SideStroem

Water Technologies

Applying advanced separation technologies, such as forward osmosis membranes, in industrial water treatment systems to decrease OPEX costs through energy savings combined with increased water & side stream solute recovery.

A Business Presentation

Topics covered

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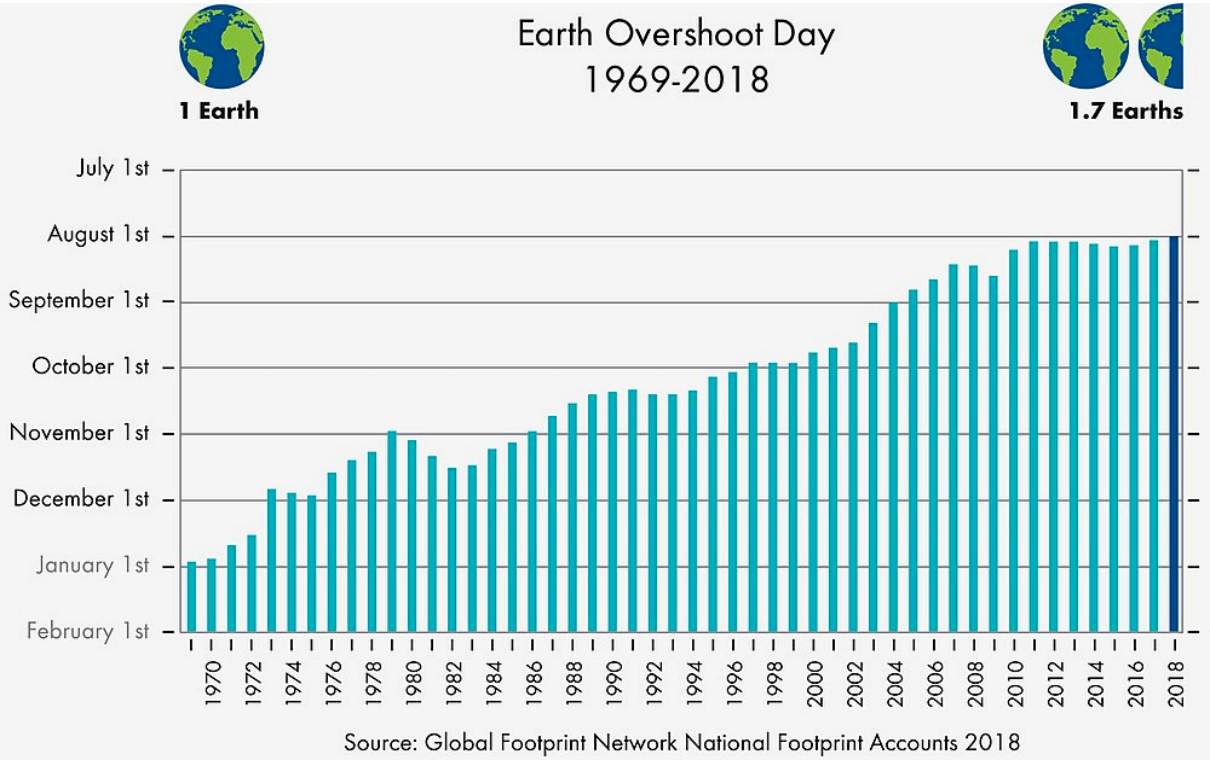
- ~~The founder~~ (available on request)
- The problem at hand
- Solution: recycling is a key driver
- Solution: productivity gains are key drivers
- Customer profile: textile dyeing industries
- Customer profile: fermentation industries
- Competitive advantage
- ~~Intellectual property strategy~~ (available on request)
- ~~3-year roadmap~~ (available on request)
- ~~Current status~~ (available on request)

We are vastly exceeding Earth's capacity to regenerate resources

As a result, humanity faces climate change, dwindling fresh water resources, loss of biodiversity, and a host of other negative consequences of ecological overspending.



Develop and implement more efficient resource recovery systems

Only by improving the efficiency of today's resource recovery systems can precious natural resources be recycled while simultaneously reducing the overall ecological impact.

TARGETED INDUSTRIAL SEGMENTS

Zero Liquid Discharge (ZLD) is the ultimate waste-water management & water recovery regime – achieving almost 100% water recovery and eliminating any liquid waste leaving an industrial plant. India is at the forefront of imposing ZLD regulations and **India's textile industries** are driving the country's ZLD adoption.

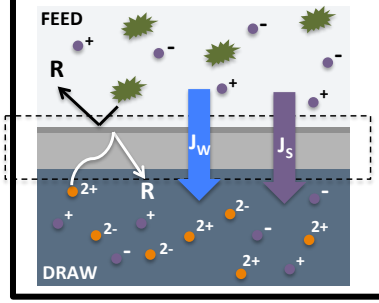
WHY FORWARD OSMOSIS?

Forward osmosis is one of a handful membrane-based low-energy ZLD alternatives. Additionally, forward osmosis holds the potential to simultaneously recover both water & valuable solute side streams from wastewater, further reducing OPEX costs while maximizing the degree of resource recovery

COMMERCIAL DRIVERS

- Government regulations.
- Augmentation of water supplies.
- Protecting aquatic environments.
- Decreasing the high energy & associated ecological costs of ZLD systems - given the reality that traditional evaporators are exceedingly energy-intensive.

TECHNOLOGY DEVELOPMENT



An FO membrane technology tailored to selectively extract both **water and NaCl** from wastewater streams*.

*https://www.forwardosmosistech.com/wp-content/uploads/2019/09/Improved-Resource-Recovery-using-novel-FO-membranes.pdf

Develop and implement more efficient industrial processes

Productivity gains from more efficient industrial processes reduces the overall ecological impact of industrial production.

TARGETED INDUSTRIAL SEGMENTS

Global fermentation industries utilize microorganisms to convert carbohydrates into desirable metabolic end products. Ingredients companies are now utilizing fermentation in specially engineered microorganisms to answer an ever increasing demand for natural ingredients that are hard to come by. Ingredients such as resveratrol, stevia, vanillin, and even safron.

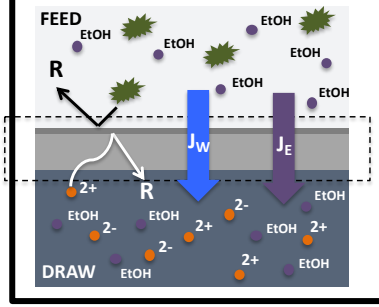
WHY FORWARD OSMOSIS?

In comparison to other membrane-based & thermal processes, FO holds the potential to remove ethanol without increasing the pressure and temperature of the fermentation broth. This serves to protect delicate target products from undesired degradation.

COMMERCIAL DRIVERS

- Increased productivity by continuously removing any ethanol (EtOH) that is produced as a by-product in fermentation liquids. The removal serves to avoid ethanol's inhibitory effect on microbial growth, which already kicks in at ethanol concentrations below 2%.

TECHNOLOGY DEVELOPMENT



An FO membrane technology tailored to selectively extract both **water and EtOH** from wastewater streams*.

*https://www.forwardosmosistech.com/entering-the-slope-of-enlightenment-fo-as-a-means-of-continuously-removing-ethanol-from-fermentation-liquids/

Customer profile: textile dyeing industries

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SideStroem Water Technologies will enable textile dyeing industries to implement novel water treatment systems that increase water and salt recovery

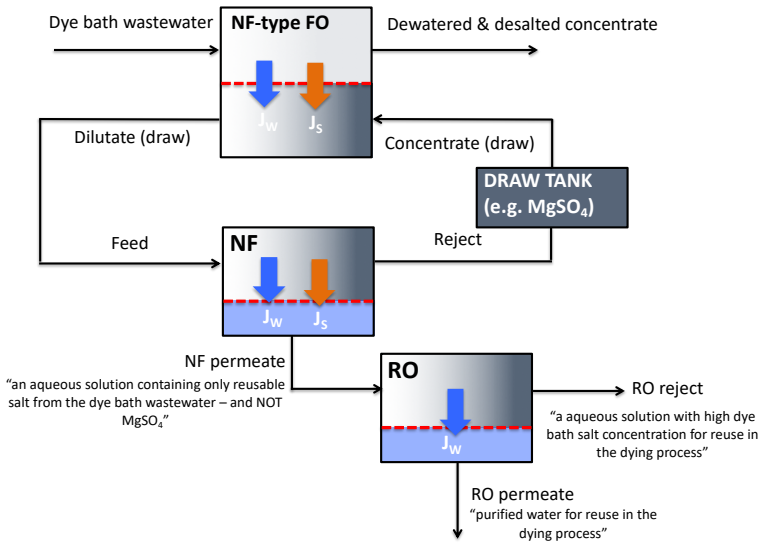
Customer pain

Current water treatment systems are OPEX intensive and do not recover valuable salts from wastewater streams.

SideStroem's solution

FO-based reduction in OPEX costs through increased water and salt recovery.

System example:



Current leads

In India there's an abundance of textile dying factories, which all must live up to strict zero liquid discharge (ZLD) regulations. The founder has a strong professional network in India

SideStroem Water Technologies will enable fermentation industries to increase productivity by continuously removing ethanol from fermentation broths.

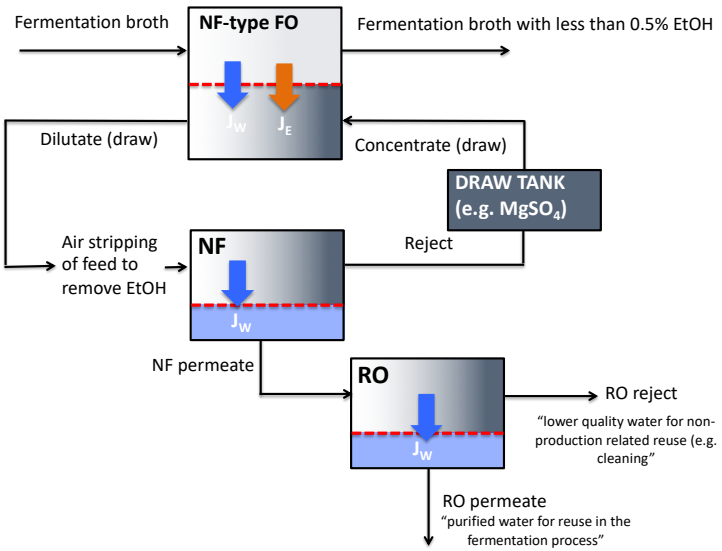
Customer pain

Ethanol inhibits microbial growth thus decreasing overall productivity.

SideStroem's solution

FO-based direct & continuous removal of ethanol from fermentation broths.

System example:



Current leads

None at the moment, which is why the development of an ethanol-selective FO membrane will be initiated down the road (refer to the business roadmap)

Attractive profit margins of >80% combined with a thriving commercial FO ecosystem

PROFIT MARGIN

Based on available market intelligence, flat sheet RO membrane elements sell for app. USD 10$ per m^2 of active membrane area.

The combined membrane element COGS amounts to app. USD 6.7$ per m^2 of active membrane area (60/40 split between membrane COGS and modularization COGS).

With reference to RO membranes, which ultimately contain the same raw materials - it is not unreasonable to target a **combined COGS of below USD 20$** per m^2 of active FO membrane area.

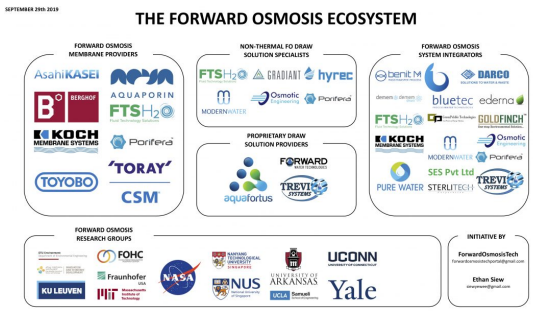
Today, industrial FO membrane suppliers typically sell FO membrane elements at **USD 100$ per m^2** of active membrane area → **>80% profit margin.**

FO SYSTEM SIZE & MEMBRANE REPLACEMENTS

Small to medium scale water treatment systems in the textile dyeing and fermentation industries have a daily water treatment capacity demand of 50m^3/day – 5000m^3/day, corresponding an **installed membrane area of app 200m^2 – 20000m^2 (i.e. business potential of USD 20.000$- USD 2 million $) per installation**.

Membrane elements are typically **replaced every 1-5 years** depending on operating conditions.

FO ECOSYSTEM



For more information: https://www.forwardosmosistech.com/the-forward-osmosis-ecosystem/

SideStroem Water Technologies

An enabler of more efficient resource recovery and productivity gains in industrial water treatment systems.

INDUSTRIAL TARGET SEGMENTS

SideStroem has identified the two industrial segments where current, large customer pains are ideally suited to be relieved by novel FO-based systems:

- Textile dying industries
- Fermentation industries

Commercial focus will be on small to medium size applications with a 50m^3/day – 5000m^3/day capacity demand.

TECHNOLOGY

Cutting-edge solute selective (e.g. NaCl & EtOH) FO membranes, which outperform current state-of-the-art on the market resulting in a unique value proposition :

1. Lowest payback time
2. Capable of selective separation/recovery of solutes (e.g. NaCl and EtOH)

BUSINESS STRATEGY

SideStroem will focus 100% on core value-adding activities and leverage its resources through partnering. This is reflected through the following choices:

- Strong emphasis on strategic partnering.
- Low burn-rate for the first 24 months of operation.
- A pragmatic IP strategy.

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Thank you for your attention!

Please visit www.forwardosmosistech.com
for more information on forward osmosis technologies.