CASE STUDY

Refinery Reduces Treatment Costs and Minimizes Silicon Carryover with Nalco Water Coker Antifoam Application

eROI℠ by Ecolab

INTRODUCTION

To control foam height during Delayed Coker operations, a West Coast refinery was utilizing an antifoam that was marketed by an incumbent supplier as a low hydrotreating catalyst impact antifoam. It was indicated to be a unique formulation which was to be more thermally stable than other comparable silicone oils, and by means of this was to produce lower silicon contamination in the coker naphtha sent to hydrotreating.

Antifoams are important to the Delayed Coker process because as a coke drum begins to fill up with solid coke, the liquid level and the foaming head are pushed up. Left unchecked, the foam would reach near the top of the coke drum and potentially exit or "foam over." Foam overs will cause significant difficulties resulting in throughput restrictions, off-specification products, and significant fouling. On the other hand, if antifoam is not properly selected and applied, too much silicon can contaminate liquid products which would cause problems in downstream hydrotreating units.

BACKGROUND

Nalco Water has developed dedicated antifoam product lines, application best practice and global technical expertise to reduce foaming and minimize its impact on process units. The antifoam product line capabilities can further support customer's key business drivers focusing on reliability and total cost of operation (TCO) reduction.

Based on review of offerings, the West Coast refinery agreed to do a comparative test of Nalco Water's antifoam technology. Trial success was defined as:

- Meet foam height control target when product is applied
- Equal or lower silicon (Si) entrained/ carryover in the Coker naphtha
- Lower cost of treatment compared to incumbent treatment

SOLUTION

After a detailed technical evaluation of the Coker unit operation, level monitoring equipment and available chemical injection system, Nalco Water's best in class antifoam product was recommended. This product has proven to be very efficient in controlling the foam front in Coker drums. It is applied following the best practice protocols developed over many years by Nalco Water, and contains a very high molecular weight silicone polymer designed for minimizing silicon carryover in this service.

Nalco Water's product was tested for a period of 45 days on numerous drum cycles across various feed qualities. To compare results on the same basis with the incumbent treatment, Coker operational changes were kept to minimal, and injection procedures remained the same. Antifoam products were tested at a similar flow rate range

ANNUAL SAVINGS

COSTS

Lowered treatment costs by

50%

PRODUCTIVITY

Effective foaming control & Antifoam injection rate was

18%↓

less than incumbent treamtment

PRODUCT QUALITY

Minimized

Si carryover

Maximized

catalyst life

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and switched back and forth to generate sufficient data to conduct a full analysis.

After the treatment, Coker naphtha samples were taken by the refinery and sent to a third-party lab for Si analysis.

RESULTS

The refinery switched directly to Nalco Water's antifoam at the same injection location without any risk. It proved that Nalco Water's antifoam was compatible with the plant injection equipment and didn't require any flushing or special cleaning of any equipment or lines before application, thus making the "switch" straight forward.

During the evaluation, foam levels were closely monitored through the installed gamma source continuous level detector noting when the foam front collapses as the product was applied. The comparison trends in Figure 1 show that Nalco Water's antifoam usage ended up being 18% less than the refinery's incumbent treatment, while achieving the foam height control target. In addition, Nalco Water's antifoam injection rate falls at the lowest range of lbs PDMS/Kbbls based on the industry's best practice. This means that the amount of PDMS utilization and contribution of Si content in the coker naphtha were minimized.

The second evaluation measured the Si concentration found in the Coker naphtha as entrainment (or carryover). Figure 2 shows the one-way Anova evaluation done on the Si results. Statistically, the Coker naphtha Si concentration measured with Nalco Water's product shows a slightly lower Si mean value (13.85), in comparison to incumbent treatment (13.93).

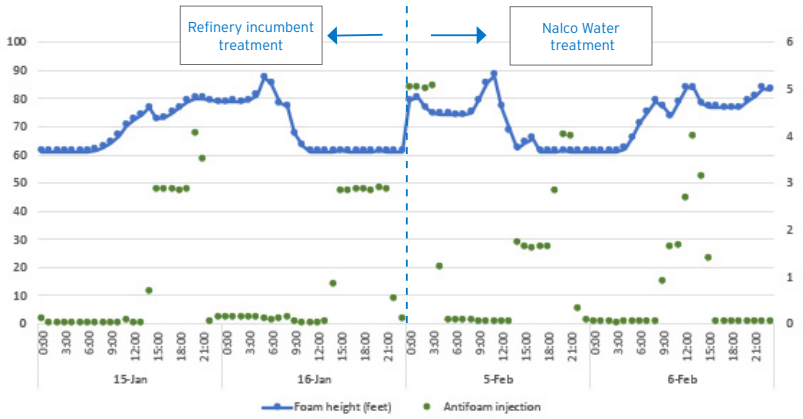

FIGURE 1: FOAM HEIGHT DROP WITH ANTIFOAM INJECTION

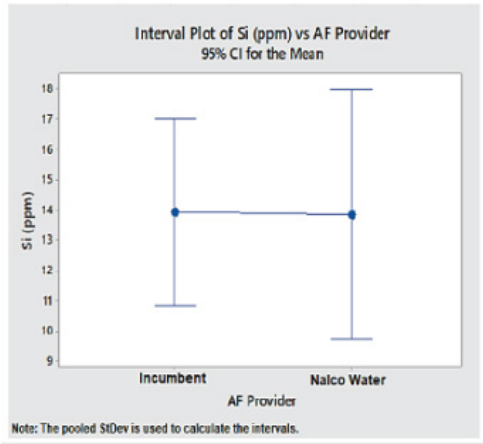

FIGURE 2: STATISTIC EVALUATION ON SI LAB RESULTS IN COKER NAPHTHA

Finally, Nalco Water's antifoam treatment cost was roughly half of the incumbent treatment cost, performing similarly (or better) under the same conditions tested. Due to these results, the refinery approved of and has continued using the Nalco Water antifoam at their Coker Unit.

CONCLUSION

The Nalco Water's antifoam, together with the global application expertise, is effective in:

1. Controlling Coker drum's foam front with lower dosage rate compared to incumbent treatment
2. Achieving a lower Si carryover

Therefore, the benefits delivered by Nalco Water's best in class antifoam products include:

- Minimizing Si carryover in products
- Controlling foaming which reduces fractionation equipment fouling
- Optimizing outages by controlling foaming in the drums
- Optimizing treatment costs

The customer was extremely satisfied with the new program, which reaffirmed their trust in Nalco Water's commitment to deliver world-class assistance, onsite expertise, troubleshooting capabilities, and value delivery to customers.

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