Shanghai DODGEN Chemical Technology Co., Ltd.

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Deeply Engaged in Cutting-Edge Fields

- Degradable Plastics
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DODGEN

DODGEN Solution Process Polyolefin Technology

Tackling the 'Choke Point' Challenge of High-End Materials

Polyolefins

They are a class of macromolecular materials formed by polymerization reaction from olefin monomers such as ethylene, propylene, butene, etc.

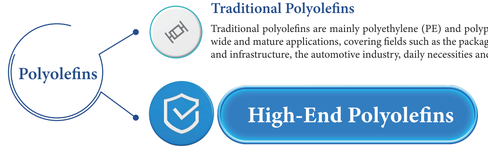
At present, the global annual output exceeds 150 million tons, accounting for about 40% of the total plastic output.

It is one of the thermoplastic plastics with the largest global output and the most extensive application.

Features

- Simple structure
- Low cost
- Easy to process
- Stable performance

PART 1 High-End Polyolefins



Traditional Polyolefins

Traditional polyolefins are mainly polyethylene (PE) and polypropylene (PP). They have wide and mature applications, covering fields such as the packaging industry, construction and infrastructure, the automotive industry, daily necessities and industrial manufacturing.

Solution Polymerization

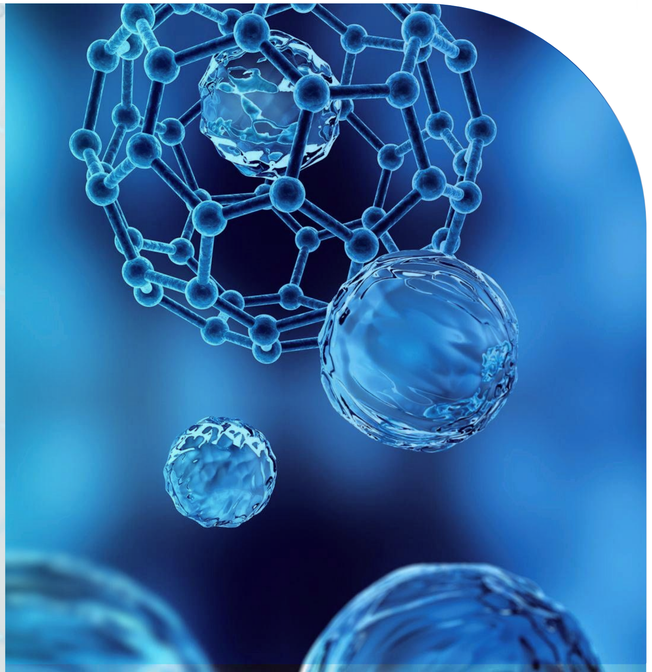
With its advantages in the flexibility of molecular design and the ability to prepare complex materials, it has become the core technology for the production of high-end polyolefins at present.

Application Cases

DODGEN solvent recovery and devolatilization process intersification technology has been successfully applied in the large-scale production of high-end products such as POE elastomers, COC optical materials, and EPOE automotive parts, helping customers capture high-value markets.

A Visual Guide to Core High-End Polyolefin Varieties and Their Applications

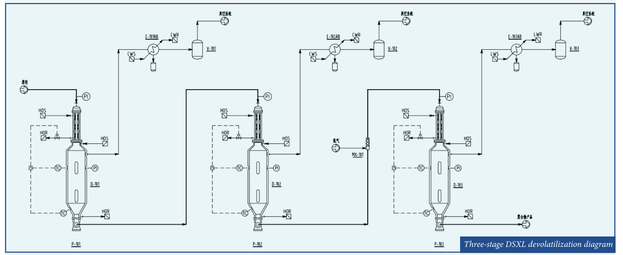
Polyolefin	Major Monomer	Main application areas	Main production process	Advantage
MPE	Ethylene	Packaging, tubing, etc	Solution method/ gas phase method	Good toughness, good transparency, high heat sealing strength, cracking resistance
MPP	Propylene	Spinning, medical, food packaging, etc	Gas phase method/ bulk method	Better processability, finer fiber, good toughness, good uniformity
EPM/EPDM	Ethylene, propylene, other vinyl compounds	Sealing, construction, cables	Solution method/ vapor method/ slurry method	Adding a small amount of other functional monomers can modify properties, balance toughness, and improve vulcanization perfeomance
POE/EPOE	Ethylene, butene/ hexene/octene	Automobile, photovoltaic, shoe material	Solution method	High elasticity, high elongation, and good impact strenth
EVA	Ethylene, acetic acid	Photovoltaic, shoe material, cable, hot melt adhesive, etc	High-pressure method/ solution method	High flexibility, resistance to temperature variations, impact strength, and stress crack resistance
EVOH	Ethylene, vinyl alcohol	Barrier packaging, automobiles, multi-layer composite bottles, etc	Solution method	High performance, low cost, and low pollution
UHMWPE	Ethylene	Pipes, profiles, fibers, hollow products and injuction molded products	Slurry method	Better impact resistance, self-lubrication, wear resistance, chemical corrosion resistance, low-temperature resistance, stress crack resistance, and anti-adhesion capability
PB-1	Butene-1	Films, plates, moulded products, composites and blends can also be used for modification	Slurry method/ gas phase method	It has the impact toughness of PE, along with higher stress crack resistance than PP and excellent creep resistance
COC/COP	Ethylene, cyclo olefin	Optics, medical, electronics	Solution method	Good optical properties, excellent biocompatibility, and high barrier properties



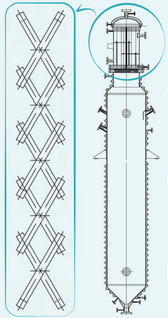
PART 2 DSXL Devolatilization Technology

The principle of DODGEN DSXL devolatilization technology is to rapidly and uniformly heat the polymer to a certain temperature through an efficient high-viscosity fluid heat exchanger, and/or add additives to the polymer that help volatile substances escape. Then, the polymer is uniformly dispersed in the devolatilizer, increasing the surface area of the polymer in the reactor and reducing the interfacial mass transfer resistance of volatile substances, so as to achieve the purpose of efficient devolatilization.

The reaction liquid of solution polymerization polyolefin from the reaction section generally has a large amount of solvent (usually reaching 60%-70%) and a solvent content of less than 20%. Dongguang usually uses 2-3 stages of strand devolatilization to remove solvents and unreacted monomers (see the process schematic diagram below). The devolatilization temperature increases step by step, and the pressure decreases step by step. After devolatilization, the residual amount is reduced to below 500ppm.



Three-stage DSXL devolatilization diagram



High Efficiency, Precision, and Cost Reduction in One

Solvent Removal Efficiency Breakthrough

The DSXL technology uses a multi-stage devolatilization design combined with a high-viscosity specialized heat exchanger for rapid heating (e.g., heating the polyolefin-solvent system to the critical vaporization temperature). The distributor disperses the melt into millimeter-sized liquid films, significantly shortening the solvent diffusion path. The residual solvent content can be reduced to below 500 ppm, meeting the purity requirements for high-end polyolefins (such as metallocene polyethylene).

Molecular Weight Protection Mechanism

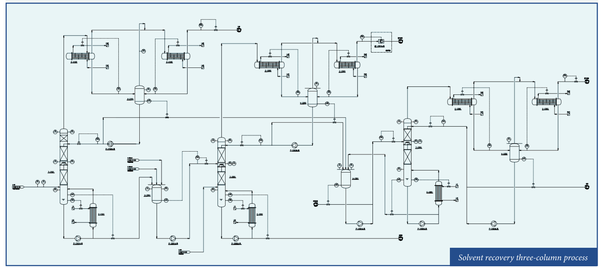
By adopting a combination of gradient pressure reduction and low-temperature flash evaporation processes, precise temperature control during the devolatilization process prevents thermal degradation of the polyolefin. The addition of additives (such as nitrogen) enhances the removal of small molecules, reducing molecular chain degradation caused by prolonged high-temperature exposure.

Significant Cost Advantage

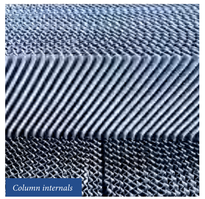
Compared to traditional twin-screw devolatilization, DODGEN DSXL Devolatilization technology saves 40%-60% in investment, while operational and maintenance costs are significantly reduced, providing remarkable economic benefits.

PART 3 DODGEN Solvent Recovery Technology

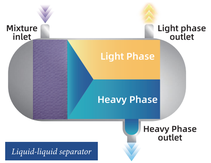
DODGEN's Solvent Recovery Process Enhancement Technology effectively helps the solution polymerization of polyolefins reduce energy consumption. Taking POE solvent recovery as an example, through a refined design of the devolatilization system and solvent recovery system, the traditional two-column solvent recovery system is upgraded to a three-column recovery system, which results in an estimated 30% reduction in energy consumption.



Solvent recovery three-column process



Column internals



Liquid-liquid separator

Main Optimizations of the Three-Column Recovery Process

Utilization of Flashing Waste Heat

A waste heat recovery system is used to capture the heat from the flashing gas phase (160-180°C) and repurpose it to preheat the feed material. This reduces the energy consumption of the flashing condensation system while providing significant thermal energy to the solvent recovery system, thereby lowering overall energy usage.

Precise Gradual Separation

The integrated design of the flashing and solvent separation system enables the precise, graded separation of solvents and monomers at each stage of the flashing process. This achieves the stepwise use of steam and optimizes the cooling capacity of the condensation system, further reducing the energy consumption of the entire system.

Efficient Distillation Column Internals

The three solvent recovery columns are equipped with high-efficiency packing materials that feature low pressure drop and high separation efficiency. This allows for higher separation performance while reducing the height of the distillation columns. Additionally, it effectively lowers the reflux ratio, resulting in lower distillation energy consumption.

Application of High-Efficiency Liquid-Liquid Separator

A high-efficiency liquid-liquid coalescer is employed to achieve continuous and efficient separation of the organic and inorganic phases during the solvent recovery process. This innovative approach effectively reduces solvent and molecular sieve loss, leading to a significant reduction in operating costs.