

# ONE DROP AT A TIME

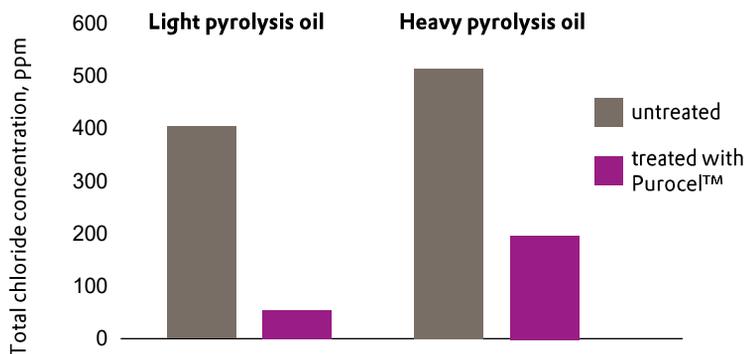
## UPGRADING PYROLYSIS OIL FOR CLEANER PETROCHEMICALS

**With a significant number of plastics originating from fossil-fuel feedstocks, the petrochemical industry continues to face mounting pressure to decarbonize its operations and transition to a more circular economy.**

Consequently, there are growing efforts to diversify beyond conventional methods and feedstocks (which rely heavily on fossil-based liquids and highly energy- and carbon-intensive processes) to shift to renewable alternatives.

### The challenge

This movement is driving new investments and laying the groundwork for a more sustainable petrochemical sector. A prime example is pyrolysis oil, produced through the thermal decomposition of end-of-life plastics in an oxygen-free process to convert plastic waste back into a valuable raw material. Pyrolysis oil offers a promising and more



Evonik's specialized adsorbent for significant reduction of chlorides in light and heavy pyrolysis oil<sup>1</sup>

sustainable alternative feedstock for steam crackers by enabling more chemical recycling and reducing dependency on virgin hydrocarbons.

Raw pyrolysis oil is still far from a plug-and-play solution, however. Its composition varies depending on the source and type of plastic used, as well as pyrolysis conditions, often containing high levels of chlorides, silicon,

nitrogen, acids, and trace metals. These contaminants pose significant risks as they can damage downstream equipment, poison catalysts, increase maintenance costs, and cause operational inefficiencies or regulatory non-compliance. There have also been economic, infrastructural and regulatory hurdles which have hindered its large-scale adoption as a feedstock.

Consistent purification solutions are required to enable greater adoption of pyrolysis oil as an effective feedstock and support the modern refiner's pathway towards greater circularity.

<sup>1</sup> untreated pyrolysis oil with 485 ppm CL, fractionated into light and heavy pyroil (cutoff 205° C)

## Commercial Scale

As an answer to these challenges, Evonik Catalysts has developed the Purocel™ series of adsorbents and catalysts.

Combining expertise in purification, hydrotreating, and modular processing, Purocel™ technologies:

- Remove chlorides, silicon, nitrogen, and other heteroatoms from pyrolysis oil streams.
- Provide regenerable and rejuvenated adsorbents, such as Purocel™ 510, for improved circularity and lower operating costs.
- Offer hydrotreating catalyst options (e.g., Purocel™ H400 series) to upgrade additional properties of pyrolysis oil beyond impurity removal – including saturating olefins and aromatics.
- Provide multi-column, modular “Rocket” technology for odor, color, and contaminant removal with efficient in-situ reactivation and programmable logic controller (PLC)-controlled operation.

With a full suite of testing capabilities, Evonik can screen adsorbents against customer feedstocks, conduct pilot-scale dynamic testing, and scale up to commercial operation.

This approach allows refineries and petrochemical operators to design tailor-made purification systems that meet stringent specifications while minimizing CAPEX and OPEX.

## THE RESULTS

Evonik’s Purocel™ solutions have demonstrated significant performance benefits in lab and pilot stage, with commercial trials showing:

### IMPROVED IMPURITY REMOVAL

In testing, Purocel™ 505 achieved up to 3× higher chloride removal than conventional sorbents.

### COLOR AND ODOR IMPROVEMENT

Purocel™ 510 has shown promising performance in improving visual and sensory qualities of pyrolysis oil streams.

### COMPREHENSIVE PURIFICATION

Purocel™ 510 (bauxite-based) effectively removes both organic and inorganic chlorides, along with other impurities such as sulfur, silicon, phosphorus and TAN.

### SCALABLE SYSTEMS

Evonik’s Rocket technology and modular skids allow systems to operate in series or in parallel, treating a wide variety of oil types (including pyrolysis oil, used motor oil, and transformer oils).

These advancements can help refiners and petrochemical operators safely and efficiently increase the proportion of pyrolysis oil in their feedstocks by unlocking higher recycled content and enabling a true circular economy for plastics.

Evonik Catalysts supports customers with end-to-end purification solutions – from lab screening to commercial-scale modular skids – to unlock the full potential of pyrolysis oil and other waste-derived feedstocks.

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*“By combining advanced adsorbents and hydrotreating catalysts, our Purocel™ series enables customers to safely and efficiently integrate pyrolysis oil into their operations - reducing contaminants, increasing recycled content, and supporting the shift to a circular chemical industry.”*

**Nirav Shah**, Global Director Growth Fields, Re-refining, LNG/Gas processing at Evonik

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To discover more about how Evonik Catalysts is driving a broad green agenda, click [here](#).

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