



Case Study

Naphtha Feed Purification: Major Impacts on Steam Crackers

Introduction

For more than 60 years Pall Corporation has been working with leading fuels and petrochemicals companies throughout the world. Major progress has been achieved in fluids contamination management, with associated process optimization, efficiency improvement, and cost savings.

Ethylene production is one of the major areas in which significant advancements have been made, and Pall now has more than **220 filter and coalescer systems installations worldwide**, on more than 15 different applications.

Our customers rely on our worldwide and local expertise and technical support, enabling them to choose the best available technologies to optimize their entire operating costs.

Application

One of our major applications in the ethylene production process is **feed stock purification**. We have sold more than 25 filtration and coalescer installations, half of them on liquid feed stock, the other half on gas stocks.

Typical impacts of feed purification are

- Furnace tubes protection against coke precursors (iron, salts, etc.) and fouling
- Contribution to extended furnace campaign
- Increase of overall production (downtime reduction)
- Maintenance reduction
- Energy saving

The overall positive impacts lead some **major licensors and ethylene producers to include the feed filters and coalescer systems in their best practice operations**, both on gas and liquid feeds.

Numerous ethylene manufacturing plants observed the negative impacts of feed contamination on their furnaces run times (up to 70% decrease has been noticed), as well as positive impacts of the feed purification.

Some specific measures of these impacts are available in published papers, but many plants are reluctant to share their data, either for confidentiality or process reasons.

Process improvements often result from several parameters being optimized, making it difficult to measure the exact impact of each.

Nevertheless, the table on page 2 lists some of the positive feedback that our customers shared with us regarding their operations.



Naphtha Crackers and Related Positive Impacts Linked to the Feed Purification

Dow USA Naphtha Cracker	<ul style="list-style-type: none"> • 33% increase of furnace run time after installation of filters & liquid/liquid coalescers (\$2M savings/year) • Payback <10 months • Reduction of maintenance, CO formation, CO₂ emissions, fuel consumption • Better control of Naphtha/steam ratio <p><i>Presented at the AIChE/EPC Spring National Meeting, Orlando, FL, April 23-27, 2006</i></p>
American Naphtha Cracker #2	<ul style="list-style-type: none"> • Without filters & coalescers: 19 days furnace run time • With prefilters only: 40 days furnace run time • With prefilters & coalescers: 55 days furnace run time
American Naphtha Cracker #3	<ul style="list-style-type: none"> • More than 40% furnace run time reduction compared to the design, without feed purification • Losses of production and high maintenance costs • Recovery of +/- 95% of the overall furnace run length design after the installation of Naphtha feed filters and coalescers
European Naphtha Cracker #1 & 2	<ul style="list-style-type: none"> • Installation of Naphtha feed filters and coalescers on the first cracker • Following positive results, installation of the same equipment on the second cracker • Positive impacts confirmed – bypass of the installation can lead to a 50% reduction in furnace run length
European Naphtha Cracker #3	<ul style="list-style-type: none"> • Naphtha feed filters and coalescers installation payback of 6 months
European Naphtha Cracker #4	<ul style="list-style-type: none"> • Installation of Naphtha filters on 3 furnace feed lines years ago • Filtration still in operation with positive impacts confirmed, but no precise data communicated
Chinese Naphtha Cracker	<ul style="list-style-type: none"> • Installation of Naphtha feed filters and coalescers in front of 4 furnaces • Increase of furnace run length from 11 to 17 days

Conclusion

High-efficiency liquid/liquid coalescers and absolute-rated filters (99.98% efficiency) used to treat liquid or gas hydrocarbon feeds in ethylene plants were found to increase the steam cracker productivity and to lower emissions by decreasing the decoking frequency.

In crackers fed with barged Naphtha, the high-efficiency liquid/liquid coalescers removed fouling and coke generating contaminants, including sodium. Filters and coalescers successfully protected the new generation of furnaces at several ethylene plants.

Customer Benefits

The major benefits of using high-efficiency liquid/liquid coalescers and absolute-rated filters include: the reduction of fouling in the furnace convection zone, the extension of the run time length of the furnaces between de-coking, the increase in the useful life of the furnace tubes, and the lowering of emissions. This technology also enables ethylene plants to use more contaminated, alternate feed stocks such as Naphtha brought in by marine transport or Light Cat-cracked Naphtha (LCN / FCC gasoline) coming from refineries. The payback period for the capital investment in the high-efficiency liquid/liquid coalescers associated with the prefilter systems was estimated to be less than one year.



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