Plastic Recycling Technology Landscape

Berkeley DEEP TECH Innovation Lab

Traditional plastic recycling technologies involve physically breaking plastic down to flakes or pellets then remolding them or integrating them into new products. These systems require careful sorting of complex waste streams and result in degraded quality plastics. A new generation of advanced recycling technologies seeks to fix the issues with mechanical recycling, creating processes that can recycle different materials and achieve high quality byproducts.

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Current technologies process different plastics and produce products of disparate value

Recycling Type	Energy Input	Output Quality	Range of plastics
Aminolysis	Room temperature	Upcycled amides	non-polyolefins
Hydrolysis	Heated solution	Like-virgin monomers	Mostly PET
Pyrolysis	~500°C heating	Fuel products	All types
Methanolysis	Heated solution	Like-virgin monomers	Mostly PET
Enzymatic	Heated solution	Like-virgin monomers	Wide range of plastics being explored

Pyrolysis and Gasification

Current large-scale operations, but high energy inputs and low value products

- Involve heating plastics under anaerobic conditions to produce oils, chars, and gases
- Can process all plastics (and other hvdrocarbons) through

MOLTEN

EXXON

GREEN FUEL Nordic Oy

Solvolysis

Some large-scale operations and several start-ups

- Break polymer bonds in plastics using solvents
- Processes use varied catalysts at different temperatures
- Some processes produce like-virgin monomers, others produce new products
- sses focus on PET

EASTMAN

DePoly

BASF

Biological and Enzymatic recycling

Lowest scale operations so far, but significant university research

- Enzymatic processes use biologically derived enzymes to break polymer bonds in plastics
- Biological processes use fungi or bacteria to break polymer bonds
- Biological/enzymatic processes can only develop a few plastics so far, but researchers are
- ions for a wide

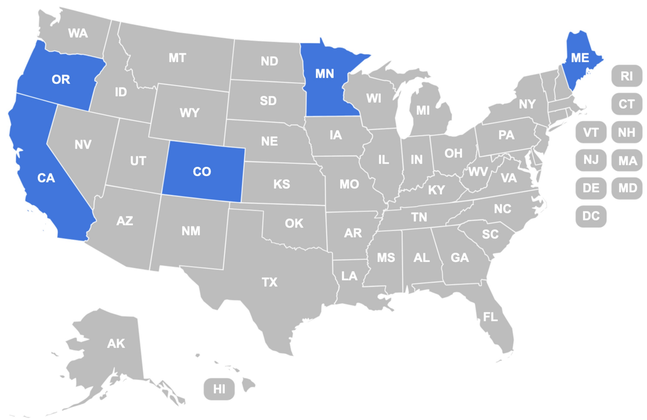
CARBIOS

Advanced recycling companies face competition from cheap virgin plastics and inconsistent feedstocks

"[T]he advanced recycling sector is challenged by the low cost of virgin plastics derived from fossil oil and a plastic recycling supply chain still in development. Furthermore, the implementation of regulated mandatory standards for meaningful recycling levels are too far out into the future."

ioniqa **(Statement in press release announcing bankruptcy)**

The complex state-by-state regulatory landscape leads to varied regulatory requirements and feedstock availability



- As an example of the varied regulations, the map to the left shows states with Extended Producer Responsibility **(EPR)** laws
- EPR laws require industries to establish funds to promote recycling their products
- States have EPR laws for varied products such as Textiles, packaging, and batteries