

# Gas–Solid Chlorination vs. Conventional Methods: How CPP Resin Quality Is Elevated



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Xianggang, China Jun 17, 2026 ([Issuewire.com](http://Issuewire.com)) - Industrial production of [chlorinated polypropylene](#) (CPP) today primarily follows three main routes: the solvent method, aqueous suspension method, and gas–solid method. While the first two are widely known, the gas–solid method—often referred to as the “third-generation process” in the industry—is redefining [CPP resin](#)

quality through environmental sustainability, product purity, and energy efficiency. Here, we examine these three production methods from a technical perspective, highlighting where the gas–solid approach delivers tangible quality improvements.

## 1. Three Production Routes: Strengths and Limitations Solvent Method

As the first-generation process, the solvent method is the most established and widely used in China. It involves dissolving polypropylene in organic solvents such as carbon tetrachloride or chlorobenzene, followed by chlorination in the presence of initiators. Advantages include uniform chlorination, precise reaction control, and stable process performance. Its main drawback, however, is heavy solvent consumption: producing one ton of CPP typically requires 0.8–2.2 tons of organic solvent.

### Aqueous Suspension Method

The second-generation aqueous suspension method suspends polypropylene powder in an aqueous solution containing dispersants and initiators, followed by chlorination under heat and stirring. By avoiding toxic organic solvents, this method is safer and more environmentally friendly than the solvent route. It allows precise control of chlorine content (15–60%) and provides excellent uniformity, meeting the needs of inks, coatings, and other industries. While commonly adopted in developed countries, this method requires substantial investment and technical expertise, and only a few domestic manufacturers can achieve industrial-scale production.

### Gas–Solid Method

The gas–solid method is the third-generation process gaining significant attention. It directly exposes powdered polypropylene to chlorine gas in a reactor without any solvents or reaction media. The shorter process and fewer variables theoretically yield higher product purity. Historically, this heterogeneous reaction faced three technical challenges: material back-mixing, difficulty in removing reaction heat, and uneven chlorination.

## 2. Gas–Solid Method Advantages: Four Key Breakthroughs

The gas–solid method stands out due to its breakthroughs across multiple dimensions:

### 2.1 Environmental Sustainability

Traditional solvent-based methods consume nearly a ton of organic solvents per ton of [CPP](#), generating significant hazardous waste. The gas–solid method eliminates solvent use entirely, producing virtually no organic wastewater or emissions. This not only prevents ozone layer damage but also avoids potential health risks, making it a highly sustainable choice in line with global carbon-reduction initiatives.

### 2.2 Higher Product Purity

Without solvents, volatile organic residues in gas–solid CPP are essentially undetectable. By contrast, conventional solvent-based CPP may retain tens to hundreds of ppm even after post-processing, a concern for food-grade and medical applications. Gas–solid CPP inks more easily comply with standards such as GB 9685 and EU 10/2011. Its clean reaction system also reduces contamination, resulting in films that are dry, clear, and highly glossy.

## 2.3 Lower Energy Consumption and Costs

Eliminating solvent recovery and waste treatment steps shortens the process, reduces equipment needs, and lowers energy consumption. At scale, energy and disposal costs per ton are significantly lower than those for solvent-based methods—total energy consumption can drop by over 15%.

## 2.4 Precise Chlorine Control

**CPP resin** applications are highly sensitive to chlorine content. CPP with 20–30% chlorine is ideal as an adhesion promoter; 20–40% chlorine CPP provides excellent bonding for inks; 63–67% chlorine CPP is used in high-performance flame-retardant or corrosion-resistant coatings. The gas–solid method enables precise control of chlorine content, allowing products to be tailored for specific applications.

## 3. Challenges and Real-World Breakthroughs

The gas–solid method’s main historical challenges were uneven chlorination, heat removal difficulties, and material back-mixing. Uneven chlorination was particularly problematic, as minor temperature variations could impact adhesion stability, slowing early adoption in the ink industry.

These challenges are now being addressed. In February 2025, China’s independently developed “Gas–Solid Chlorinated Polymer Production Technology and Equipment” was recognized by the Ministry of Industry and Information Technology as an advanced applicable technology. Innovations in process greening, integration, and domestic core equipment resolved issues of material back-mixing, stickiness, heat removal, and uneven chlorination. Currently, production lines with 20,000 tons/year capacity have been established, with plans to expand into chlorinated polypropylene manufacturing.

While large-scale gas–solid CPP production is still evolving, stability varies among suppliers. Some domestic manufacturers have achieved consistent production of chlorinated polyethylene, demonstrating industrial feasibility. When sourcing gas–solid CPP, it is recommended to request batch testing and application data and to conduct small-scale trials when needed.

## 4. Frequently Asked Questions Q1: Does gas–solid CPP have better adhesion than conventional products?

At equal chlorine content and formulation, gas–solid CPP matches high-quality aqueous suspension CPP in adhesion. Both rely on the same molecular structure and “like-affinity” principle with PP substrates. Gas–solid CPP excels in lower solvent residue and higher batch consistency, making it the better choice for applications requiring food-grade or medical compliance. Even when adhesion alone is the priority, gas–solid CPP’s precise chlorine control ensures consistent performance across batches.

### Q2: How soluble is gas–solid CPP in solvent-free systems?

Solubility depends on chlorine content and molecular weight rather than production method. Both gas–solid and aqueous suspension CPP dissolve well in toluene or xylene. Solvent-free systems typically use methylcyclohexane with ethyl acetate, n-propyl acetate, or butyl acetate. Gas–solid CPP, being dry and solvent-free, may dissolve slightly slower initially compared with solvent-residual CPP.

### Q3: How does gas–solid CPP compare in cost and value?

Short-term prices for gas–solid CPP may be slightly higher than solvent-based CPP but similar to high-

end aqueous suspension products. Considering total cost, its low solvent residue reduces post-processing, batch consistency minimizes waste, and compliance with green standards facilitates client audits. For food-grade and medical applications, gas–solid CPP’s regulatory advantages outweigh the price difference, offering strong value for mid-to-high-end uses.

## Conclusion

To evaluate a reliable gas–solid **CPP supplier**, consider three key factors:

- Proprietary process equipment and stable production capabilities;
- Batch-consistent third-party test reports, especially solvent residue data;
- Proven application experience, particularly in ink printing and related industries.

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