Plastics upcycling with
Hydrochemolytic™ Technology

ADURO CLEAN TECHNOLOGIES

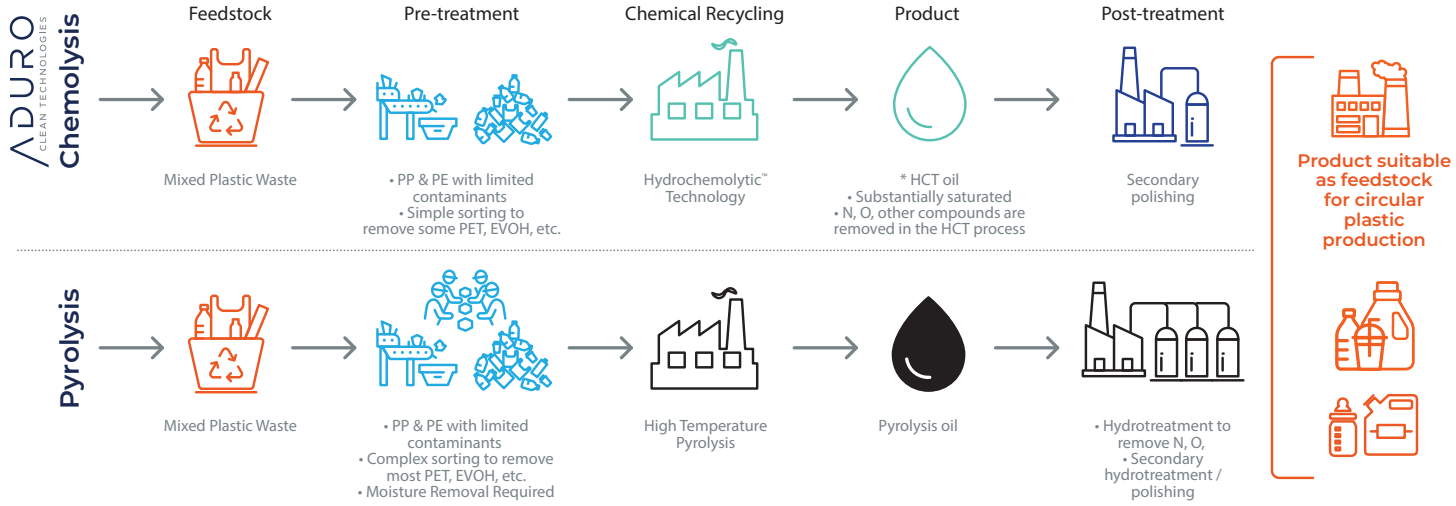
Achieving product purity in **chemical recycling**

The **Between** Chemistry.

Contaminants in plastic waste can be problematic in chemical recycling processes aimed at reclaiming plastics for the circular economy. Some are added during production to enhance plastics' performance, some are plastics from incomplete sorting, and many enter during use and collection. Chemically, they are hugely varied, containing oxygen (O), nitrogen (N), and other elements that can affect processing and contaminate the high-purity hydrocarbon products required for re-entering plastic production.

The proprietary HCT deals with contaminants simply and directly: Its selectivity in deconstructing plastics molecules into high-purity products also excludes diverse contaminants so that N and O from paper, food, and plastics that slip through the sorting process, yet without diminishing the purity of product hydrocarbons. Inorganics are likewise excluded and do not adversely affect the performance of HCT or product quality.

Traditional pyrolysis forcefully breaks molecules in plastics and contaminants into reactive pieces that get scrambled and then recombine. As a result, N and O from food residues and contaminant polymers like PET, nylon, EVOH end up in the desired hydrocarbons generated from plastics. This requires purification by expensive post-processing.



Features of Hydrochemolytic Technology

Environmental impact

Compared to pyrolysis, HCT operates under milder conditions, resulting in lower CO_2 emissions and minimal loss of carbon.

Cost efficiency

HCT is cost-efficient using less energy because it requires minimal pre-sorting and post-treatment, making it both sustainable and economically viable.

Versatility

HCT can process plastic waste with various contaminants, such as PET, EVOH in multi-layers optimizing resource recovery from challenging mixed waste.

The ideal balance **between** economic and environmental benefits

Superior yield
Higher return on investment with plastics resource capture >90%

Minimal post processing
Yields valuable hydrocarbons achieving removal of contaminants by simple separation

Tolerance for contaminants
Lower costs for pre-processing of plastic feedstocks

Lower emissions
As little as 5% feedstock loss to methane and CO_2

Energy efficiency
Lower temperatures than conventional pyrolysis

Supports circularity
High quality feedstocks for the circular production of plastics

High-purity products despite feedstock contaminants

According to the US EPA, 85.7% of waste plastics in municipal solid waste streams are PE, PP, PS, and PET, fully three-quarters of which are the "polyolefins" PE and PP. Pyrolysis and Aduro HCT take direct aim at these, but prices of polyolefins yielded by modern sorting techniques varies inversely with contaminant content, meaning price increases with decreasing amounts of impurities that include nylon, PET, PS, EVOH, and use residues from paper and food.

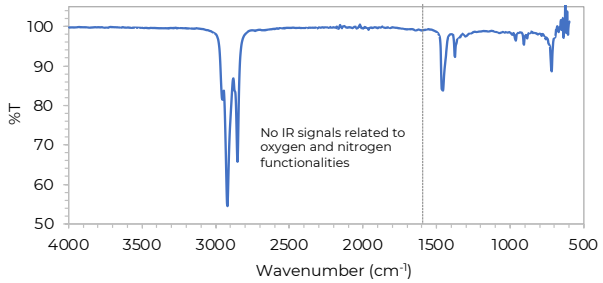
In pyrolysis, these contaminants carry through into the crude oil product, requiring extensive, expensive chemical post-processing before entry into the circular economy. By contrast, HCT selectivity yields the required high-purity hydrocarbons that can be "polished" through simple, cost-effective separation techniques. The contrast is between high and low yields, high- and low-purity products, simple and complex post-processing.

HCT

- ~85% PE with
- 1 – 2% each of PP, PET and PVC,
- 10% ash; contaminated with Cl, Ca, Ti, Fe, etc.

- Substantially saturated hydrocarbons
- No IR signals related to oxygen and nitrogen functionalities

Functional group analysis of the product using IR



Path to the future

Process development Aduro is actively working to scale up HCT for commercial application, with configuration of a next-generation process anticipated by the end of 2024. The company's continuous process unit is operational, paving the way for widespread adoption of this game- changing technology.

Versatile implementation One strength of the Aduro technology approach is its versatility, which provides economic and operational flexibility to meet specific needs of customers and minimizes implementation risks and costs while maximizing speed and efficiency, effectively accelerating the path to revenue.

Sustainability through innovation Chemical recycling and the circular economy are essential components in the transition towards sustainable resource management. Ensuring high-purity yields from recycling processes, like the Aduro HCT, is critical to maintaining the integrity and functionality of recycled materials, thereby supporting a robust circular economy. By integrating these innovative approaches, we can move towards a more sustainable and resilient future.

Aduro Clean Technologies is the **between** that connects the benefits of modern life with an environmentally sustainable future.

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