Synder Filtration

Membranes that perform. People who deliver.™

NFS™ Seawater Sulfate Removal Case Study

As global demand rises, nanofiltration technology has become essential throughout the oil and gas industry by improving the efficiency of waterflooding processes and enhancing oil recovery. Water injection solutions must have low concentrations of sulfate in order to prevent barium sulfate and strontium sulfate scaling. In addition, high sulfate concentrations can lead to the formation of hydrogen sulfide, which results in oil well souring.

Overview

The objective of this study was to examine the performance of Synder's NFS sulfate removal membrane against that of a leading competitor with an incoming feed stream representative of that found in the field. ASTM D1141-52 is a well-known, standard practice for the preparation of substitute ocean water and was therefore used in this study to simulate seawater, a common feed for waterflood injection processes.

Experimental

Synder's NFS and a sulfate removal membrane from a leading competitor were tested in 2540 spiral wound element modules. ASTM D1141-52 synthetic seasalt was used as the incoming feed. Elements were tested at 330 psi with a feed flow rate of 3 gpm at 25°C. Permeate flux and sulfate rejection were recorded at 0%, 25%, 50%, and 75% total system recovery. Sulfate rejection was determined using Hach SulfaVer 4 Sulfate Reagent in conjunction with a Hach 1720E Series 2 spectrophotometer.

Table 1: ASTM D1141-52 Synthetic Seawater Composition

Sea Salt Mix	Conc. (g/L)	% of Sea Salt Mix
NaCl	24.53	58.49
$MgCl_2$	5.20	26.46
Na_2SO_4	4.09	9.75
$CaCl_2$	1.16	2.765
KCl	0.695	1.645
$NaHCO_3$	0.201	0.477
KBr	0.101	0.238
H_3BO_3	0.027	0.071
$SrCl_2$	0.025	0.095
NaF	0.003	0.007
TOTAL	36.032	100.0

Project Goal
Examine performance of Synder's NFS sulfate removal membrane with synthetic seawater

Feed
ASTM D1141-52 Synthetic Seasalt

Elements
2540 Synder NFS
2540 Competitor Element

Parameters Measured
Permeate flux
Sulfate rejection

Testing Conditions
Pressure: 330psi
Feed flow rate: 3gpm
Temperature: 25°C

Results

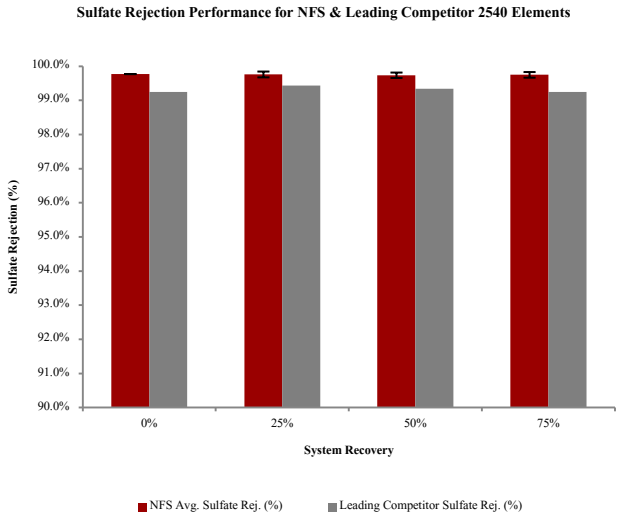

Figure 1: Average sulfate rejection performance for NFS and the leading competitor 2540 elements.

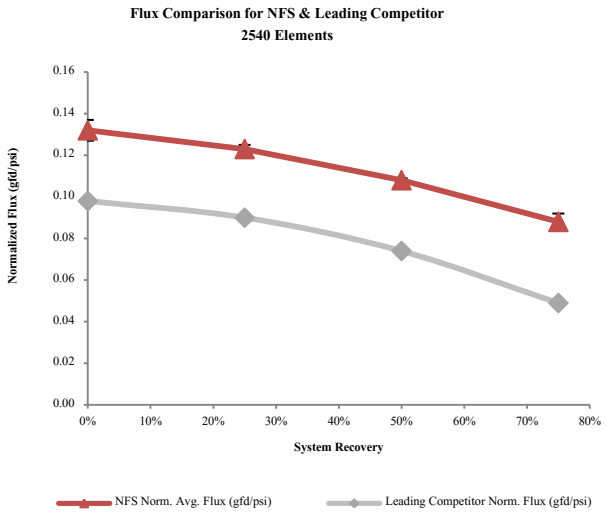

Figure 2: Average normalized flux (gfd/psi) performance for NFS and the leading competitor 2540 elements. Data was collected from 0 to 75% recovery.

Conclusion

The results of this study indicate that NFS demonstrates superior sulfate rejection and flux performance versus a leading competitor in a feed stream comprised of ASTM D1141-52 synthetic seasalt. Throughout the duration of the study, NFS had an average sulfate rejection of greater than 99.5% compared to 99.2% rejection observed for the leading competitor. More noticeable was the increased flux observed for NFS, which was approximately 25-30% greater overall, and lower flux decay which was ~33% for NFS and ~50% for the leading competitor. These results indicate that Synder's NFS membrane is suitable for EOR techniques and sulfate removal applications throughout the oil and gas industry.

Contact Us

4941 Allison Parkway
Vacaville, CA 95688, USA
Phone: 1 (707) 451-6060
Fax: 1 (707) 451-6064
Email: sales@synderfiltration.com