TruBind™ 300 Cartridges

Produced Water and Wastewater Treatment Filtration Performance Tested in Field Conditions

Market Application Publication

Market Summary

All oil fields produce water and condensate with the oil and gas during production. Produced water often contains a high level of dissolved and free hydrocarbons after the first separation and before it is discharged overboard or re-injected into the reservoir. The volume of produced water from oil and gas wells does not remain constant over time. The water-to-oil ratio increases over the life of a conventional oil or gas well. Water makes up a small percentage of produced fluids when the well is new. Over time, the percentage of water increases and the percentage of product declines. For crude oil wells nearing the end of their productive lives, water can comprise as much as 90% of the material brought to the surface.

Contact Information

Parker Hannifin Corporation
domnick hunter
Process Filtration - North America
2340 Eastman Avenue
Oxnard, California, USA 93030

toll free +1 877 784 2234
phone +1 805 604 3400
fax +1 805 604 3401
dhpsales.na@parker.com

www.parker.com/processfiltration

Parker domnick hunter

Product Overview

The **TruBind 300** oil absorbent filter has been specifically designed for the oil and gas industry to remove oil and hydrocarbon contaminants in produced water streams before re-injection or for discharge within current statutory levels. Parker approached one of only two capable laboratories to assess the performance of our product and compare it to main competitors in this field. This document summarizes the results and findings of that investigation and is the first time this test has been conducted in field conditions.

Purpose

- Trial performance of filter in actual field conditions
- Test the filters ability to meet Oil Pollution Prevention and Control (OPPC) regulations
- To provide like for like data against competitor products

ENGINEERING YOUR SUCCESS.

Background

The **TruBind 300** is an innovative absorbent media based filter cartridge designed for use in oily water treatment and produced water polishing applications. The product was developed using a unique polymeric based absorbent to allow oil producers to meet the increasingly challenging OPPC regulations of <30 ppm oil in produced water.

The Parker innovation team commissioned an industry recognized independent test house to develop a testing methodology, that was designed to produce optimum end use simulation of the product. The experience of the selected team and the specialized equipment at their disposal meant that a valid, real life, test could be carried out to give a valid and realistic indication of the product end use performance.

Testing was also carried out on competitive filter cartridges to verify and validate the testing methodology and assess any performance claims. End users in the oil industry were surveyed to

ascertain the most relevant operating parameters. Typical oil type, droplet size, concentration and typical process flow rates were identified.

Testing of TruBind 300

An assessment of performance

Test Parameters

North Sea oil industry contacts were surveyed to ascertain what the most relevant operating parameters were. Typical oil droplet size, oil concentration and flow rate were ascertained and utilized in the simulated performance tests, these are listed below:

- Oil type: light /medium crude (density 844 kg/m3)
- Oil droplet size: 20µm
- Inlet Oil Concentration: 300 and 100 ppm
- Flow rate: Typical 1.325 and 1 gpm per 10" (250 mm) filter cartridge

Test Ref.	Test Product	Oil Conc. (ppm)	Oil Droplet Size (µm)	Water Temp (°C)	Flow Rate (gpm)
1	TruBind 300	300	20	Ambient	5.3
2	TruBind 300	100	20	Ambient	5.3
3	TruBind 300	300	30	Ambient	4.0
A	Competitor 1	300	20	Ambient	5.3
B	Competitor 2	300	20	Ambient	5.3

Figure 1 - Testing Plan

Oil in water analysis

Oil in water analysis was carried out by solvent extraction and infra red (IR) quantification. The procedure followed is in line with the previous DTI IR method which is referred to as "Methods of Sampling and Analysis of Production and Displacement Water Discharges for Exemption from Section 3 of the Prevention of Oil Pollution Act 1971".

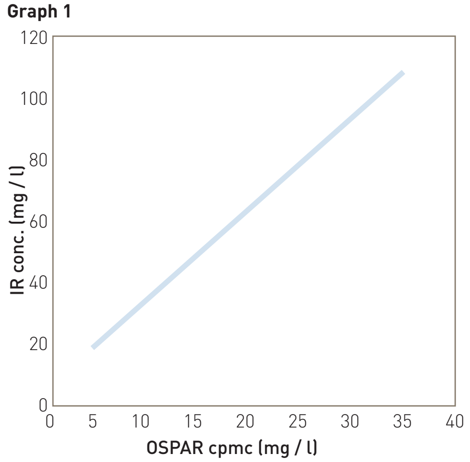
A correlation of this methodology and the OSPAR GC-FID method is presented in Graph 1. Results are presented as both measured IR and derived CG-FID values.

It is worth noting that there is present considerable discussion in the industry regarding the relative reduction in concentration readings given by the OSPAR method. There is a possibility that further reductions in effluent oil in water concentrations will be imposed in order that a real reduction in pollution levels can be attained.

Oil droplet and size distribution

Oil droplet size was determined using a Galai CIS-1002. The instrument utilizes laser diffraction technology and has a sample cell capable of working at pressures up to 120 bar. The oily water passes through the unit continuously, allowing analysis to be carried out on line as and when required.

Graph 1

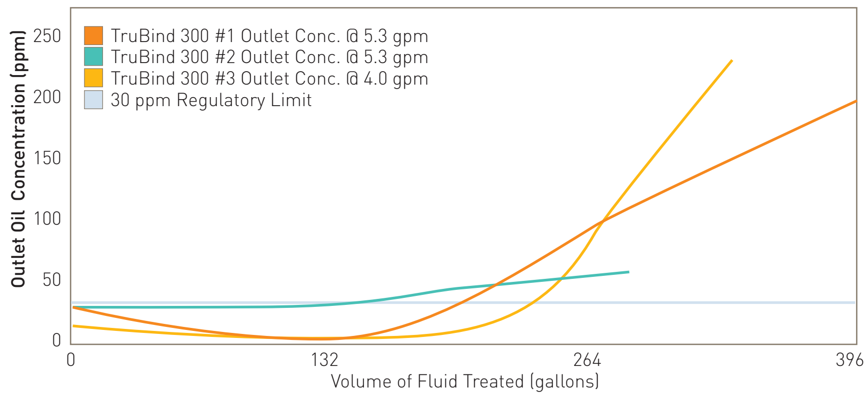


TruBind 300 Findings

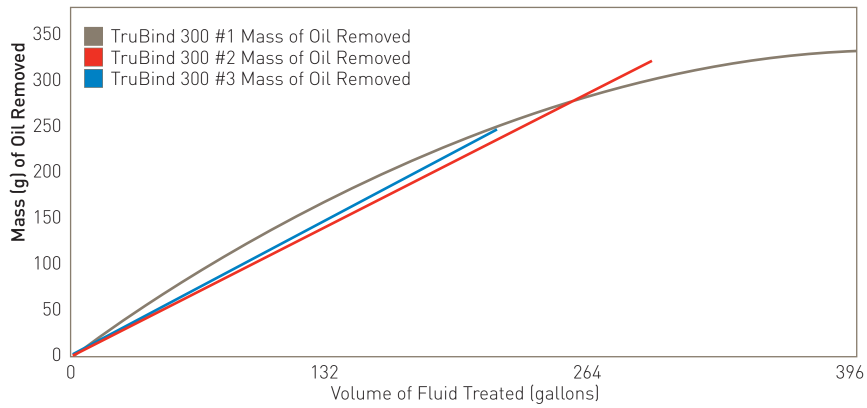
Removal performance

- The effluent oil concentration was reduced to below 30 ppm in all of the **TruBind 300** tests. As expected test results illustrate that a reduced influent oil concentration and/or a reduced flow rate will contribute to a further reduction in the effluent oil concentration.
- Oil concentration was reduced to below 30 ppm for at least 30 minutes at 300 ppm inlet and 5.3 gpm.
- Estimated oil capacity for the **TruBind 300** product at 300 ppm inlet concentration and 4.0 gpm, with medium/light crude, was 13.3 ounces per 40" (1000 mm) filter.
- For a full summary of test results*, please contact Parker Process Advanced Filtration Division.
- Competitive product A gave a minimum outlet oil concentration of 72 ppm. At no time during the test did this product provide an outlet oil concentration of <30 ppm.
- Competitive product B gave a minimum outlet oil concentration of 7 ppm, rising to >30 ppm after treating only 18 gallons of fluid.
- Competitive product B was the only product tested to release oil under normal operational conditions.
- Both competitive products tested were single 40" (1000 mm) filters.

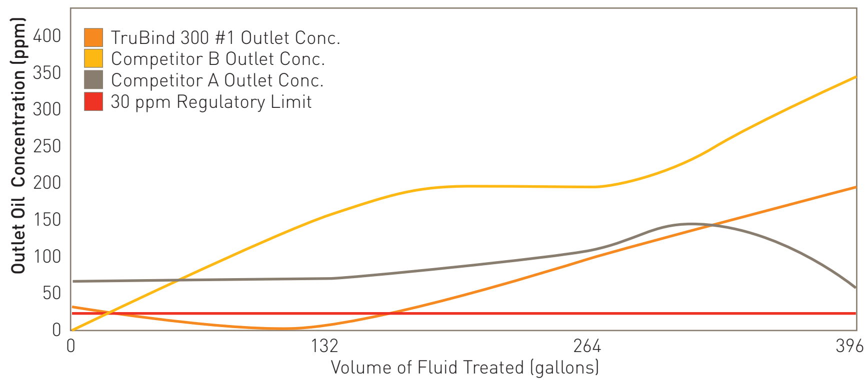
Graph 2 - TruBind 300 Effect of flow rate on outlet oil concentration



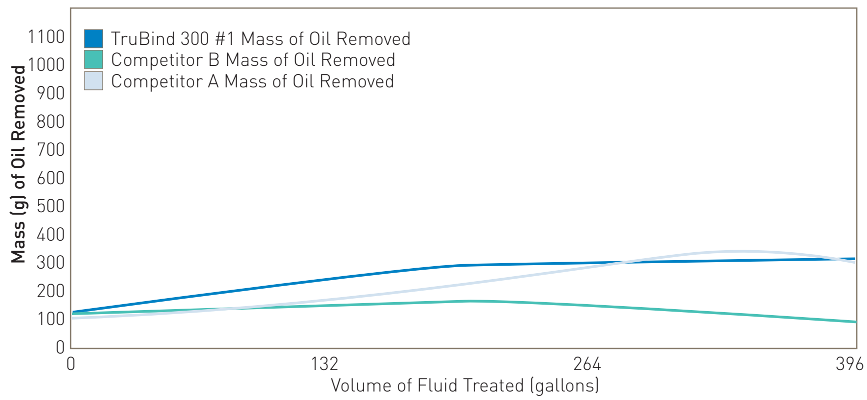
Graph 3 - TruBind 300 Effect of flow rate on mass of oil removed



Graph 4 - Competitive comparison outlet oil concentration at 5.3 gpm



Graph 5 - Competitive comparison mass of oil removed at 5.3 gpm



*The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

Test Methodology

Creating the right environment

An oily water mix was prepared by injecting a light medium crude oil (density of 844 kg/m^3), into a clean sea water stream.

The following parameters were monitored throughout the tests:

- Volumetric flow rate
- Influent and effluent oil concentration
- Pressure drop across the test filter and housing
- Fluid temperature of the oily water
- Oil droplet size and size distribution at the inlet
- Flow rate was controlled and maintained to a constant rate throughout testing of each cartridge and the differential pressure was continuously monitored. Continuous analysis of the oil in water concentration, oil droplet size and size distribution was not possible, so samples were taken at regular intervals.
- The testing methodology was identified as capable of giving a relatively straightforward assessment of filter performance against industry defined parameters and operating conditions.
- Three repeat tests were performed and returned similar values for outlet oil concentrations and mass of oil removed.

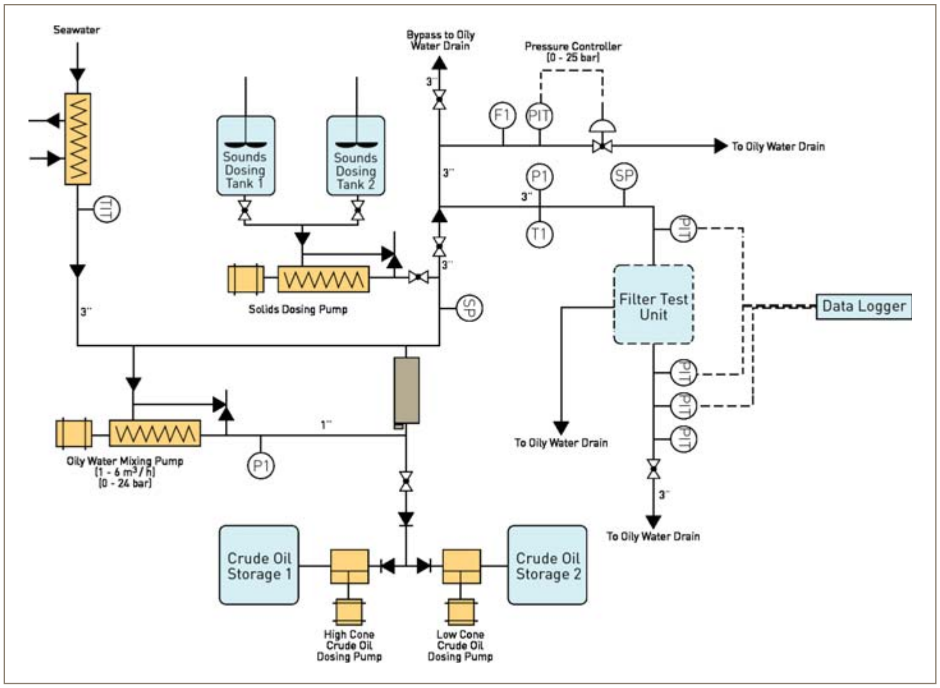


Figure 2 - Test Stand Schematic

- Of the three tests, two were performed at 5.3 gpm and one at 4.0 gpm per 40" cartridge. At the lower flow rate, the TruBind 300 treated a higher volume of fluid before effluent oil in water levels rose above 30 ppm although the mass of oil removed remained relatively the same.

The oily water mix is cut and dispersed through a shear valve with the oil droplet size distribution modified to produce the selected size range by adjusting the shear valve.

The prepared oil in water dispersion was then introduced to the filter at a controlled flow rate.

Conclusion

The Trubind 300 product can provide effluent that meets the current OPPC regulations for oil content in produced water.

Under the conditions tested and in comparison to two major competitive products TruBind 300 gave a superior oil removal performance.

- All performance data has been gathered in field conditions.

Parker domnick hunter

ENGINEERING YOUR SUCCESS.