Case Study: CH-1959

INNOVATIVE FIELD TEST ALLOWS REFINER TO MANAGE RISKS POSED BY CRUDES CONTAMINATED WITH TRAMP AMINES

Case Study: Refining Process Treatment

INTRODUCTION

A refinery located in North West Europe had processed a relatively steady feed slate for a number of years with few crude related operational issues being experienced. However, due to a change in production methods, one of the most frequently processed crudes was now being treated with a triazine based H_2S scavenger and the associated tramp amine contamination was resulting in a number of operational issues.

Tramp amine contamination in crude oil is increasingly becoming a problem in the refining industry as crude oil producers are now treating more crudes with additives to meet tighter specifications on the maximum permittable H_2S levels in crude cargos. The utilization of triazine based H_2S scavengers resulted in significant amounts of tramp amines being present in the crude oil processed in the refinery that could lead to significant operational issues on the crude distillation unit and at the Effluent Water Treatment Plant.

Detecting these amines before the crude is processed is difficult and time consuming with current methodology. Their presence in crude is typically confirmed after the processing of the contaminated crude has already begun and associated issues begin to manifest themselves. Without sufficient prior warning of amine contamination, it is difficult to put mitigating actions in place, which is a significant risk to the refinery.

BACKGROUND

The refinery had been experiencing issues with tramp amine ingress when a particular problematic crude was being processed. The presence of the amines were detected due to the fact that pH in the CDU overhead sour water increased significantly. Due to these unexplained high pH levels, the local Nalco Champion team took several samples of the overhead water and submitted these for detailed analysis. This confirmed the presence of monomethylamine (MMA) suggesting that the crude in question is being treated with a MMA based triazine H_2S scavenger.

The ingress of MMA led to issues in the overheads of the CDU with high levels of amine impacting pH control and increasing the risk of salt formation. Consequently, the refiner implemented an amine removal program to remove the MMA at the desalter. This program achieved good results, however, while reducing the amine ingress to the CDU, it increased the amount of nitrogen in the desalter effluent that is then processed at the Waste Water Treatment Plant (WWTP). Due to this increased nitrogen loading, the refinery has come close to breaching their discharge consent limits.

Therefore, there is a compromise between protecting the CDU and reducing the impact on the WWTP.

Amine ingress via the crude oil is unpredictable and largely unforeseen. Additionally, due to the fluctuating levels, there was still no definitive reason to ban the processing of crude in question as there were no effective means to accurately analyze a cargo before it was accepted by the traders and refinery for processing.

However, due to the processing issues that were being experienced and the risks they posed, the refinery asked Nalco Champion to help support the two key processing challenges posed by tramp amine contamination:

- Could the refinery identify which incoming crudes contain amines to allow preventative action to take place?
- Could the refinery evaluate any future cargo before it is accepted for processing at the refinery?

SOLUTION

The accurate detection and quantification of the amines is of primary importance and the first step is source identification. However, existing analytical techniques are quite specialized and many refiners lack the analytical capability to determine the amine concentration, relying instead on 3rd party laboratories, which is both expensive and time consuming.

To address this, Nalco Champion developed a field test for amines that is quick, accurate and operator independent. The PATHFINDER™ Amine Test can determine the concentration of a number of amines including the most prevalent tramp amines, MMA and MEA. This can be deployed in refineries to monitor amines in the crude as well as other streams, such as desalter effluent and overhead sour water. By using the data, refineries can accurately track amine ingress and put together plans to mitigate the effects of the tramp amines, optimizing an amine removal program.

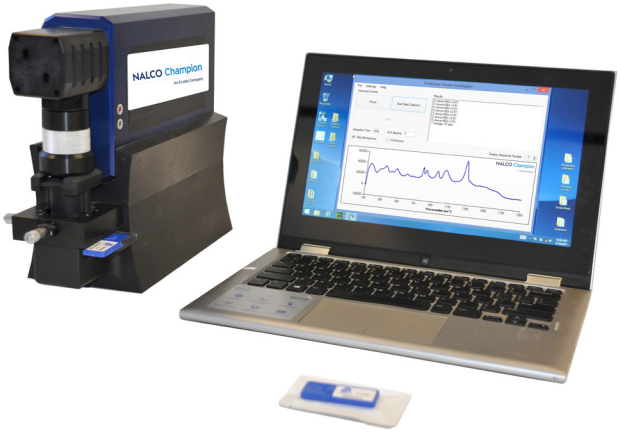

Figure 1: PATHFINDER Amine Test (PAT) for field speciated amine analysis

RESULTS

The implementation of the Pathfinder Amine Test at the refinery allowed for the rapid identification of crudes contaminated with tramp amines. The quick turnaround time provided engineers with an early warning of potential issues, allowing them to put protocols in place to mitigate the effects associated with amine ingress.

With the results, the amine removal program could be optimized, thus reducing the risk to the CDU overheads by reducing the risks of tramp amine salt formation and allowing for better control of the overhead pH levels. Additionally, the test was also used to analyse the desalter effluent and by quantifying the level of amine, the refinery could temporarily divert the contaminated desalter effluent stream away from the WWTP, thus reducing the risk of breaching their discharge consent limits.

CONCLUSION

Before the implementation of the Pathfinder Amine Test, the refinery had no effective means to analyze the crudes arriving at the refinery to determine the levels of tramp amine. The lack of forewarning resulted in the refinery being reactive to the tramp amine issues,

hastily trying to mitigate the issues on the unit as they manifested themselves.

By implementing the Nalco Champion Pathfinder Amine Test (PAT), the refinery now had the potential to quickly, in a matter of hours, quantify the amines (MEA/MMA) present in each cargo arriving at the refinery, allowing them to proactively put preventative measures in place to lessen the impacts.

The refinery is now in the position to use the test to evaluate future crude oil receipts and, with the ability to determine the concentration of tramp amines, they can pinpoint problematic cargos. With this data they can speak directly with the traders and reject these cargos on the basis that they pose too much of a risk to the CDU and discharge permits.

By implementing this innovative technology, Nalco Champion successfully worked with the refinery to maintain asset reliability and integrity while also ensuring that they operated within their environmental consent limits. As a result, by incorporating the PAT into the refineries' crude pre-screening measures, Nalco Champion has added another layer of "insurance" to avoid potential costly impacts. This tool provides timely data to make informed decisions on mitigating strategies to employ if processing of these discounted tramp amine contaminated crudes goes forward through the plant.

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