Case Study: CH-1967

BEST PRACTICES FOR TRAMP AMINE CONTAMINATED CRUDE IMPROVES CRUDE FLEXIBILITY

Case Study: Petrochemical

INTRODUCTION

A Gulf Coast refinery processing high rates of light-tight oil (LTO) was concerned about potential downstream impacts from reported tramp amine contamination. The refinery planned to run crudes that are contaminated with amines, like Eagle Ford, over the long-term and wanted to ensure it had all the information necessary to make informed decisions to mitigate the associated potential problems.

Tramp amine contamination in crude oil is increasingly becoming a problem. Producers are treating more crudes with additives to meet tighter specifications on the maximum permittable H_2S levels to meet transportation guidelines. The utilization of triazine based H_2S scavengers is the main culprit responsible for some significant operational issues, such as:

- Increased salting potential on the crude distillation unit
- Higher nitrogen loading at the Wastewater Treatment Plant

The refinery was looking for a new way of measuring actual amine content in the field to become more aware of the processing challenges of running the crude. They could then evaluate best practice mitigation strategies to maintain unit reliability and safety, while capturing the potential margin gain these crudes present.

BACKGROUND

The presence of the amines was first detected from high pH levels in the crude overhead sour water and desalter effluent streams. In response, the local Nalco Champion team started taking additional samples of the overhead and effluent water for a more detailed analysis. This confirmed the presence of monoethyanolamine (MEA) as the main "bad actor", with it's likely origin coming from MEA-based triazine H_2S scavenger.

Measuring individual amines is difficult in the refinery without expensive analytical equipment (IC, ion chromatography). Other alternatives are costly external laboratories, with a time delay of weeks to receive results.

To address this, Nalco Champion introduced a new way to monitor speciated amines on crude unit streams, increasing the data and knowledge around this problem. The PATHFINDER™ Amine Test (PAT) was developed to allow for quicker turnaround of speciated amine results in water (or crude oil) – see Figure 1. It can be used for MEA, MMA, DEA, DMEA, and other amines.

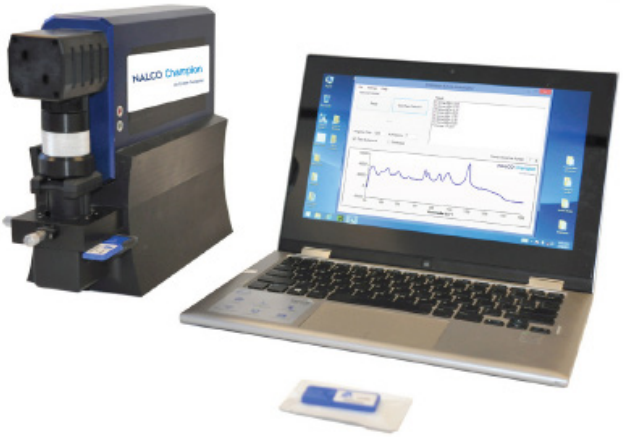

Figure 1: PAT – Pathfinder Amine Test

The ingress of MEA resulted in high levels of amine in the crude unit overheads impacting the pH of the sour water on numerous occasions. More importantly, the high levels of MEA resulted in an increased risk of salt formation in the top sections of the crude tower. Figure 2 shows how

often the atmospheric tower top delta-T (ie. the difference between the tower top temperature and the calculated salt formation temperature of the amine salt) fell below 10ºF (shown in red) for MEA-Cl.

SOLUTION

Now with the PAT deployed and its data verified for tracking the tramp amine content, new mitigation steps could be considered for the abatement of the aforementioned salt formation issues. The treatment approach proposed meant the refinery could further optimize the tower delta-T targets to avoid future salt formation problems, and/or work to expand their current crude diet.

The Nalco Champion best practice program for amine removal allowed the refiner to continue purchasing cost-advantaged LTO. This best practice approach is based on years of documented field experiences and application. The program involves using acid at a certain control pH target range, with a specifically designed wash water corrosion inhibitor. Thus the amines can be transferred from the oil phase to the water phase, and out of the desalter through the effluent.

By successfully removing the amine, the MEA chloride salt formation temperatures reduced, thus increasing the safety margin against the tower top temperature (figure 2). This increase allowed the refiner to maintain tower top temperatures, avoid potential salt formation issues and more importantly maintain higher value distillate production rates. Figure 2 shows a jump from negative temperatures (meaning the tower top temp is lower than the salt formation temp) to above 10ºF, and has been managed for over 100 days since the start-up of the amine removal program.

CONCLUSION

The implementation of the Pathfinder Amine Test, coupled with the introduction of the Nalco Champion best practice tramp amine removal program, provided an effective risk mitigation approach to the refinery. It allowed for higher processing rates of cost-advantaged crudes while maintaining safe operation of the atmospheric tower.

The value this program has brought to the plant is estimated at between $4-5 Million annually.

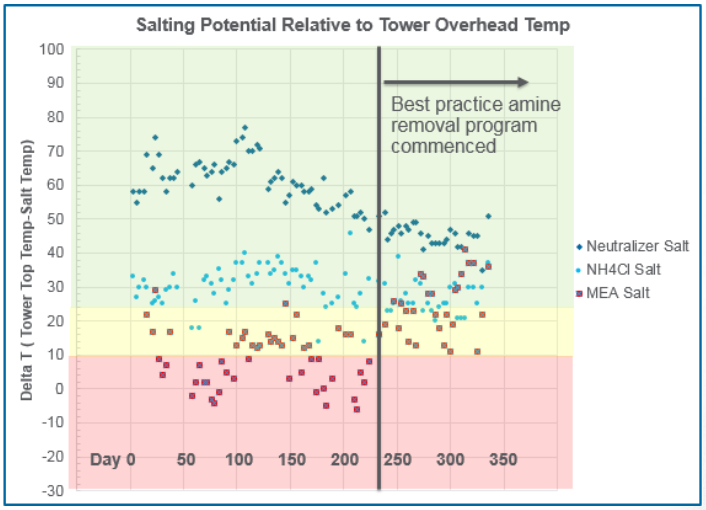

Figure 2: Field amine-chloride salting potential, using the PAT

NALCO CHAMPION Locations

Headquarters
11177 S. Stadium Drive
Sugar Land, TX 77478 USA

Asia Pacific:
52 Jurong Gateway Road #16-01
Jem Office Tower
Singapore 608550

Europe:
Ir.G.Tjalmaweg 1
2342 BV Oegstgeest
The Netherlands

Latin America:
Av. das Nações Unidas 17.891
6º Andar 04795-100
São Paulo SP Brazil