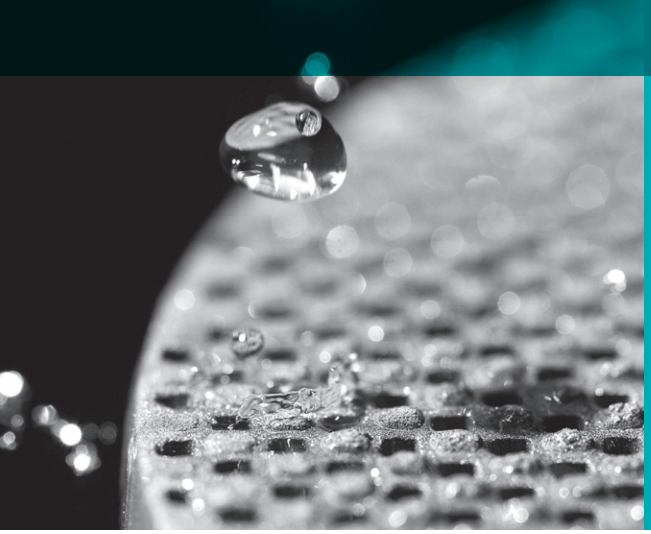

FUTURE FILTRATION

SILICON CARBIDE CERAMIC MEMBRANES

PRODUCED WATER

PRODUCED WATER CHALLENGES

Discharge and re-injection of Produced Water from oil production is becoming increasingly challenging for the oil producers as the world's oil wells mature and the water cut increases.
At the same time many regions are tightening the legislation for discharge of Produced Water which means that the oil producers have to look for new technologies.

SILICON CARBIDE MEMBRANES FOR PRODUCED WATER TREATMENT

Polymeric or ceramic ultra filtration membranes can very easily produce permeate with well under 5 ppm oil. The main obstacle for membranes has been that polymeric membranes handle oil very badly and that ceramic membranes so far have been expensive.
Due to the unique hydrophilic properties of Silicon Carbide it is possible to obtain higher water fluxes on LiqTech's SiC based CoMem membranes than with other membrane materials. Continuous process flux for oil/water separation is recorded between 200 - 2000 L/(m^2*h) – depending on the nature of the produced water. This means that membrane filtration has become a viable alternative to micro-flotation and walnut shell filters, while providing superior quality of the treated water.

FULL SCALE OFF-SHORE INSTALLATION TO BE COMMISSIONED IN Q1 2014

LiqTech International have provided Silicon Carbide UF membranes for off-shore produced water treatment. The installation will be delivered by the Danish company Semco Martime and will be commissioned in Q1 2014.

UNMATCHED PERFORMANCE!

The ceramic membranes produced by LiqTech are made of Silicon Carbide (SiC).
SiC has unique material characteristics, which result in unmatched membrane properties:

- SiC membranes have the highest water flux compared to any other membrane material (polymer/ceramic)
- SiC membranes are chemically resistant for the full pH-range, pH 0-14
- SiC membranes are thermally resistant up to 800 °C

The high water flux for SiC leads to high filtration capacities per membrane element.

PORE SIZE- MICRON	LMH L/(m^2.h)
0.04	3,000
0.1	4,000
1	10,000
3	> 12,000

Pure water flux achieved with CoMem Conduits OD146x865 mm (8.02m^2) at 25 °C

CASE 1: PRODUCED WATER TREATMENT FOR DISCHARGE

Full scale off-shore installation to be commissioned in Q1 2014. Delivered by SEMCO maritime.

APPLICATION

Treatment of produced water at off-shore oil platform in the North Sea where customer has challenges in meeting discharge limit of 30 ppm of oil with conventional technology.

FEED WATER

Oil: up to 2500 ppm (highly emulsified source)
TSS: 75-200 mg/l
Temperature: 2-17°C

MEMBRANE

CoMem Conduit OD146x865mm.Ø3mm channels,
0,04 micron pore size

PROCESS DATA

Cross flow: 2m/s – 2 stages
TMP: 0.4 bar
Permeate flux: 200 LMH

PERMEATE

Oil: <10 ppm
TSS: <10 mg/l

CASE 2: PRODUCED WATER TREATMENT FOR REINJECTION

Field trials in Colombia at HOCOL production site. In cooperation with Constructora Conconcreto.

APPLICATION

Treatment of produced water for re-injection at on-shore production site. The field trial was carried out in order to evaluate the performance and feasibility of using LiqTech's ceramic membranes for filtration of produced water for reinjection.

FEED WATER

Oil: up to 60 mg/l
TSS: up to 9 mg/l
Temperature: 60°C

MEMBRANE

CoMem Conduit OD146x865mm.Ø3mm channels,
0,04 micron pore size

PROCESS DATA

Cross flow: 1.2-1.6 m/s
TMP: 0.7-1.0 bar
Permeate flux: 400-600 LMH

PERMEATE

Oil: 0-5 mg/l (For 95% at the time below 1 ppm)
TSS: <0,03 mg/l

CONCLUSION

The pilot experiments showed that it is possible to remove both oil and TSS from the produced water below required limits and regardless of the feed water oil concentration. Thus, SiC membranes can replace conventional technologies such as micro flotation and walnut shell filters with one step filtration.

Case 1 - Final installation with LiqTech's SiC membranes

Case 1 - ATEX pilot unit delivered by SEMCO

Case 1 - Permeate-feed-concentrate

Case2 - Test setup with automatic pre-filtration (300 µm), CIP unit and LiqTech's MultiBrain membrane filtration unit

Case2 - Samples from the field trials: Permeate (left) and feed (right)

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