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LA SOSTENIBILITÀ DELL'ACQUA NEI SISTEMI AGROALIMENTARI

Mercoledì 15 gennaio 2025 | Ore 14.15 - 15.30

Online - piattaforma Zoom

Membrane Processes in the Food & Beverage Industry

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1859

Classical and Developing Membrane Uses

Dairy:

- Removal of bacteria and spores
- Separation and fractionation of casein, proteins
- Concentration and demineralization of whey

→ **New products** (fat globules).

Wines:

- Clarification
- Stabilization

→ Reduce **alcohol content**.

Juices:

- Clarification
- Concentration
- Deacidification

New products (low sugar, bioactive compounds, natural aroma); **sensitive substances**.

Beers:

- Clarification

→ Reduce **alcohol content**.

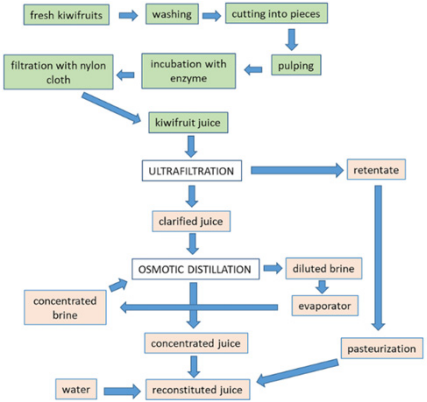
High selectivity toward substances of different size and properties

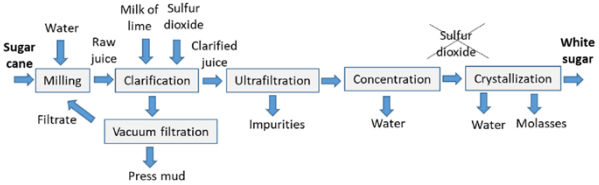
Possibility to **reduce or eliminate chemicals**

Extraction of **high-vaulable and sensitive substances.**

Water management and water reuse/recycling

Examples: Kiwifruit Juice and Sugars





from: Charcosset, Food Engineering Reviews (2021) 13:322–343, https://doi.org/10.1007/s12393-020-09262-9

Water Consumption in EU Food Factories

Food Industry	Product	Unit	Specific water consumption
Dairy	Milk	$m^3.ton^{-1}$ of raw materials	0.33–12.61
	Cheese	"	0.24–4.9
	Powder milk	"	0.50–4.27
Fats and oils	Oilseed/ vegetable oil	$m^3.ton^{-1}$ of oil produced	0.2–4.5
	Olive oil	"	2.16–10.29 (3 installations)
Fruits, vegetables and agricultural	Potatoes	$m^3.ton^{-1}$ of products	10
	Tomato	"	2.5–9
	Fruits and vegetables	"	1–15
	Sugar beet	$m^3.ton^{-1}$ of beets	0–0.9
	Soft drinks and nectar/juice	$m^3.hL^{-1}$ of products	0–0.3 (maximum at 5.1)
Beverage	Beer	$m^3.hL^{-1}$ of products	0.2–0.6 (maximum at 3)

from: Garnier *et al.*, Journal of Food Engineering 344 (2023) 111397, https://doi.org/10.1016/j.jfoodeng.2022.111397

Specific Uses

Water consuming activity	Beverage (%)	Meat processing (%)	Vegetable (%)	Dairy (%)
Ingredient	60	0	0	0
Plant cleaning	25	48	15	49
Cooling towers	2	2	5	6
Process operations	8	47	78	42
Auxiliary use	5	3	2	3

from: Garnier *et al.*, Journal of Food Engineering 344 (2023) 111397, https://doi.org/10.1016/j.jfoodeng.2022.111397

Examples of Successful Reuse/Recycling

Dairy:

Origin: flushing water

Typical treatment: NF or RO

Use of reused water: heating, cooling, cleaning (quality often higer than potable water)

Beverages:

Origin: bottle washing, tank rinsing

Treatment: NF or RO

Use of reused water: cleaning, rinsing, irrigation (quality often higer than potable water)

Fruits and Vegetables:

Origin: washing cooking

Treatment: MF, NF or RO

Use of reused water: cleaning, first washing

Vegetable Oils:

Origin: mill

Treatment: UF, NF or RO

Use of reused water: irrigation, safe discharge

Case Study 1 @PoliTo Water Recycling in the Beer Industry

Parameter	Input Composition	Required Quality
Salinity	3 mS/cm	0.08-0.1 mS/cm
pH	7.7	8-8.5
TDS	2500 ppm	100 ppm
TOC	9.5 ppm	-
Hardness	47.3 fH	4-5 fH

→ **DESALINATION** REQUIRED

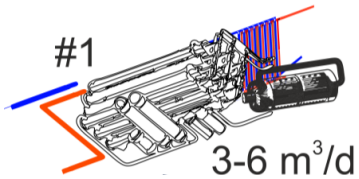
Availability of **waste heat** from spent grains discharge (80-90 °C)

MELODIZER

Funded by the European Union

Sustainable membrane distillation for industrial water reuse and decentralised desalination approaching zero waste

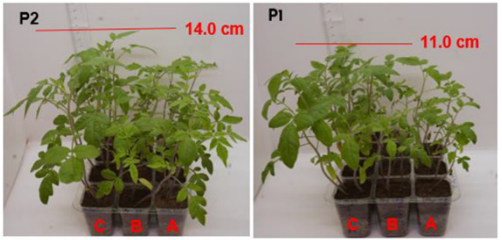
www.melodizer.eu



Case Study 2 @PoliTo
Water Recycling from Fuel Cells

Parameter	Input Composition	Required Quality
Salinity	5.7 µS/cm	as pe: REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
pH	7.6	
TDS	Very low	
TOC	3.2 ppm	
TN	< 1 ppm	

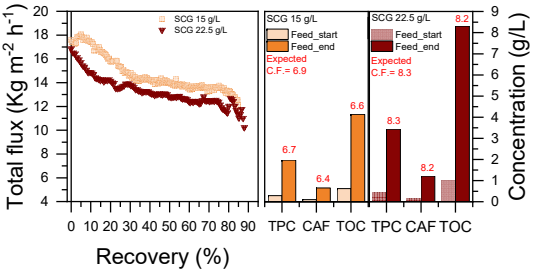
→ **DISINFECTION** and **CONTROLLED MINERALIZATION** REQUIRED for irrigation purposes



Case Study 3 @PoliTo Water Recycling and Substance Extraction in the Coffee Industry

→ **CONCENTRATION** REQUIRED for substance extraction:

- Caffeine
- Flavonoids/polyphenols



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