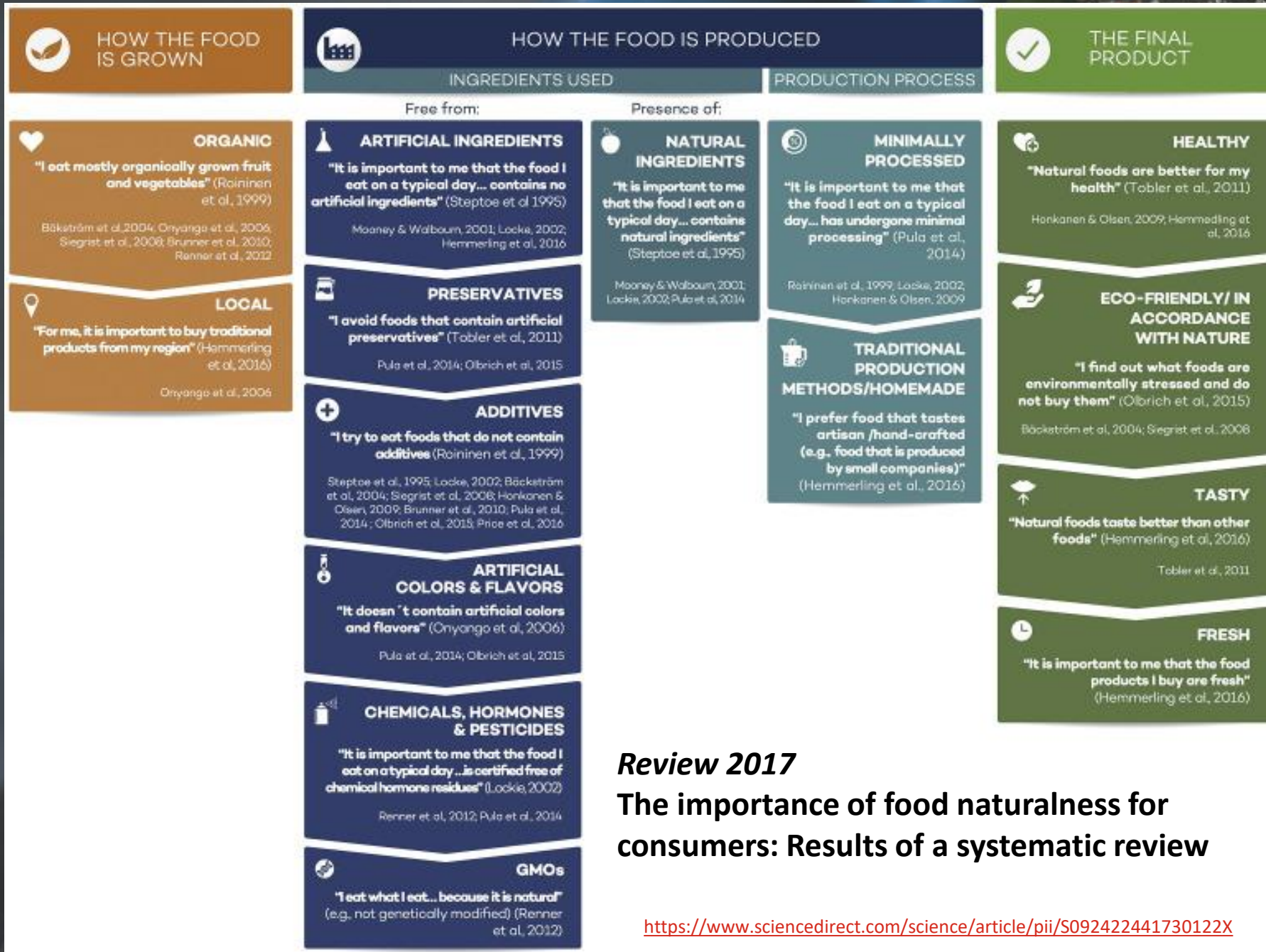


# PAKASTEKUIIVATUT INGREDIENTIT

## POHDITTAVIA ASIOITA 2

- Vienti-näkökulma
  - ❑ pakastekuivaus saattaa olla jo normina tietyillä markkinoilla (pääsyvaatimus markkinoille)
  - ❑ kaupallinen kannattavuus kriittisenä asiana
- Kuivausprosessi ja muut teknologiset tarpeet/investoinnit: koko prosessin hallinta ja toimiva skaalaus
  - ❑ tehokkuus, energia-asiat, jatkuvatoimivuus vai batch, manuaalisen työn tarve
- Ei kuivauskäsittelyä (mikrobiologinen kuorma haastavien raaka-aineiden osalta?)
- Allergeenit, hygienia ja niiden hallinta (erilaiset raaka-aineet samassa tilassa)





LUONNOLLISUUS

**Review 2017**  
**The importance of food naturalness for consumers: Results of a systematic review**

<https://www.sciencedirect.com/science/article/pii/S092422441730122X>



**Kiitos!**

*foodwest*

