Compressor Suction Scrubber Evaluation

Traditional Design v MySep Approach

Introduction

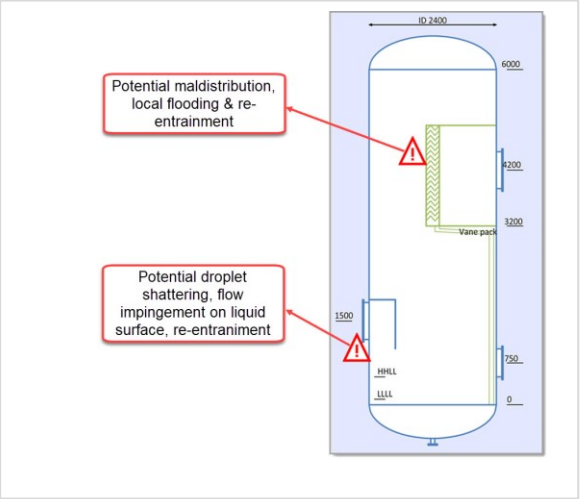
The software products MySep Studio and MySep Engine have been developed by MySep Pte Ltd: www.mysep.com

MySep Studio was used to analyse the behaviour and performance of an existing suction scrubber in a hydrocarbon vapour compression application. The original separator had been designed using traditional methods by an engineering contractor. Compressor fouling led the operator to suspect serious carry-over issues. This prompted an evaluation with MySep software and subsequently, exploration of a retrofit solution.

Typical Industry Guidelines

A number of traditional industry guidelines have evolved. These are often based purely on empirical methods and recommendations based on traditional practice.

Consider typical recommendations for a scrubber in hydrocarbon service at 30 barg with compression suction service and allowable carry-over requirement < 0.1 USG/MMSCF.

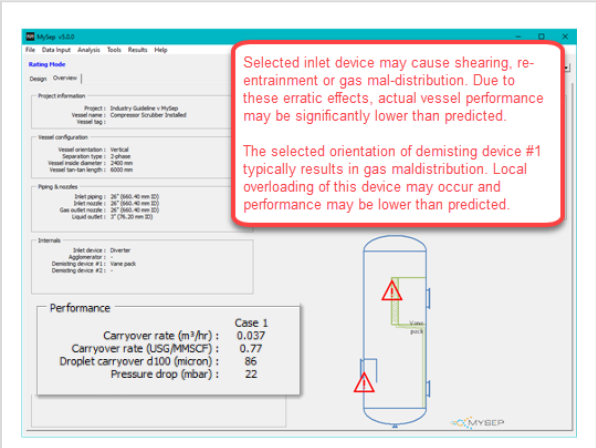


- Range of inlet devices cited: diverter plate, half pipe, vane type, cyclonic
- Overall vessel K-values within company accepted limits
- For vane pack demisting device, K-values in the range of 0.9 – 1.0 ft/s (0.274 – 0.305 m/s)
- Vane pack momentum limit: 20 lb/f s2 (29.8 kg/m s2)

The above criteria, and configurations illustrated in traditional guidelines, resulted in an installed arrangement as shown.

MySep Studio Guidelines

In rating mode of MySep Studio, the geometry of the existing scrubber is replicated. Process operating conditions and phase flows are input. The key vapour phase and liquid phase properties are input directly or, alternatively, these may be readily imported from a process simulation.



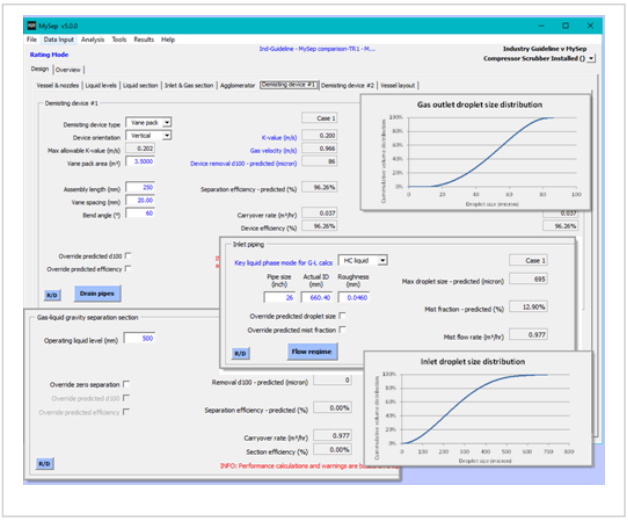
The program gives warnings to indicate aspects of the configuration considered "undesirable."

In this case the type of inlet device can cause shear and shattering of droplets. It will promote impingement of the vapour flow on the liquid surface with risk of additional entrainment. The arrangement of the vane pack demisting device, with horizontal flow, requires the vapour to accelerate and turn. This promotes velocity maldistribution with risk of local flooding and re-entrainment.

Analysis in MySep Studio

Using MySep Studio we see that an idealised analysis of the existing arrangement results in carry-over ≈ 0.8 USG/MMSCF with droplets of up to 86 µm.

The incremental analysis predicts that around 13% of the liquid in the inlet piping is introduced as mist, a dispersion with largest droplets ≤ 695 µm. Gravity is ineffective in removing these droplets and the operating conditions, coupled with the mist loading, determine that the vane pack will only remove droplets > 86 µm.

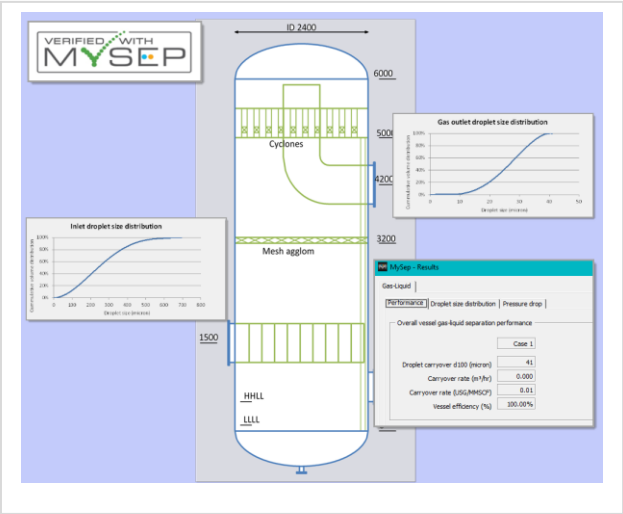


The result is an overall carry-over exceeding specification (with non-idealities neglected) of 0.1 USG/MMSCF.

Actual performance will be poorer than predicted, as the program warns, and Computational Fluid Dynamics (CFD) modelling would also be needed to achieve a comprehensive determination.

Retrofit Remediation

Using MySep Studio the engineer devised a retrofit scheme to provide improved internals and give **assurance that performance specifications were achieved**.



A vane-type inlet device was deployed to replace the diverter..

At the operating pressure of this unit vane pack demisting devices are close to their limits for reasonable separation efficiency.

An alternative solution was explored.

In retrofit a vertical flow mesh agglomerator was mounted upstream of a deck with 80 vertical flow demisting cyclones.

Predicted carry-over was reduced to 0.01 USG/MMSCF with droplets < 42 μm.

The agglomerator works effectively with the cyclones at high gas loading. At significant turndown, the mesh pad will provide all required separation capacity.

Conclusions

In many aspects of process engineering, it is wise to question solutions that claim the merit of low initial cost, without analysing their ability to meet performance requirements. For 2-phase and 3-phase process separators, MySep software can help Engineering Contractors and Process Operators achieve Greenfield designs and Brownfield revamps with assurance of meeting gas-liquid and liquid-liquid carry-over specifications.

For more on MySep Customers and product Applications visit our Web Site: www.mysep.com

MySep Pte Ltd, Tom Ralston & Wim Moyson, June 2020