

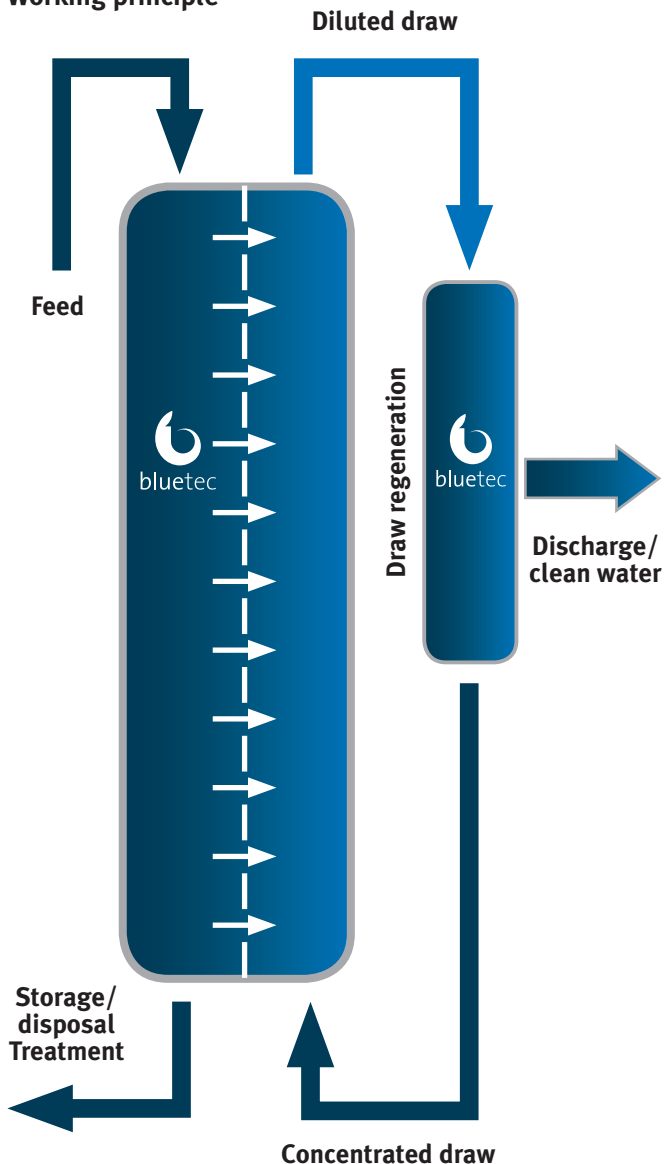


## Technology Fact Sheet: Forward Osmosis

### Short description

Forward osmosis (FO) is a promising technology to treat feed streams with a high fouling tendency. The core element is a semi-permeable membrane, over which a highly saline solution (draw solution, DS) draws water from the feed. Since no mechanical pressure is used in this step, FO shows a low tendency for irreversible fouling. FO produces a concentrate and a diluted DS with diminishing fouling risk. Coupled with a subsequent treatment to re-concentrate the DS, e.g. reverse osmosis or membrane distillation, FO facilitates efficient membrane treatment for feed streams with high fouling risks.

### Working principle



### Advantages

- ▶ Facilitating use of membranes for feeds with a high fouling risk
- ▶ Reduction of energy consumption in comparison to thermal treatment
- ▶ Very high up-concentration close to Zero Liquid Discharge can be possible
- ▶ No use of mechanical pressure in the FO unit
- ▶ Low irreversible fouling
- ▶ No high temperatures required
- ▶ Excellent permeate quality

### General data

Typical applications	Highly fouling waste waters Product concentrate Bio-processes Zero liquid discharge
Average energy consumption	10 – 15 kWh/m <sup>2</sup> with energy recovery system
Average chemical consumption	DS salts: depending on selected salt and feed composition, typically: <ul style="list-style-type: none"> <li>• NaCl: 15 g h<sup>-1</sup> m<sup>2</sup></li> <li>• MgCl<sub>2</sub>: 3 g h<sup>-1</sup> m<sup>2</sup></li> </ul>

### Remarks

- ▶ At high concentration factors, some concentrates can be further treated by anaerobic digestion
- ▶ For high osmotic pressures, DS recovery can be done using a multi-step high brine RO treatment (HBRO™)

### References and patents

**References:** Pilots of 12 m<sup>3</sup>/day and 0.5 – 5 m<sup>3</sup>/day

**Patents:** Under application

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