

Styrene Producer Saves Up to \$400,000 a Year with PRISM™ Polymerization Inhibitor



VALUE DELIVERED



COSTS

Reduced polymerization costs 26%

\$400,000

BACKGROUND

The styrene industry uses antipolymerants to control polymer formation during the distillation of the styrene monomer to a final product. Most of the industry uses a combination of an inhibitor and a retarder. The role of the inhibitor is to control and minimize polymer during the normal operation of the plant, while the retarder remains unreacted during normal operation as a safeguard to avoid a runaway polymerization in case of an emergency shutdown of the unit.

The average styrene plant in the world spends 725K\$ annually in antipolymerants, with the maximum seen being 5 times this number. The styrene monomer production lost as polystyrene can also be very significant, with documented cases of up to 3MM\$/y in lost production. In view of this, proper optimization of the antipolymerant program is paramount.

Optimizing an antipolymerant program for a styrene producer not only requires cost-efficient chemistries, but also the know-how, experience and tools that conventional commodity suppliers can't offer.

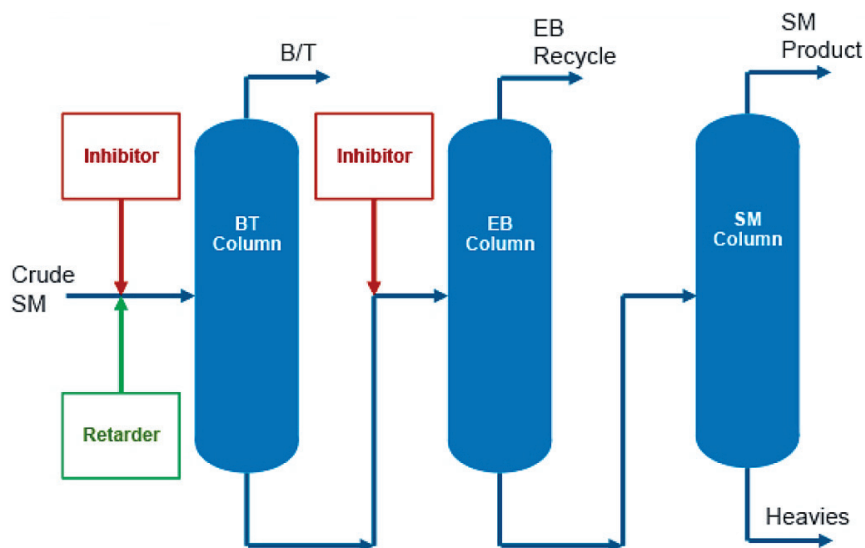


FIGURE 1: ANTIPOLYMERANT PROGRAM CONFIGURATION.

The Nalco Water PRISM program offers the combination of highly cost-efficient chemistries and the required experience, know-how and tools to optimize antipolymerant programs for styrene producers.

A European styrene producer was using a commodity competitive antipolymerant program for years in their back-ends distillation section; the program included the combination of an inhibitor and a retarder.

When approached by Nalco Water, the customer recognized the antipolymerant program had never been optimized and suspected there may be room to reduce costs associated to polymerization control.

As a first step, the customer was willing to focus on the optimization of the inhibitor expense, which was significant. Leaving potential retarder optimization for a second phase.

SOLUTION

Nalco Water was allowed to audit the plant following our standard procedure for styrene programs:



As a result of our audit the following improvement opportunities were identified:

- Replace chemistry for a more cost-efficient inhibitor (different active)
- Optimize inhibitor to allow some polymer to form
 - Existing program was over-dosed and the polymer formation was null with the corresponding inhibitor high financial impact as the benchmarking results depict in Figures 2 and 3

The Nalco Water chemical program solution recommended was:

- Replace competitor inhibitor with new highly cost-efficient PRISM inhibitor
- Start at high dosage and gradually reduce down following Polymerization Costs to identify optimum dosage using same injection points
- Maintain retarder dosages

Implement 3D TRASAR™ Technology for Monomers tool for on-line residual measurement of the inhibitor

RESULTS

The results of the inhibitor implementation replacing the competitor's product can be seen in Figure 4.

Since implementing the polymerization inhibitor at similar dosages of the competitor product, the amount of polymer produced in the plant dropped dramatically. As the dosage was gradually reduced, polymer started to increase allowing Nalco Water to determine the dosage required for the same polymer make as the previous competitor's inhibitor, a "like-for-like" program. This allowed for more polymer to form while still ensuring a safe operation, while exploring a new economic optimum operating conditions from the Polymerization Costs point of view.

Figure 5 shows the daily evolution of the Polymerization Costs before and during the trial. It can be observed how the polymerization inhibitor was able to deliver the same polymer formation at lower Polymerization Costs compared to the competitor program. As the audit also revealed, the Polymerization Costs for this customer could be optimized by reducing inhibitor dosage enough to allow some polymer to form, while staying within safe and typical polymer make levels.

**Polymer Make Benchmark
vs. 10 other plants**

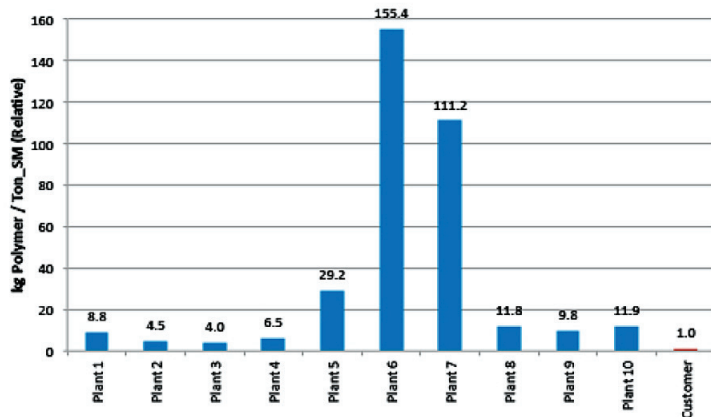


FIGURE 2: POLYMER MAKE BENCHMARK REVEALED CUSTOMER WAS PROBABLY OVERDOSING INHIBITOR AS POLYMER WAS SIGNIFICANTLY LOWER THAN TYPICAL OPTIMIZED PROGRAMS.

**Polymerization Costs Benchmark
vs. 10 other plants**

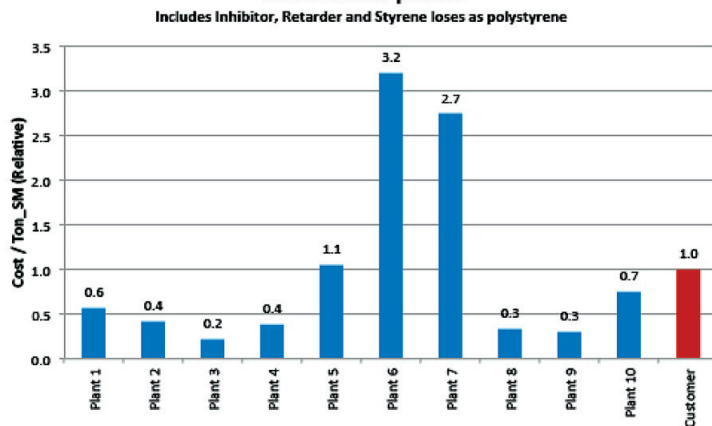


FIGURE 3: THE POLYMERIZATION COSTS BENCHMARK CONFIRMED CUSTOMER WAS OVERDOSING INHIBITOR AND THERE WAS ROOM FOR OPTIMIZATION, ITS POLYMERIZATION COSTS WERE HIGHER THAN TYPICAL PLANTS WITH NALCO WATER OPTIMIZED PROGRAMS.

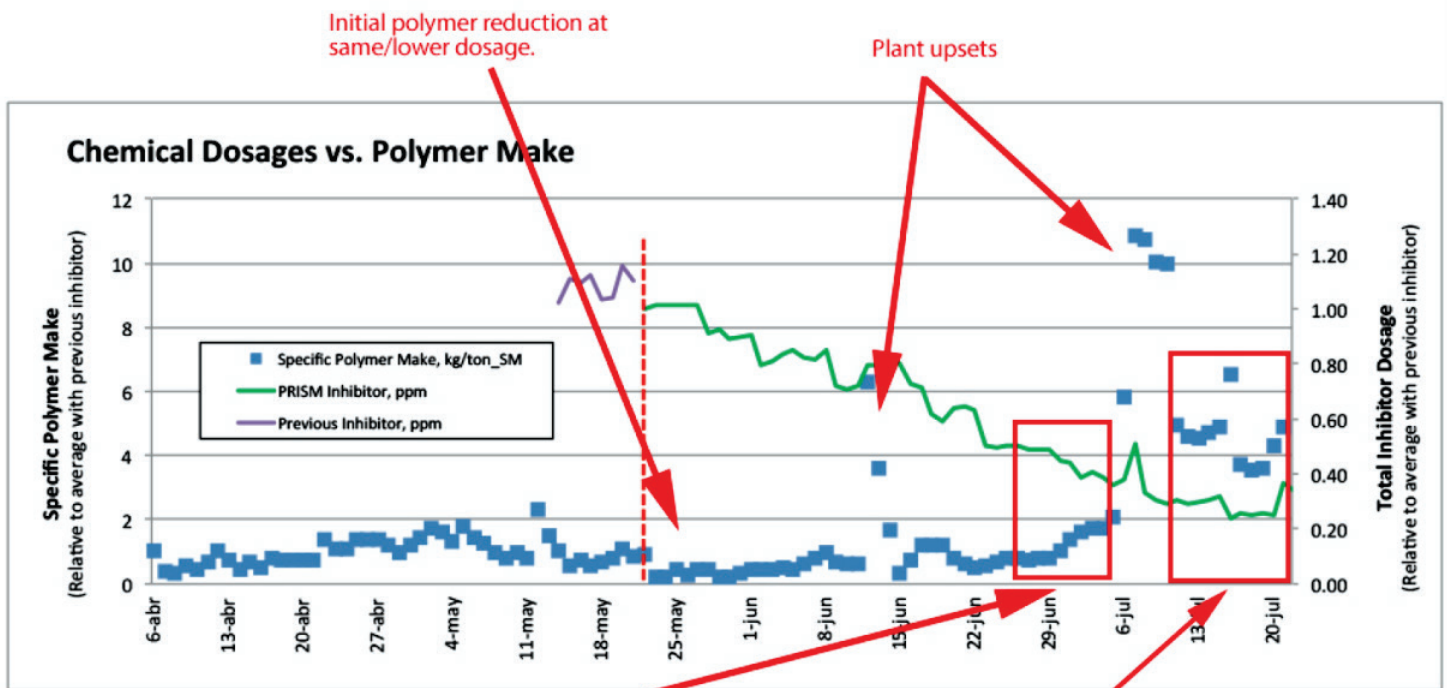


FIGURE 4: SPECIFIC POLYMER MAKE (PER TON STYRENE MONOMER PRODUCT) VS. TOTAL INHIBITOR DOSAGE DURING INHIBITOR IMPLEMENTATION.

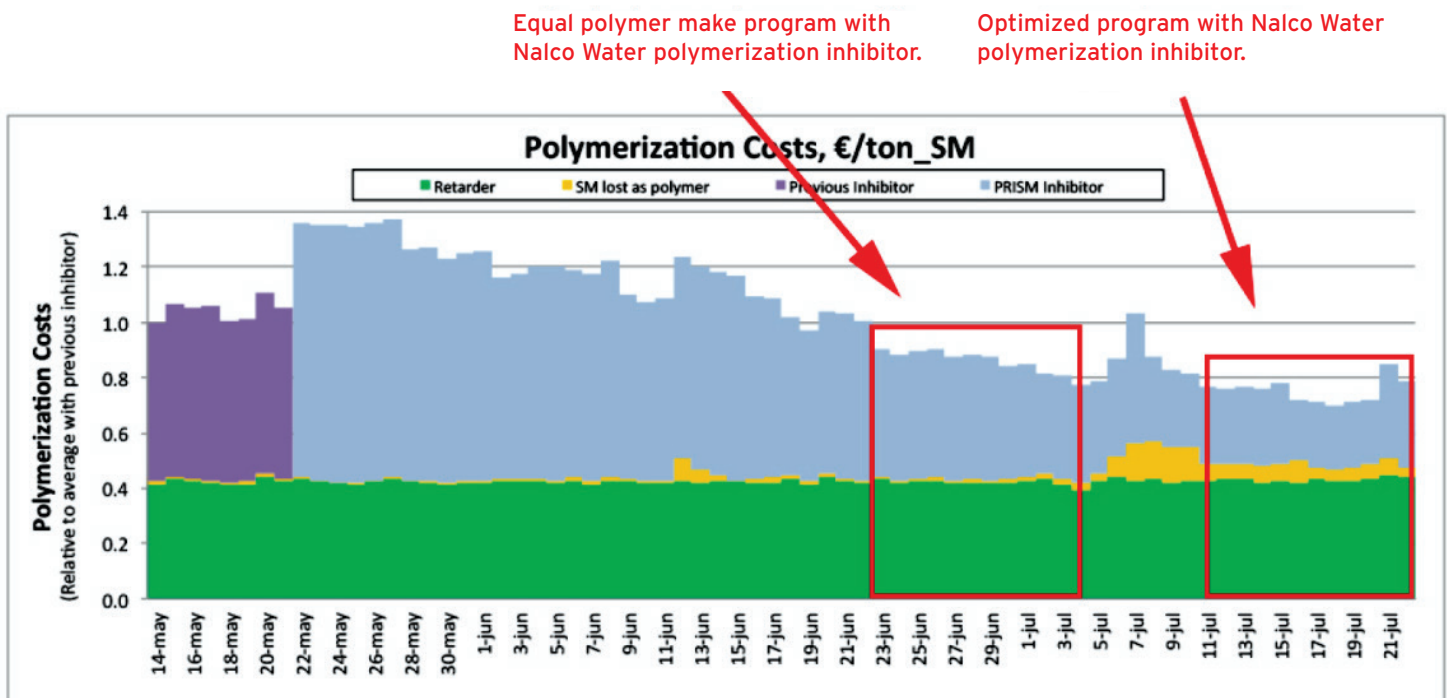


FIGURE 5: POLYMERIZATION COSTS DURING THE IMPLEMENTATION AND OPTIMIZATION OF INHIBITOR. PLEASE, NOTE ALL DATA IS NORMALIZED TO PROTECT CONFIDENTIAL CUSTOMER INFORMATION.

CONCLUSION

- The combination of highly cost-efficient chemistry, know-how, experience and specific tools allowed Nalco Water to optimize the customer's antipolymerant program to reduce polymerization costs by up to 26% (400K\$/y).
- The Nalco Water inhibitor replaced the competitor's inhibitor reducing Polymerization Costs by 14% (200K\$) annually.

- The program, optimized by Nalco Water allowed 26% (400K\$) annual reduction in Polymeration Costs vs. the previous competitor program.
- Figure 2 - Polymer Make Benchmark revealed customer was probably overdosing inhibitor as polymer was significantly lower than typical optimized programs.

Nalco Water, an Ecolab Company

Downstream: 11177 S. Stadium Drive, Bldg 31, • Sugar Land, TX 77478

North America: 1601 West Diehl Road • Naperville, Illinois 60563 • USA

Europe: Richtstrasse 7 • 8304 Wallisellen • Switzerland

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

Greater China: 18G • Lane 168 • Da Du He Road • Shanghai China • 200062

Latin America: Av. Francisco Matarazzo • nº 1350 • Sao Paulo – SP Brazil • CEP: 05001-100

Middle East and Africa: Street 1010, Near Container Terminal 3, Jebel Ali Free Zone, PO BOX 262015, Dubai UAE

ecolab.com/nalco-water