

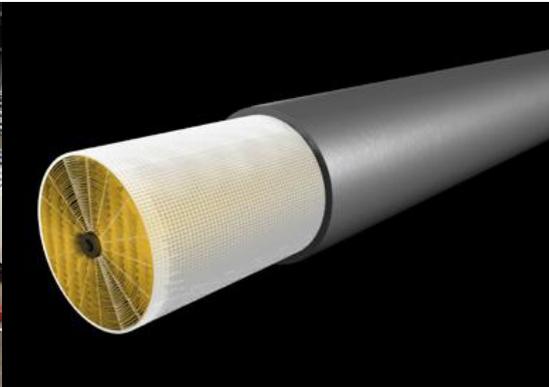
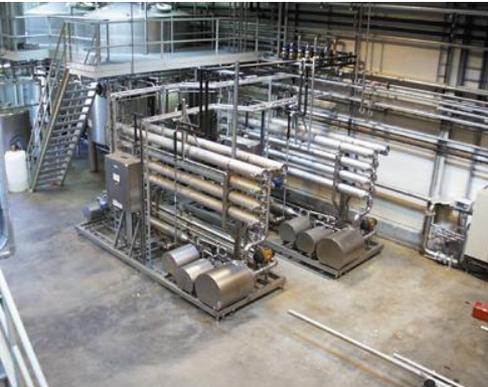
Membranteknikk a.s

Membrane filtration of stickwater.

Recent development and application examples.

Odd Henning Sirnes, Membranteknikk a.s.

Rasmus Gundersen, AGIA Engineering and Consulting



Membrane filtration “milestones” in the fish meal industry.

1985: Research projects executed by SSF.

1988: ELCRACK project including membrane system.

1992: Installation of membrane filtration purification system at Egersund Sildoljefabrikk.

Plus various reported special application systems.

Characteristics/ conclusions from previous projects.

Partly successful up to 20% concentration level.

The presence of oil causing fouling problems.

Interesting aspects with respect to potential of desalination.

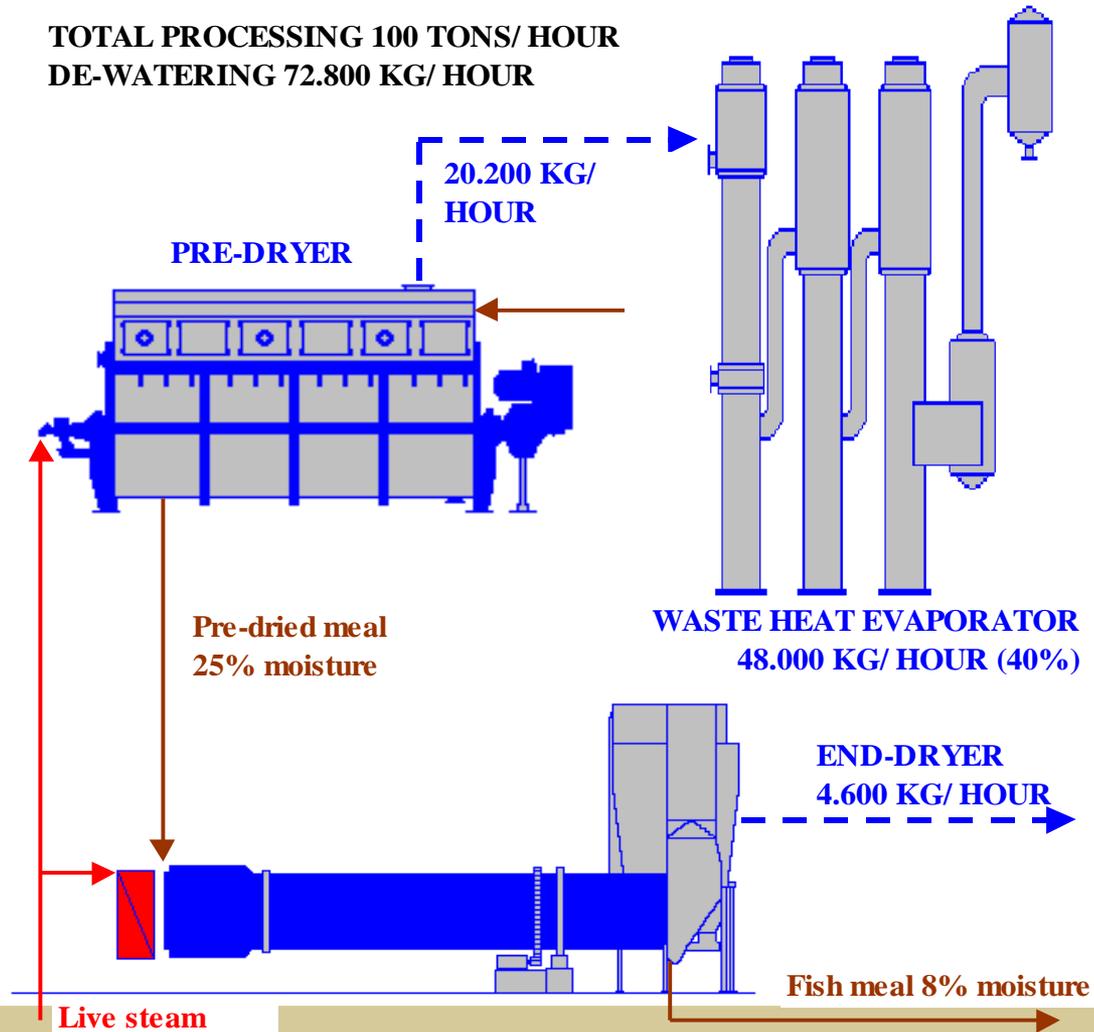
So far the membrane filtration technology considered as partly premature applied in the fish meal process.

Incentives for re-introducing the membrane filtration alternative.

- Solution for easy installation and less complicated capacity increase in existing de-watering systems.
- De-watering alternative in restricted energy regimes (limited steam, waste heat).
- Easy operation (Automatic/ CIP).
- Improving product quality by removal of non-attractive constituents.
- Improvement of environmental aspects.

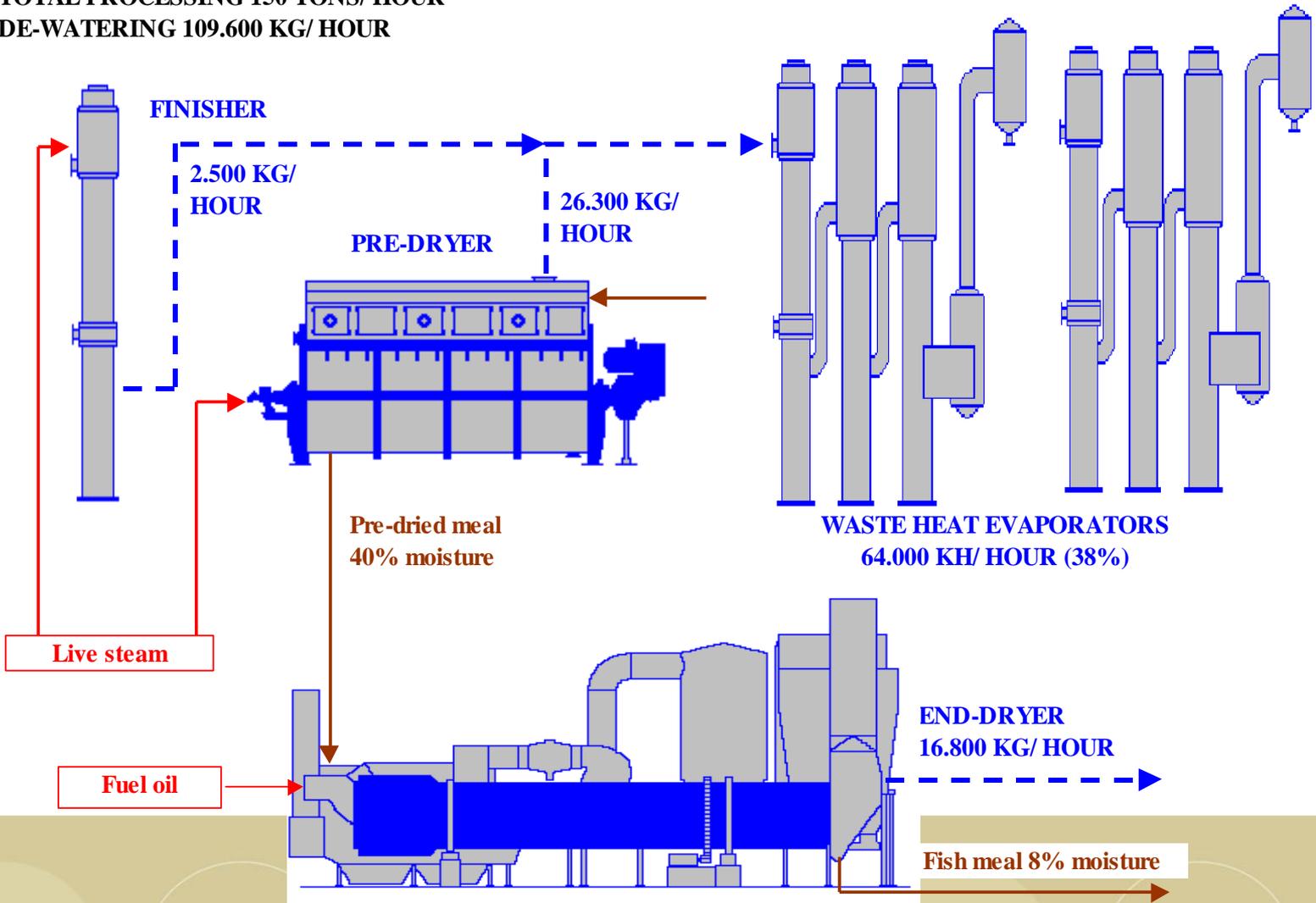
Original de-watering model.

TOTAL PROCESSING 100 TONS/ HOUR
DE-WATERING 72.800 KG/ HOUR



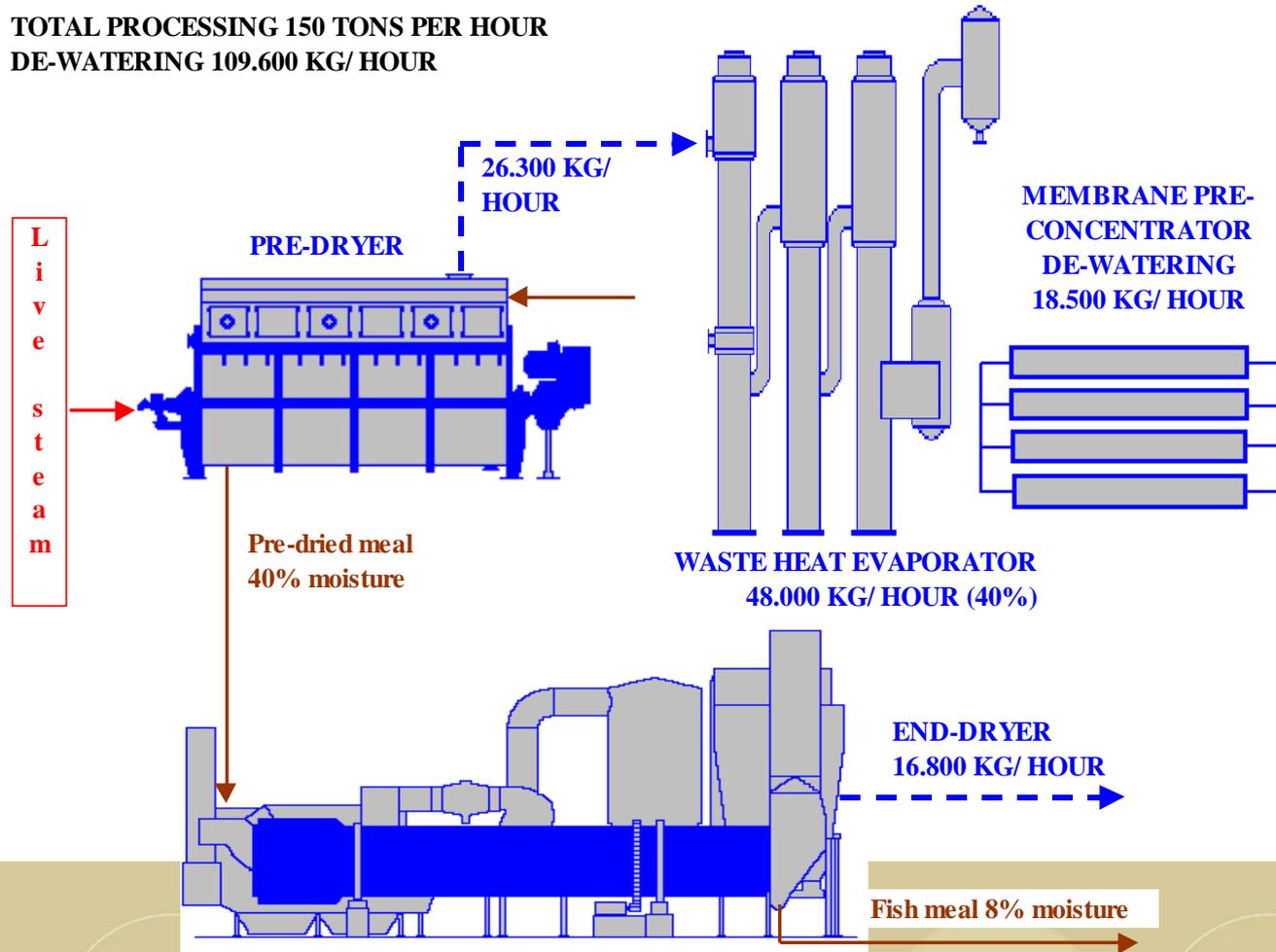
Expanded de-watering model.

TOTAL PROCESSING 150 TONS/ HOUR
DE-WATERING 109.600 KG/ HOUR



Alternative expanded model.

TOTAL PROCESSING 150 TONS PER HOUR
DE-WATERING 109.600 KG/ HOUR

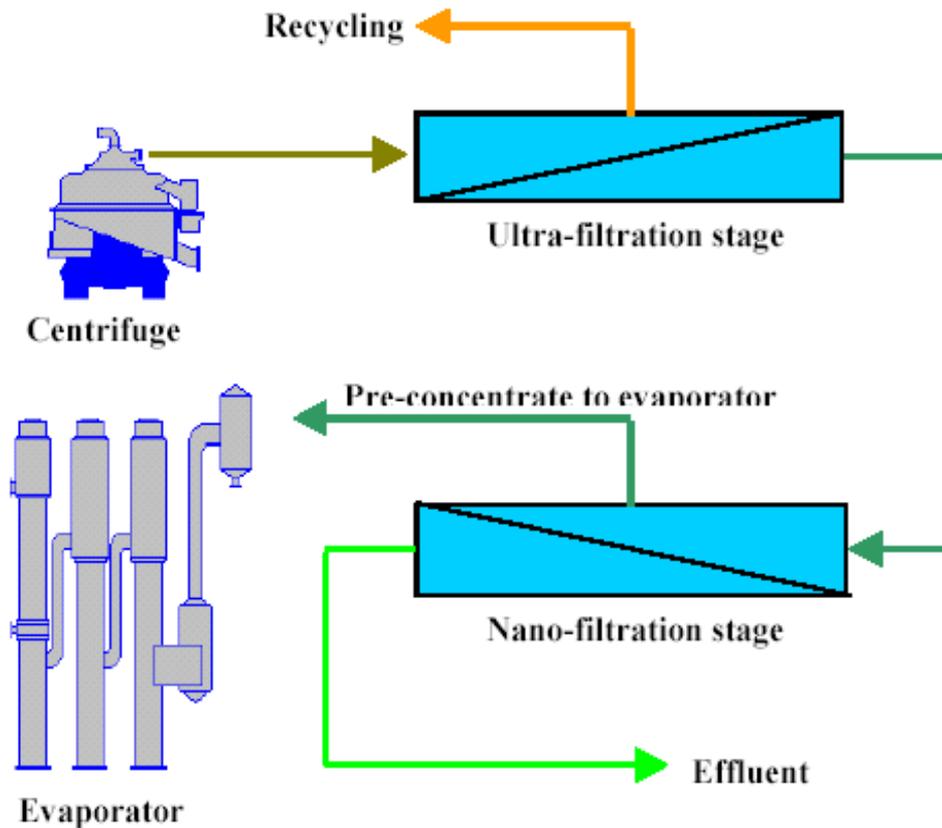


Proposed solution for the alternative expanded model.

2-stage membrane filtration system, implying:

- Complete de-oiling by use of special ultra-filtration membranes in first stage.
- Subsequent de-watering through second stage operating in Nano-filtration mode.

Process implementation.



Technology features.

- Very efficient de-watering up to 20-25% concentration level.
- Complete de-oiling of the stickwater fraction.
- High desalination efficiency. Can be boosted by expanding to dia-filtration.
- Significant improvement of the subsequent evaporation process. Increased evaporation velocity and radical reduction of fouling.

Technology features (B).

- Unique alternative for reducing the dioxin/ PCB problem.
- The obvious solution for desalination of fish meal.
- Generating new and interesting opportunities in the development of new product qualities of fish meal.
- Very attractive alternative for increasing the capacity in existing de-watering systems.

Alternatives for reducing the residual oil content (dioxin/ PCB) in fish meal.

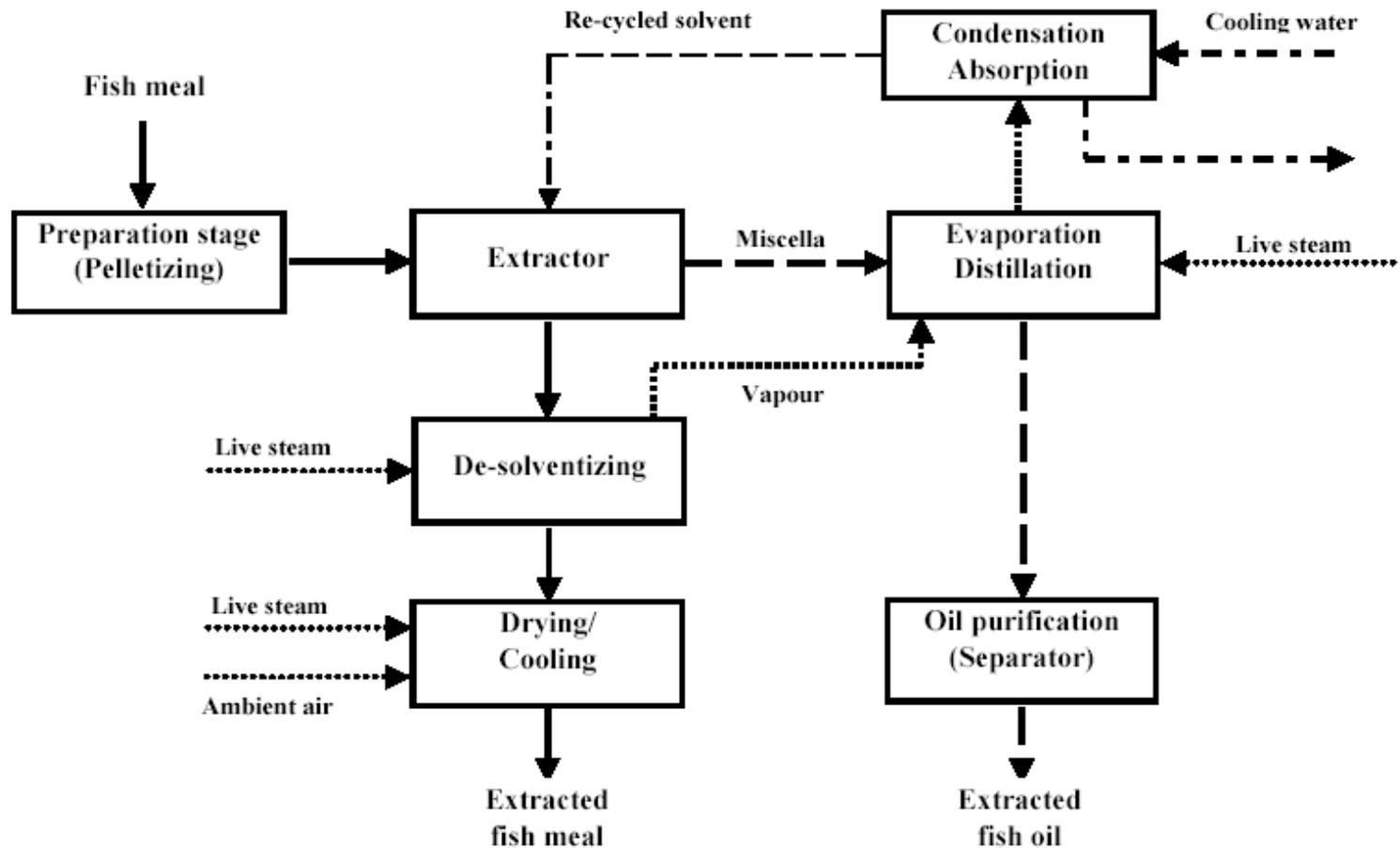
Alternative 1:

Conventional solvent (hexane) extraction process.
Enabling a fish meal with residual oil content of 2-3%.

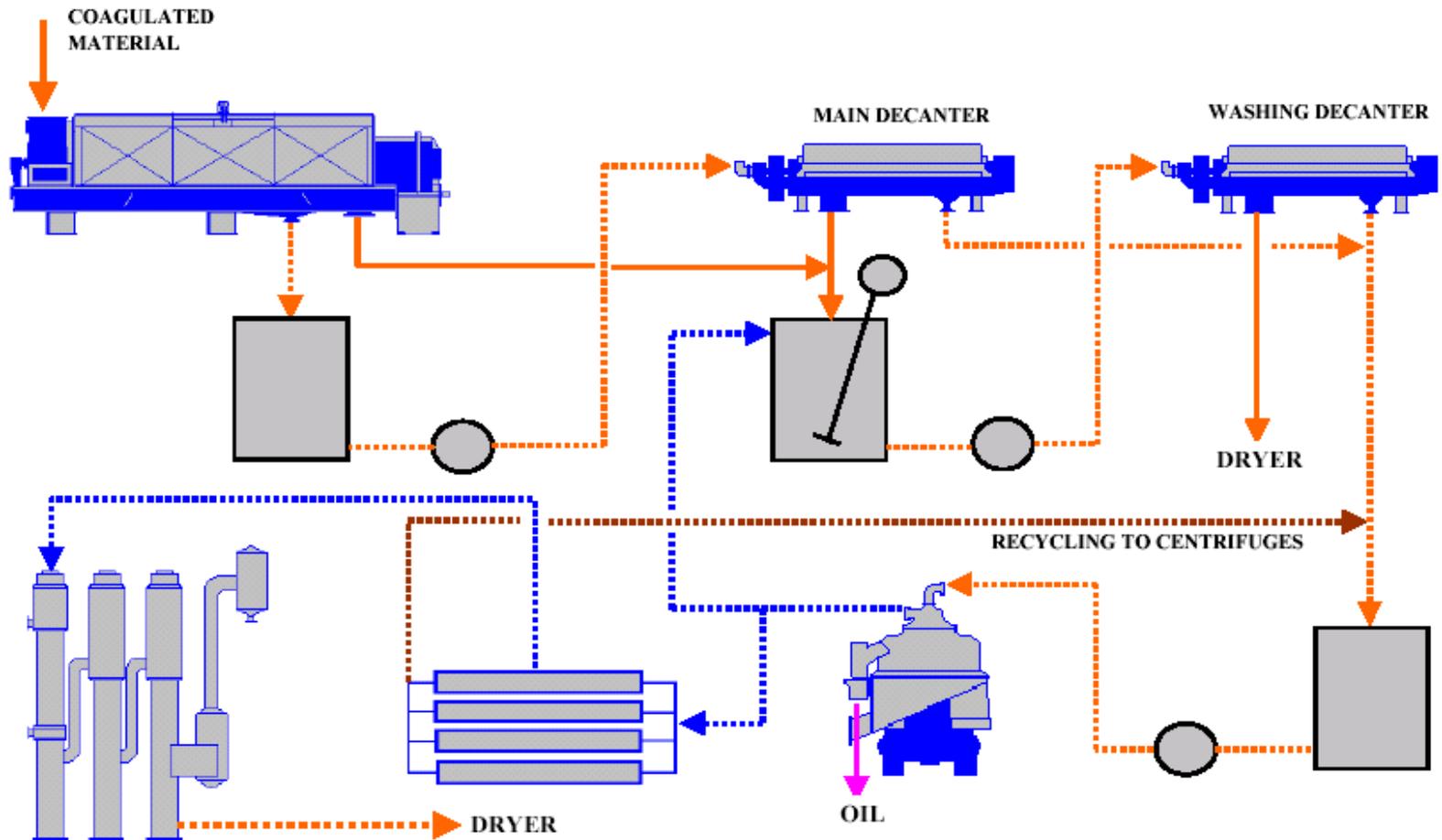
Alternative 2:

Improved de-oiling of solid fractions by implementing hot liquid extraction stage combined with membrane filtration and improved high speed separation of the stickwater fraction. Enabling a fish meal with residual oil content of 3-4%.

Solvent extraction process.



Hot water extraction process including membrane filtration system.



Membranteknikk a.s

Consists of two persons.

Working with niches i.e special applications for more than 15 years.

Our market is world wide.

The production of the systems are made in Denmark.

All systems manufactured in 316L materials or better!

Two Pilot-plants available for field testing.

References:

Amersham Health AS – Lindesnes Fabrikker
Tine Norske Meierier
Landteknikk AL
Synnøve Finden ASA
Medpallet Pharmaceuticals AS
Trio Ving AS
ABB Skien
Becromal Norway AS
Vennesla Kommune
Åseral Kommune
Valio OY, Finland
Egersund Sildoljefabrikk AS

Spiral Wound membranes

We only work with this element configuration.

High membrane area compared to demand of space.

Cross flow – Tangential flow, keeps the membrane clean.

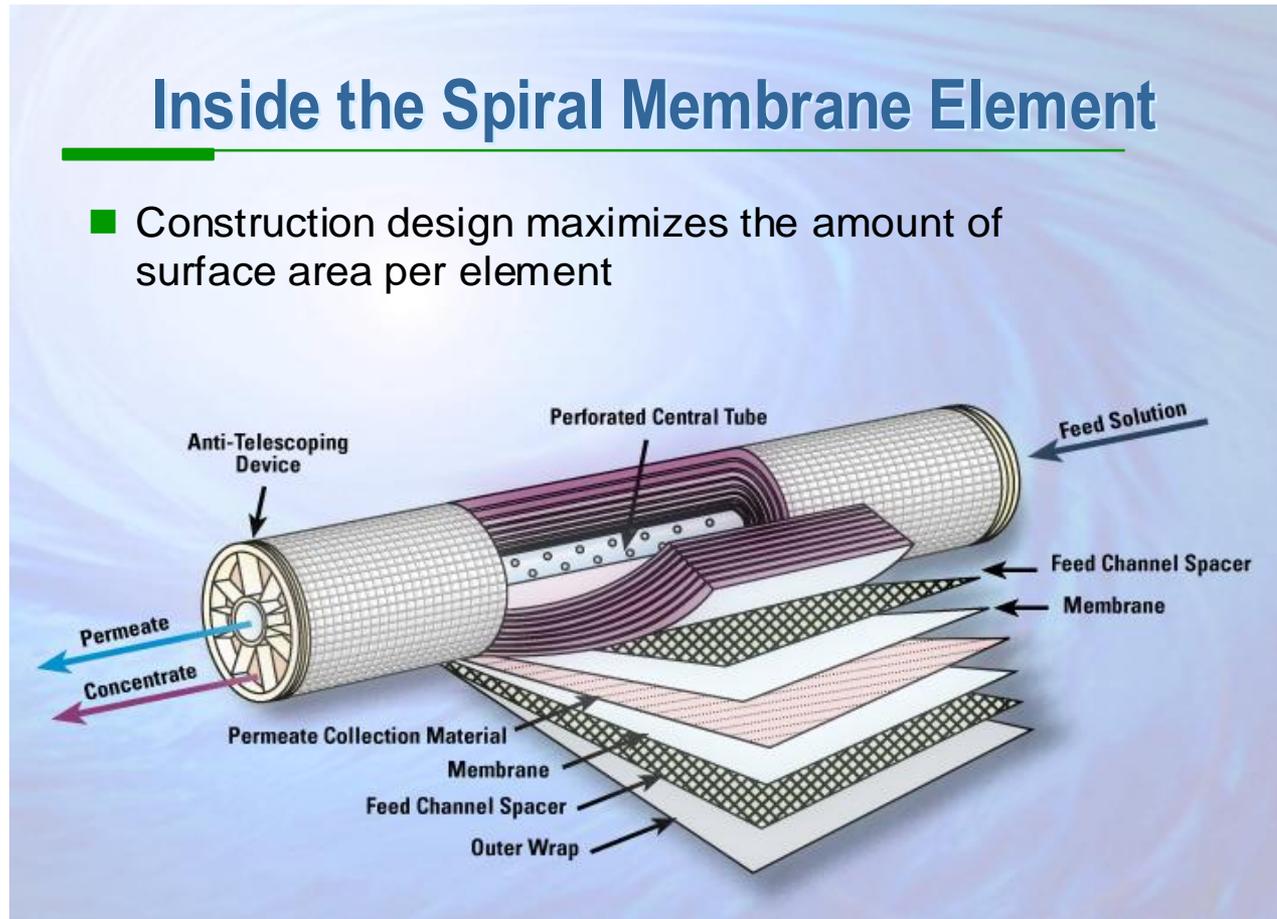
Fouling.

UF – NF – RO filtration.

Spiral Wound membranes.

Inside the Spiral Membrane Element

- Construction design maximizes the amount of surface area per element

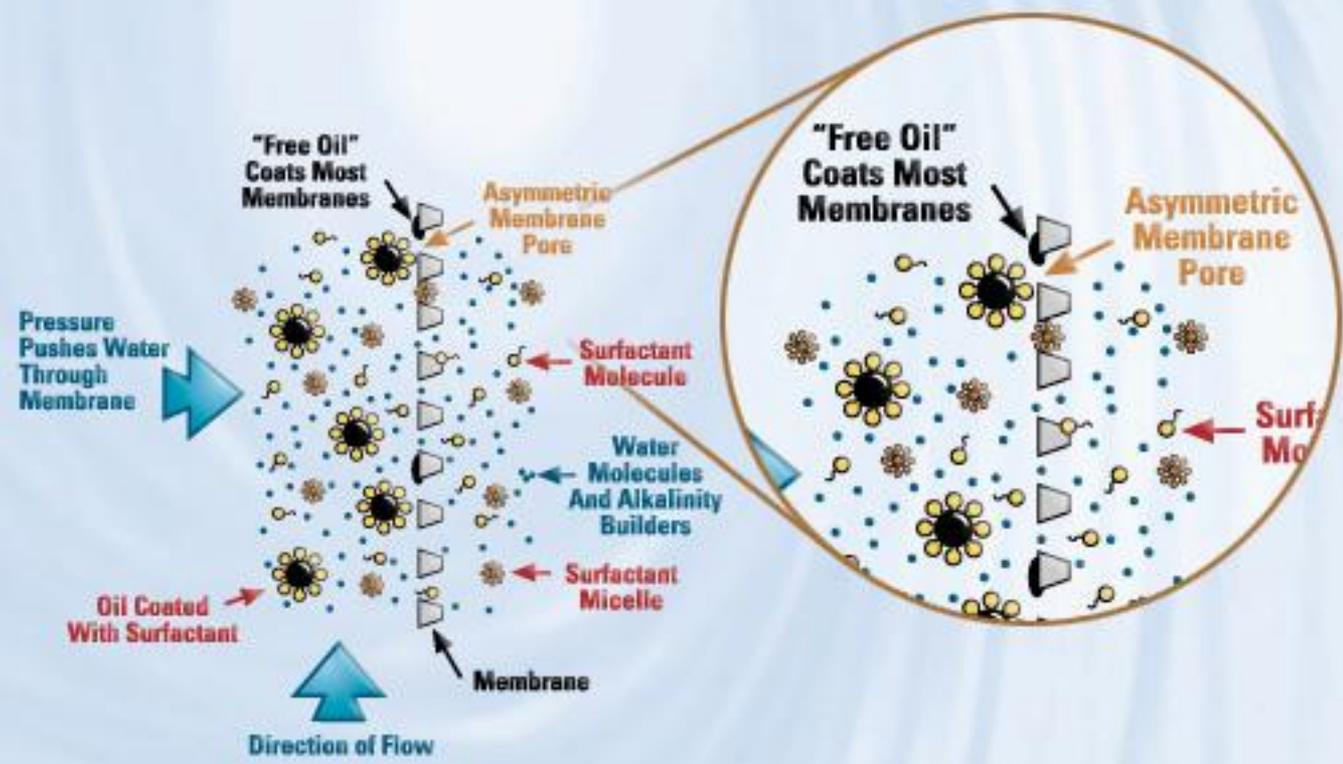




UltraFiltration Membrane

“FOULING FREE” TECHNOLOGY

To avoid “free oil” fouling, the UltraFiltration membrane is engineered to be extremely hydrophilic (water attracting), as opposed to conventional oleophilic (oil attracting) membranes



Filtration of Stickwater.

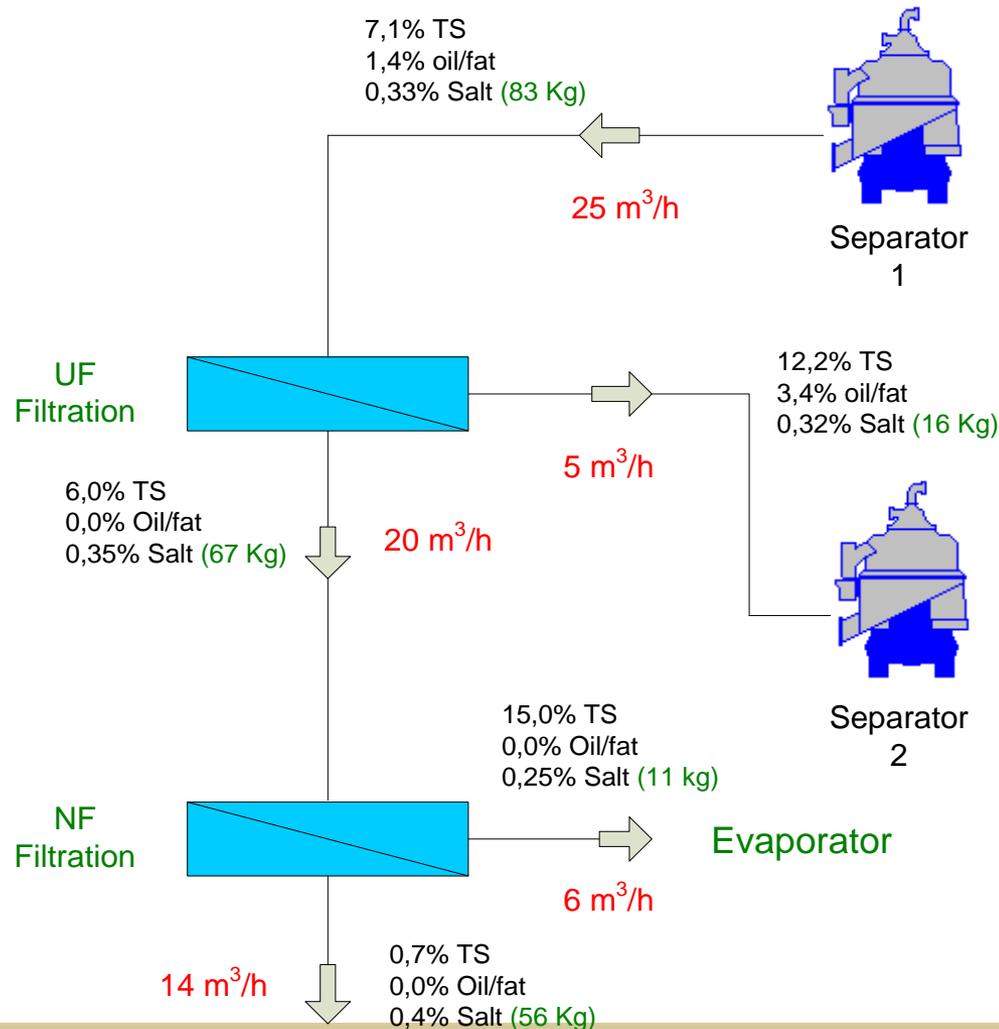
1 or 2 sections depending on the application.

UF section removes oil and fats

NF section concentrates and dia-filtrates (removes salts)

High temperature filtration 75 – 90 degrees C.

Mass balance, UF – NF filtration.



Analyses, UF – NF filtration.

Content of oil in UF permeate < 0,1 ppm.

Content of fat in UF permeate 2 – 4 ppm.

Content of oil/fat in UF retentate app. 3-4 %.

Content of solids in NF retentate app. 15 - 18 %.

Totally removed app. 67% of the initial salts.

This can be improved by using dia-filtration.

The results have been achieved with our two pilot systems in Norway and Denmark.

Filtration of Stickwater.



Concentrate UF

Permeate UF

Concentrate NF

Permeate NF

Typical design of a Membrane Filtration System



Advantages with Membrane Filtration Systems.

Low energy consumption.

Completely automatic system, including CIP.

Easy to install.

Expect 3 – 5 years lifetime on the membranes.

Thank you for the attention!

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