The CONTACTOR™

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Regenerators: Why Purge Condensate

Purging condensate from the overhead condenser on a regenerator is frequently done in amine units, but not always. Should it be, and what are some of the reasons for implementing such an action?

What's in the Condensate?

This discussion assumes the overhead vapor from the regenerator is free from entrainment. Purging condensate is not a remedy for curing entrainment's ills. If the vapor contains entrained liquid the cure is prevention, not treatment after the fact. The column may be operating too close to flood, there may be foaming issues, or head-space mist pads may be inadequate.

Purging (blowing down) condensate should be done to control contaminants that entered the condenser as species in the vapor. Examples include ammonia, hydrogen cyanide, and methanol. Unless periodically purged from the amine system, these components tend to accumulate in reflux water returned from the overhead condenser and, as shown by rate-based simulation, they appear in even higher concentrations in the top few trays or feet of packing within the regenerator itself.

Case Study: Methanol Contamination

Data for the case study are taken from a paper published in Hydrocarbon Processing (Sep/Oct, 2018) in which CO_2 is being removed from an amine unit's Y-grade feed contaminated with 65 ppmw methanol. The amine unit is part of one of 15 NGL fractionation trains operated by Enterprise Products. The feed originates from a host of shale plays containing methanol injected at the well heads to control hydrate formation in the pipelines. The process is shown schematically Figure 1 where ProTreat® simulation results are shown (**red**) and compared with measured plant measurements (**black**). It can be seen that the simulations (which are 100% prediction, not regressions to measurements) reproduce very closely the measured data.

The contactor was actually an in-line motionless mixer contacting the incoming gas with a DEA solvent, with the gas-liquid mixture then being phase separated in a settling vessel. It was simulated as an ideal stage flash and simulated with 60% efficiency by bypassing 40% of the feed to the amine system directly to the LP Flash.

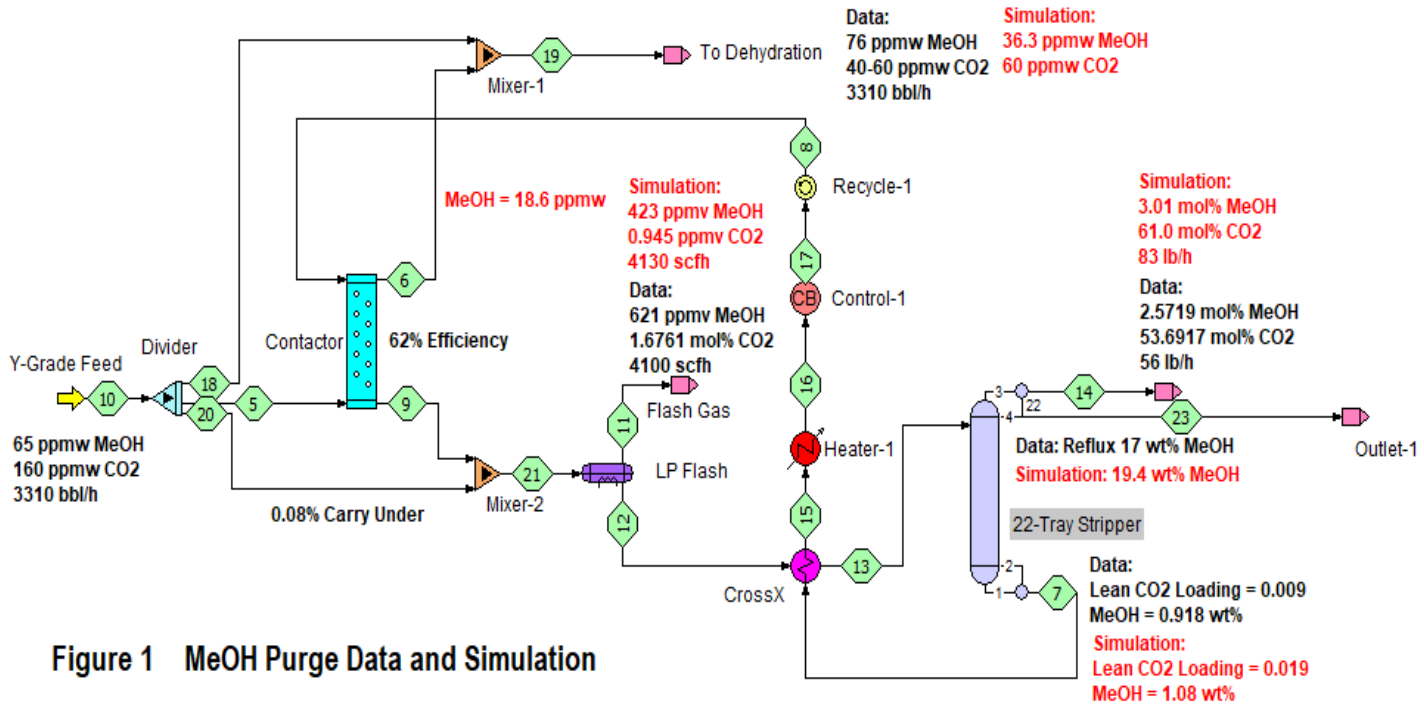

Figure 1 MeOH Purge Data and Simulation

Without any reflux purge, the reflux was simulated to contain 19.4 wt% MeOH (vs. 17% by plant measurement) and, perhaps more importantly, the lean amine being returned to the contactor contained 1.08 wt% MeOH by simulation vs. 0.918 wt% by measurement. What are most important to the plant operators, however, are the CO_2 and MeOH content of the treated liquid and, as the accompanying Figure 1 shows, simulation and measurement are in quite close agreement.

Purge rate can have a profound effect on the concentration of the purged component in the reflux water. Figure 2 shows the effect of percentage of the condensate purged in the example case of methanol.

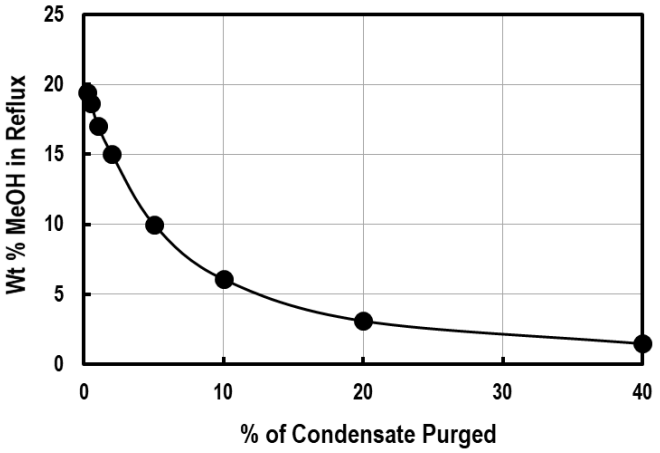

Figure 2 Purging Even a Small Percentage of Condensate Dramatically Reduces MeOH in the Reflux to the Solvent Regenerator

Other contaminants that will accumulate in the reflux at the top of a regenerator behave the same way. It doesn't take a lot of blowdown to get rid of much of the contaminant from an amine system.

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