



Currently, various technologies are utilized to produce virgin-like quality recycled polyethylene from waste materials. The predominant method for recycling waste LDPE/HDPE involves mechanical recycling utilizing additive master batches. The main aspects of different methods are briefly outlined:

Mechanical

Process Steps:

- Collection & Sorting
- Washing (hot/cold water, detergents, sometimes caustic soda)
- Shredding
- Extrusion & Pelletization (with degassing and filtration)

Key Technologies for Better Quality:

- Vacuum Degassing Extruders: Remove volatile contaminants.
- Melt Filtration : Filters out fine contaminants.
- Additives/Compatibilizers: Improve mechanical properties and stabilize the polymer.
- Viscosity Control: Maintains molecular weight (using chain extenders if needed).

Pros:

- Low cost
- Simple tech, widespread availability
- Energy efficient compared to chemical recycling

Cons:

- Limited to clean and homogeneous waste
- Properties degrade after multiple cycles

Solvent-based Purification

Concept:

Dissolve PE in a solvent, remove contaminants/additives, and re-precipitate pure polymer.

Example Tech:

- CreaSolv® Process (Fraunhofer)
- PureCycle Technologies (focuses on PP, but similar tech being applied to PE)

Pros:

- Yields near-virgin quality
- Retains molecular structure
- Effective for multilayer plastics (LDPE films, etc.)

Cons:

- More expensive than mechanical recycling
 - Needs precise solvent handling
 - Still emerging in industrial scale
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Chemical Recycling (Pyrolysis, Depolymerization)

Pyrolysis: Thermally breaks PE into fuels or naphtha-like substances which can be re-polymerized.

Pros:

- Works with dirty/mixed waste
- Produces feedstock for new virgin polymer

Cons:

- Energy-intensive
 - More costly than mechanical recycling
 - Still under scale-up
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Advanced Mechanical + Additive Masterbatch Blending

Use of additive masterbatches during extrusion:

- Chain extenders (e.g., Joncryl for PET, some versions for PE)
- Stabilizers (UV, thermal)
- Compatibilizers for mixed polyolefins

Pros:

- Enhanced quality from simple mechanical lines
- Cost-effective

Cons:

- Limited by degree of original contamination
- May need precise formulation

The know-how in short is described below.

Know-How for Achieving Virgin-Like Quality

Key Parameter	Details
Feedstock Quality-	Use post-industrial or well-sorted post-consumer waste
Cleaning Technology	-High-efficiency hot washing and float-sink separation
Extruder Type-	Twin-screw or cascade extruder with vacuum venting and melt filter
Melt Filtration-	Fine filters (e.g., 50–150 µm) to remove gels, dust, and contaminants
Additives-	Stabilizers, odour control agents, chain extenders
Quality Control-	Use MFI, DSC, FTIR, tensile testing to verify properties

Conclusion: *The most effective economic method for achieving virgin-like quality recycled plastics from LDPE/HDPE waste is through mechanical recycling utilizing additive masterbatch technology.*

Enhanced Mechanical Recycling combined with Additive Masterbatch Technology is presently the most cost-effective and advanced approach for recycling polyethylene (particularly HDPE/LDPE) to a near-virgin quality. With appropriate sorting, cleaning, and filtration, the recycled PE can be utilized in packaging, consumer products, and industrial uses.

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If you have any other questions or would like to suggest topics for us to write about, please feel free to contact us at info@polymerupdateacademy.com