

Coffee Concentration

Using Aquaporin Inside® forward osmosis



UNIQUE CUTTING-EDGE PRODUCT



**HIGH RETENTION
OF AROMAS AND
FLAVORS**



**QUALITY-
ENHANCING**



**SUPER
CONCENTRATION**



**EASY
RETROFITTING**



**NOVEL
PRODUCTS**

- ✓ 20 – 9,000 times higher aroma retention compared to thermal concentrate
- ✓ Novel and high-quality products can be derived from concentrated coffee
- ✓ Super concentrated aromas to develop new products

- ✓ The Aquaporin Inside® FO process can easily be retrofitted to existing processes and customized according to manufacturing needs
- ✓ Simple flush cleaning with water to sustain process performance

MAKE IT TASTIER

Through processing, volatile aromas and flavors are lost in many industries such as the food & beverage, biotechnology, and cosmetic industries. The losses are caused by numerous factors like thermal treatments and transfer of odor compounds from packaging material. Some of those aromas and flavors are significant; however, their losses cannot be avoided entirely.

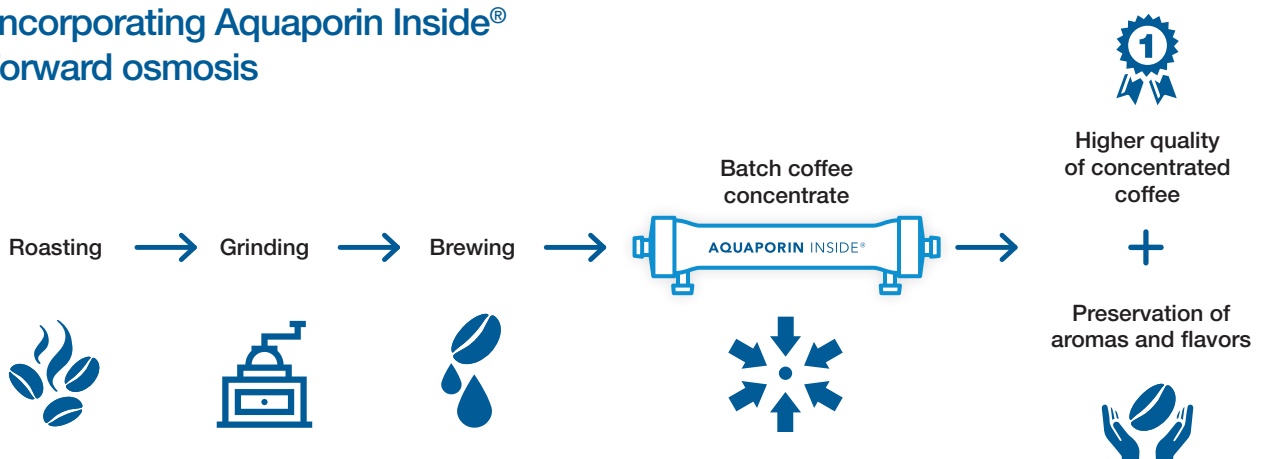
Obtaining desirable quality becomes a challenge as taste and smell are crucial attributes for consumer interest. Consequently, recovering these losses becomes necessary to enhance the quality of the products to remain attractive for the end-consumers. Forward osmosis is a novel technology that can maximize the quality. Implementing FO in the process will enhance the quality of products and obtain desirable levels of aromas and flavors.

ENHANCING AROMAS AND FLAVORS IN COFFEE CONCENTRATION USING FORWARD OSMOSIS

Conventional process



Incorporating Aquaporin Inside® forward osmosis

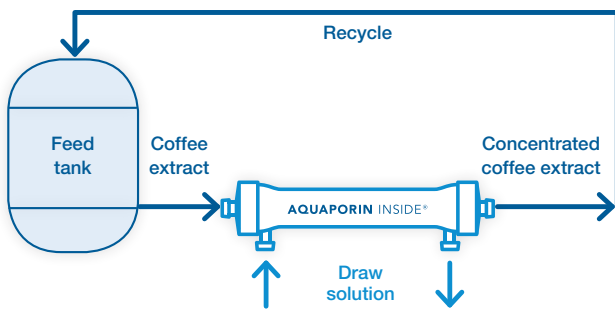


CASE STUDY

Coffee aroma concentration using Aquaporin Inside® HFFO2

Method

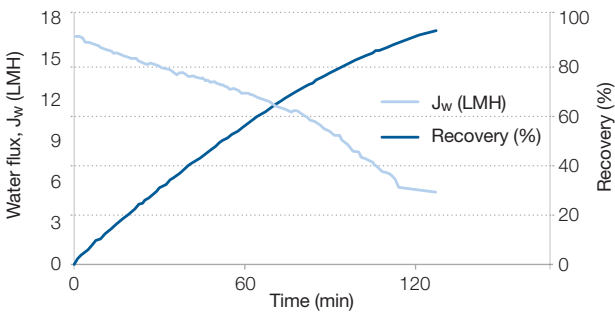
A lab-scale study using Aquaporin Inside® HFFO2 was carried out to validate the technical feasibility. Experiments were performed in FO mode where the active layer of the membrane was facing the feed side.



Mode of operation	Feed solution in batch mode Draw solution in continuous mode
Feed solution	60L organic coffee extract
Draw solution	1.5 M MgCl ₂
Operating conditions	1 LPM Feed inlet 0.4 LPM draw inlet < 1.0 bar TMP FO mode (feed in lumen side), co-current, 25°C
Membrane type	Aquaporin Inside® HFFO2 module (2.3m ²)
Membrane QC	Before and after coffee concentration

Results

- ✓ 30x concentration of coffee in 2 hours (96% recovery)



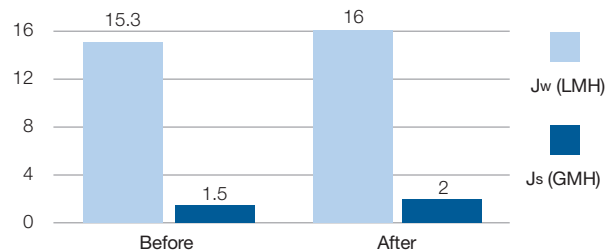
Solution type	Initial sample	Concentrate sample
Description	60L organic coffee extract	Coffee concentrate @ 96% recovery
Volume (L)	60	2
TDS (%)	1.6	38.7
Brix (°)	2.1	45.5
VCF	1	30
pH	5.2	5.2

High-quality concentrate coffee

Compound	Fresh coffee extract (µg/kg)	FO concentrate (µg/kg)	FO draw solution (µg/kg)	Thermal concentrate (µg/kg)
2,3-Pentanedione (100.1 g/mol)	1,516	26,096	0	461
Ethylpyrazine (94.1 g/mol)	5,568	114,778	2	13
Furfural (96.1 g/mol)	6,190	105,093	3	1,152
2-acetylpyrazine (122.1 g/mol)	1,734	38,253	0	1,814
4-vinyl guaiacol (150.2 g/mol)	9,295	179,231	62	5,237

Quality control test

Aquaporin Inside® HFFO2 module performance is fully recovered after coffee concentration and water flushing.



EXTENDING TO OTHER PRODUCTS



Natural food flavor concentration



Fragrance concentration



Tea extract dewatering

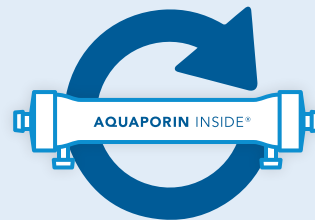
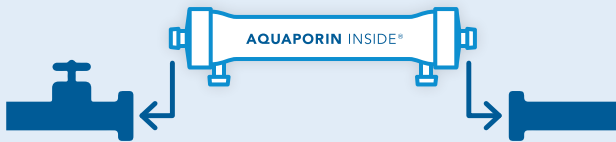


Alcoholic drink concentration



Pharmaceutical and nutraceutical concentration

CONCLUSIONS



Aquaporin Inside® FO can easily be retrofitted to existing processes to recover losses of flavors and aromas. It can deliver high-quality and highly concentrated coffee extracts. Overall, FO can be widely applied in many industries where flavor and aroma recovery is essential.

About Aquaporin

Aquaporin A/S is a global water technology company located in Denmark.

Aquaporin is dedicated to revolutionizing water purification with its novel membrane technology.

The main goal of Aquaporin is to develop the Aquaporin Inside® technology which is capable of separating and purifying water from all other compounds.

The Aquaporin Inside® platform uses biotechnological principles in a technological context which is a novel upcoming field with large commercial perspectives. This is a field where Denmark has taken an early global lead.

About Pure Water Enterprises Pvt. Ltd.

Pure Water Enterprises Pvt. Ltd. is a leading environment technology and service distributor over the last 20 years in Western India.

It is located in Mumbai, the commercial capital and gateway for the largest industrial zones in India.

Pure Water Enterprises has successfully forged strong relationships with more than 1000 end-users, systems integrators, and consultants in the region. Pure Water Enterprises provides both facilities to carry out trials and systems for commercial applications. For more information, please contact Pure Water's experts at info@purewaterent.net or **+91 22-24715665**.

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