

Pyrolysis Oil Purification for Steam Cracker Integration

Technip Energies is committed to defining solutions to make the circular economy a reality. Thus, we have developed a resilient and flexible purification and upgrading train for pyrolysis oil produced from plastic waste. Our technology enables us to offer the market a licensed process that allows a wide range of pyrolysis oils to be used as feed to steam cracking furnaces.

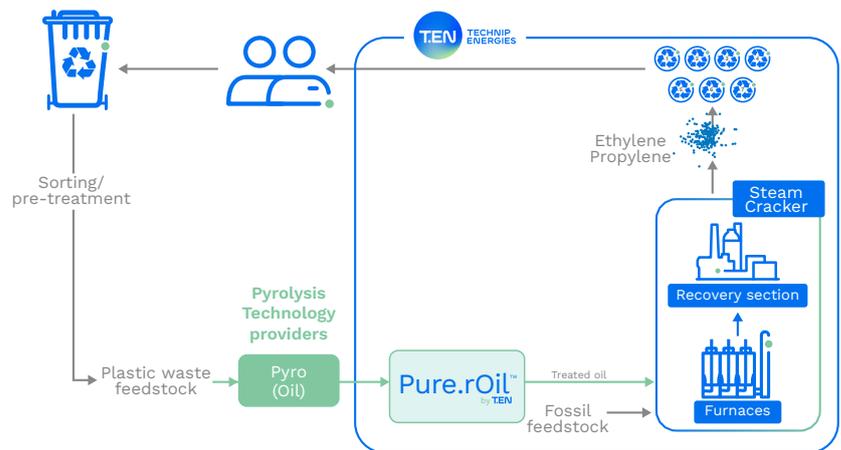
Mechanical plastic recycling has certain shortcomings, such as its inability to handle all types of plastic waste and to ensure virgin quality of recycled products.

Pyrolysis of plastic-rich waste can overcome these limitations and thus ensures true circularity once the associated products can be successfully processed in steam crackers.

There is a large range of pyrolysis technologies which can produce pyrolysis oils from plastic waste. The range of technologies and wastes used as feed result in a wide range of pyrolysis oil qualities. Pyrolysis oils can be used as feed to steam cracker furnaces, although at increasing capacities, these oils need to be treated to remove contaminants and, in some cases, to modify the final boiling point, to enable them to be optimally processed in steam crackers. Technip Energies has developed a technology to condition the pyrolysis oil produced from plastic waste, with the ability to process as wide a range of oils as possible, while eliminating or minimising any modifications to liquid feed steam crackers. This technology is based on existing referenced technologies.

Technip Energies has carried out due diligence on the leading providers of pyrolysis oil technology, which enables us to be sure that our clean-up technology can handle a wide range of oil qualities. It also enables us to advise clients how to ensure that they have a robust supply chain from the waste available to an oil feed suitable for processing in their steam cracker.

A true circular economy thanks to Technip Energies' Pyrolysis products purification trains



Our proprietary Pure.rOil purification and upgrading train ensures safe and flexible feed preparation for any liquid cracker. This technology benefits from:

- Key know-how brought by Technip Energies' expertise in ethylene technology combined with existing lube oil recycling technologies.
- Processing steps already proven in industry at large scale, as demonstrated by our strong track records in ethylene quench system projects and deep knowledge of fouling mechanisms.
- Ability to model the impact of the feed on furnaces using proprietary SPYRO® software.
- Well-established relationships with the key hydrogenation catalyst suppliers

Technip Energies provides customized solutions to integrate the technology with liquid steam crackers, which are optimized on a case-by-case basis. Our solution is based upon preferred hydrogenation catalyst suppliers although can incorporate a client's own, or preferred, hydrogenation technology, if desired.

Plastic Pyrolysis based oil feedstock: Feedstock definition, key challenge and purification strategy

Integrating pyrolysis oil from plastic waste into an existing steam cracker feed is a challenge that needs to tackle the dual concerns of a potential heavy oil tail, while managing the presence of contaminants. The extent of the tail and the contaminants present vary, depending on the nature of the feed to the pyrolysis unit and the pyrolysis technology.

If untreated, the heavy tail in the oil feedstock can exceed the end point specification for existing furnaces, but removal of this heavy material can cause fouling problems in the separation equipment and if not processed adequately will give rise to a new waste stream from the cracker. At the same time, various contaminants which can have negative effects on the steam cracker need to be removed or reduced to acceptable levels (e.g., nitrogenated compounds, metals, chlorides, oxygenates, sulphur compounds). Hydrogenation for saturation of olefins and some contaminant removal is based on commonly available technologies from selected and qualified catalyst suppliers.

The purification strategy comprises a dedicated multilayer contaminant removal scheme with several levels of safeguard for key components including chlorides, oxygenates, metals, etc.

It maintains the operability of the steam cracker unchanged by allowing:

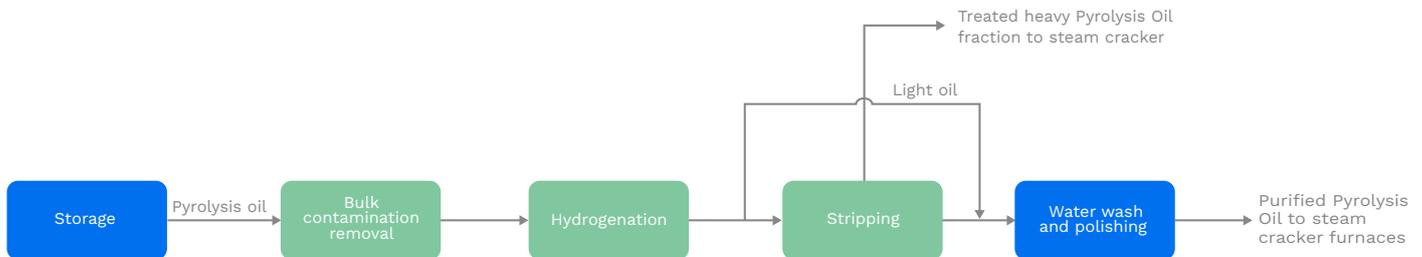
- The mitigation of fouling and corrosion issues in the furnaces
- A final product on-specification
- Poison-free operation of ethylene plant catalysts

Why choose Pure.rOil by T.EN

In today's environment, with growing awareness to minimise plastic wastes, companies are searching for ways to increase the recycled content of plastic products, and to reduce their carbon footprint. Incorporating a purification technology, such as our Pure.rOil by T.EN, provides ethylene producers with a flexible, reliable and circular alternative to feedstock from fossil sources.

Pure.rOil™
by T.EN

Pure.rOil by T.EN Overall Block Flow Diagram*



The principal sources of the technology used are:

- Technip Energies' Chloroff technology, developed and implemented many years ago for the clean-up of spent lube oil
- Hydrogenation technologies and catalysts tested on actual oil samples
- Technip Energies' quench technology, used on a large number of operating liquid cracking plants
- Ripple Trays™ used as the tray of choice in many fouling systems in ethylene plants

MAIN UTILITIES FROM/TO CRACKER

- Hydrogen
- Power
- Cooling water
- LP steam/condensate
- BFW
- PA/IA/Nitrogen
- Service water
- Regeneration gas
- Flare release



Jim Middleton
Ethylene Product Line Leader
jim.middleton@technipenergies.com

Andreas Borman
VP Sustainable Chemistry Product Line and
Managing Director, Frankfurt
andreas.borman@technipenergies.com

www.technipenergies.com