Question 83: Since Sulfolane-based aromatic recovery units are experiencing corrosion-related problems, are there alternative solvents available? What are the advantages and disadvantages of these alternatives?

METKA (Sunoco, Inc.)
We operate four solvent extraction units. The literature reports that there are alternative solvents available that have more capacity and are more selective than the traditional solvents. The degradation products, however, can still be corrosive. The use of any of these new solvents should be carefully reviewed and evaluated. Comprehensive review of your existing unit design and how it relates to a new solvent is essential. Our experience is that the corrosion tendency and acidity of the tradition solvents can be controlled if the solvent is properly monitored and maintained.

The keys to good solvent quality control are minimizing air infiltration, effective regeneration and removal of light organic acids, and solvent filtration. This can be accomplished by using direct feeds or nitrogen blanketed tanks, effectively de-aerating imported feed stocks, and eliminating air leaks in the regeneration systems. Helium testing and pressure tests, specifically hydros, have proven to be effective tools for leak identification. Maintenance of the regeneration and filtration system is also essential.

Establishing good monitoring practices can readily identify issues. Typical process indicators include solvent pH, color, and acid number. Our experience has shown that the solvent quality can be greatly improved and corrosion tendency reduced by addressing these items. One of our units was challenged to maintain solvent quality and control corrosion for an extended period.

A concerted effort to identify the air sources and repair the regeneration system resulted in significant improvement in solvent quality as can be seen on the slide. You'll see on the first one that pH was low for a very long period. We repaired our overhead fin fans in our solvent recovery section in repaired the regenerator condenser. There was significant improvement in the pH.

Gasoline ProcessesGasoline ProcessesSulfolane pH History23456789pHRepaired Ovhd FinFansRepaired Regen Condenser

This is also seen in the acid number presented in this next slide. Once both things were repaired, we had a significant decrease in acid number.

Gasoline ProcessesGasoline ProcessesSulfolane Acid# History00.050.10.150.20.250.30.350.4ACID # Repaired Ovhd FinFansRepaired Regen Condenser

Another one of our units that historically had adequate solvent quality began to deteriorate due to solvent regenerator charge limitations. There were mechanical issues on our condensate system, which limited the regenerator reboiler system. We repaired the condensate system, the performance improved, and we increased charge to the regenerator. As you can see, once we made the repairs, solvent pH

significantly improved and our color number dropped.

QUINTANA (Valero Energy Corporation)
Valero also has four extraction units. We have three different solvent systems among those units. All of them are subject to oxidative decomposition and corrosion associated with that if the solvent treatment methods and recommendations are not followed. As such, we agree with John that it's best to deal with the root cause of oxygen ingress and improve solvent quality rather than consider an expensive solvent change-out. Since different solvent systems have different optimal heat exchanger configurations, you may incur additional equipment costs to look at a change of solvent system.

Gasoline ProcessesGasoline ProcessesUDEX Solvent Quality012345678910Solvent pH0123456Solvent ColorSolvent pHSolvent ColorRepaired Solvent RegeneratorRegenerator SD for Exchanger Cleaning
The key sources of oxygen are either through the feed or leaks in the vacuum section, as John has suggested. The main strategies to limit oxygen ingress via the extraction feed are summarized on this slide and in The Answer Book, so I won't go through them all in detail here. But the main objective is to reduce the dissolved oxygen in the feed to less than 0.5 ppm.

We should note conventional Sulfolane units with a liquid phase extractor are likely at more risk to feed oxygen than extractive distillation units because an extractive distillation configuration will tend to strip the oxygen overhead, and you don't necessarily contact the dissolved oxygen with the solvent phase in the hotter parts of the unit. John has already mentioned helium leak testing as providing help to identify vacuum leaks. Furthermore, it's important to monitor flange-face finishes, especially in older units. Over time, if you do a lot of blinding, you may scratch up some of those flange faces and you may have to reface them in order to prevent vacuum leaks.

Another consideration is around pumps. When you're doing pump maintenance, if you use temporary blinds, you can affect the alignment of the pump. That may give a greater tendency in the vacuum section of the unit for oxygen ingress. In that case, you might consider installing permanent spectacle blinds or spacers to eliminate those misalignment problems.

2008

Submitter

Operator