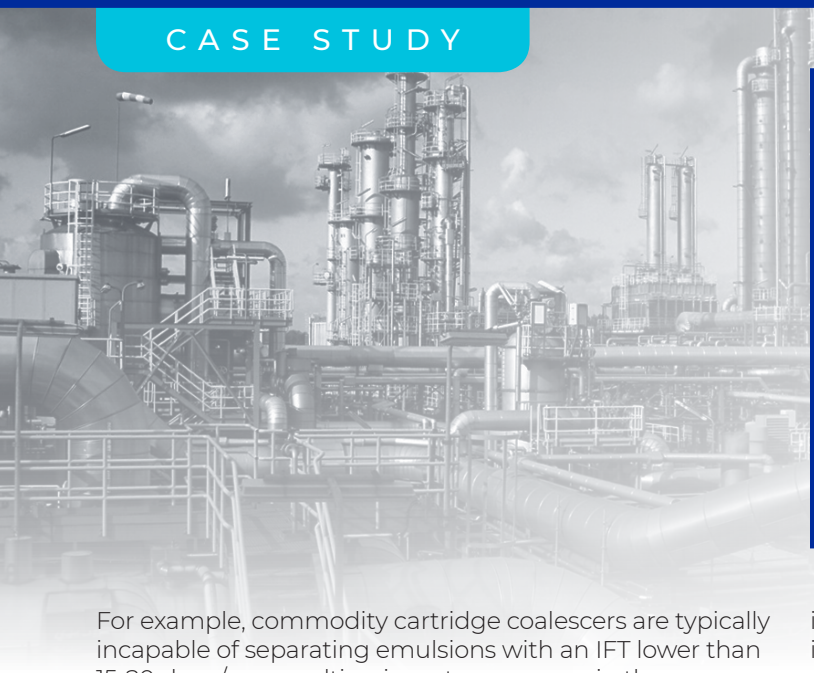
Pall's Field Tests Demonstrate Effectiveness of Pall's Coalescer to Protect Condensate Stabilizer

CASE STUDY

PICSPSEPOGEN



Application

The condensate stabilizer separates the lightest particles from the hydrocarbon condensate in order to make condensate safe for storage and transportation. The condensate leaving the three-phase separator always contains free (undissolved) water that needs to be eliminated prior to entering the stabilizer to ensure smooth operation.

Many different technologies exist to separate liquids from liquids, but conventional liquid/liquid separators (e.g. electrostatic coalescers, separators with mesh pads, cartridge coalescers) may exhibit a very limited performance if the liquid/liquid mixture is stable.

For example, commodity cartridge coalescers are typically incapable of separating emulsions with an IFT lower than 15-20 dyne/cm, resulting in water carryover in the presence of more stable emulsions. Field measurements and plant surveys carried out by Pall downstream of existing separators confirmed these findings. Results from three site surveys performed in the Middle East and North Africa regions are shown in table 1.

Problem

The condensate stabilizer requires efficient protection to minimize the ingression of water and solid contaminants. The salt laden water can cause corrosion and dissolved salts can deposit ('salting'), causing fouling issues inside the column and the reboiler. Solids can deposit and cause fouling as well. Inadequate protection of the stabilizer may result:

- Shutdowns for cleaning purposes
- Process upsets due to more difficult fine tuning of the stabilizer operation
- Product quality issues (LPG, condensate)
- Risk of corrosion in export storage tanks and pipelines, etc.

Efficient condensate dewatering may be difficult to achieve when the IFT is low. The IFT is strongly affected by the presence of dissolved chemicals that are used in upstream production activities (e.g. corrosion inhibitors, hydrate inhibitors, etc.) which have surfactant properties and tend to lower the IFT. It is very common that the IFT between the water and the condensate is lower than 5 dyne/cm.

Such an emulsion containing micron size water droplets would typically not settle within a few hours.

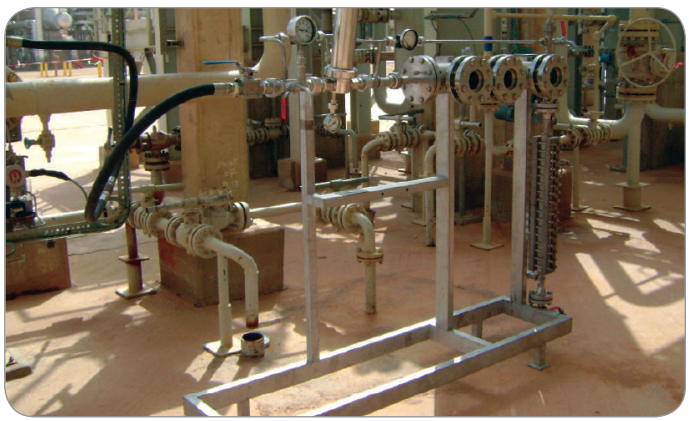
Pall has conducted several site surveys in North Africa and in the Middle East to help plants understand the root causes of the problems experienced in their stabilizer and downstream. Site A was suffering from salt deposits inside the column causing plugging and resulting in a shutdown every 3-4 months for water wash to dissolve the salts. Site B was experiencing the plugging of the heat exchanger upstream of the column as well as deposits in the reboiler, malfunctioning of the stabilizer, and corrosion issues in the export lines. Site C was facing frequent deposits inside the reboiler of the column, causing an important maintenance step requiring cleaning of the deposits. All these problems appeared to be related to significant carryover of free water to the stabilizer.

Table 1: Site survey results

Site	A	B	C
Flow rate m^3/h (gpm)	70 (308)	330 (1452)	25 (110)
Pressure barg (psig)	29.5 (428)	29.5 (428)	32 (464)
Temp. °C (°F)	36 (97)	65 (149)	44 (111)

Field test results

The site surveys were carried out by Pall's engineers from its Scientific & Laboratory Services (SLS) team which provides technical assistance. SLS mobilized test equipment for online measurement of liquid and solid contamination. Measurements were made at different locations including downstream of the existing separator (i.e. upstream of the stabilizer). The coalescer test unit used to assess the water content in the condensate is shown below.



Pall's coalescer test unit used for assessing water content in condensate

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Results of tests carried out downstream of the condensate stabilizer are shown below.

Table 2: Test results downstream of the condensate stabilizer

Site	A	B	C
Visual appearance inlet Pall coalescer	Strong haze	Moderate to strong haze	Strong haze
Visual appearance outlet Pall coalescer	Clear & bright	Clear & bright	Clear & bright
Total water content (ppmw) inlet Pall coalescer	400-500	1800-4800	500->10,000
Total water content (ppmw) outlet Pall coalescer	n/a	390	30-80

Condensate samples collected at Site C at the outlet (left) and inlet (right) of Pall's coalescer test unit

Condensate samples collected at Site B at the inlet (left) and outlet (right) of Pall's coalescer test unit

At each site a very significant water carryover from the upstream separator was confirmed, highlighting the inability of conventional separators to effectively separate water from condensate. The condensate entering the stabilizer still contained a lot of free water, from about 0.5 m^3/h (2.2 gpm) at Site A to more than 2 m^3/h (8.8 gpm) at Site C, which clearly explains the various problems reported by the three plants.

The condensate exiting the condensate stabilizer is very hazy in appearance because of the remaining presence of free (undissolved) water in the form of fine droplets. Pall's coalescer demonstrated its ability to separate these fine droplets. The visual appearance of the condensate exiting Pall's coalescer is clear & bright, which indicates that the remaining free water content in the condensate is near the solubility limit. Typically, the free water content is below 20 ppmw, as was measured at Site B. The total water content as reported in the table reflects both the soluble and the insoluble (free) water. The soluble water content is dependent on the condensate composition and the operating temperature, which explains the difference in the results at Site B and Site C as condensate from Site B (at the coalescer outlet) contained a higher total water content due to a higher aromatic content and temperature.

Conclusion

In the condensate dewatering application, free water is typically present in the form of very fine droplets because of low IFT. Although they are fine, they are detrimental to the stabilizer. Typically, conventional separators are unable to efficiently protect the stabilizer because of their inability to separate emulsions with an interfacial tension lower than 15 dyne/cm.

Pall's PhaseSep® coalescers are capable of separating both large and micron-size water droplets from the condensate, making this technology the most reliable and cost-effective solution for condensate dewatering applications. PhaseSep coalescers are a proven solution that have demonstrated incomparable performances in the numerous critical liquid/liquid separation applications found in the oil & gas, refining, and petrochemical industries.

PALL CORPORATION

Corporate Headquarters
Port Washington, NY, USA
+1-800-717-7255 toll free (USA)
+1-516-484-5400 phone

European Headquarters
Fribourg, Switzerland
+41 (0)26 350 53 00 phone

Asia-Pacific Headquarters
Singapore
+65 6389 6500 phone

Visit us on the Web at www.pall.com/industry
Contact us at www.pall.com/contact

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