# Seven performance reasons to change to a C10 plasticizer

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# Seven **performance reasons** to change to a C10 plasticizer

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Superior technical performance and greater sustainability of PVC plasticizers are critical to many applications, particularly outdoors (roofing membranes and tarpaulins). Increasingly customers want a combination of greater longevity, lower maintenance costs, and lower carbon footprint. On all technical performance parameters, phthalate ester plasticizers based on isomeric C10 alcohols deliver a level of excellence that C8-9 plasticizers cannot achieve.

This article focuses on performance comparisons based on the leading C8-9 general-purpose plasticizers available today. But do the performance differences warrant a change to C10? This article will help you decide.

C10 plasticizers belong to a small club of just two general-purpose plasticizers Dipropylheptyl phthalate (DPHP) and Diisodecyl phthalate (DIDP). Both provide similar performance properties with DPHP marginally better in some areas. There are seven key areas where C10 plasticizers can show a clear advantage over their C8-9 rivals.

## The Magnificent Seven

1. **VOLATILITY** – the low volatility of C10 plasticizers is perhaps one of the most important reasons why C10 plasticizers are more durable and are ideal for use in higher operating temperature applications such as cables wires and auto-motive interiors. The added durability increases product longevity to provide a more sustainable solution with a lower cradle-to-grave footprint.

2. **WATER ABSORPTION** – C10 plasticizers have an exceptionally low level of water absorption, which is a key weathering performance parameter for outdoor applications and cables subjected to moisture, particularly in reducing maintenance and service issues.

3. **FOGGING** – achieving low fogging is important in automotive foil applications where mandatory fogging requirements make C10 plasticizer the clear favorite in the auto industry.

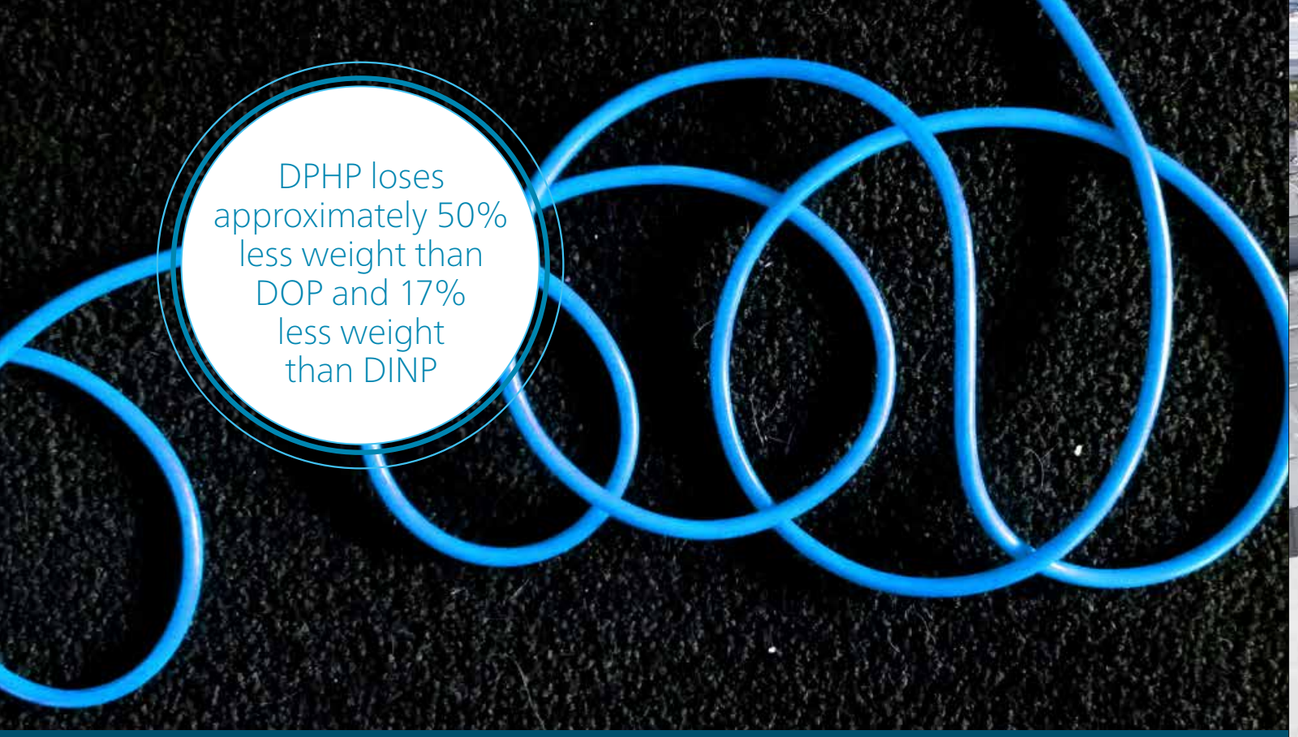
4. **UV/AGING** – DPHP, in particular, offers excellent UV stability and aging performance compared to other general-purpose plasticizers, making it preferred for roofing membranes and applications where weathering is an essential factor. By extending the useful product life, products contribute to greater sustainability and lower carbon footprint.

5. **MIGRATION** - coupled to low volatility, C10 plasticizers offer very low migration for stable longer life performance and a better toxicological profile.

6. **DENSITY** – C10 plasticizers' lower density means that higher extrusion and calendering rates are achievable in processing, and also the overall PVC compound weight reduced, which is particularly important in the auto industry.

7. **NON-CLASSIFIED** (toxicologically approved) – significantly, compared to C8 plasticizers, which are classified, both the technical performance and safety profile of C10 plasticizers are non-classified under REACH.

On the following pages, you will find more in-depth proof of the significant performance advantages C10 plasticizers offer.




# C10 plasticizers promise an extended, more sustainable and trouble-free life

C10 plasticizers' unique chemical and mechanical properties make them an outstanding choice for PVC products requiring long-life durability and performance reliability. Where these demands occur, it is difficult to substitute DPHP or DIDP with C8-9 plasticizers. C10 plasticizers offer proven advantages, particularly DPHP in weather resistance, exceptional flexibility, and overall wear and tear. This facilitates sustainable and low maintenance solutions for tough outdoor applications.

The advantages become evident when looking at the direct performance comparisons between C10 and C8-9 plasticizers. Below is the performance data relating to the 7 advantages of C10 plasticizers cited in this article. For comparison, we have chosen DINP and the once widely used DOP, which is now a classified plasticizer.

## LONG-LIFE DURABILITY AND GREATER SUSTAINABILITY

As a combination, the characteristics of softness, flexibility, and durability appear to be rather contradictory, but that is precisely the performance standard C10 plasticizers achieve. Underpinning this is the exceptionally low volatility and the resistance to degradation in PVC compounds operating at high or elevated temperatures.

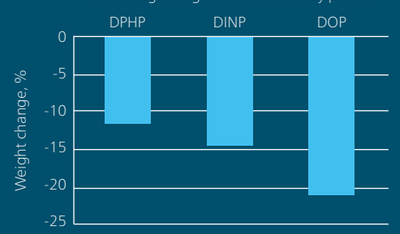
The graph below confirms the low volatility in terms of weight loss over 7 days at elevated temperatures, which clearly shows that DPHP loses approximately 50% less weight than DOP and 17% less weight than DINP. This low volatility provides the product with the durability, sustainability, and mechanical property retention needed to promote a long and trouble-free life.

In particular, cable and electrical wire manufacturers favor C10 plasticizers because of their long-life span and their ability to operate safely at high temperatures. This performance reliability avoids expensive maintenance and service issues, especially with underground cables.

DPHP's ability to easily form and shape due to its great flexibility is another key reason why it is preferred in the PVC insulation of cables and wire. Being able to twist and bend without cracking is a primary safety demand, and in this respect, C10 plasticizers are the best at minimizing the risk.

Volatility

Percentage weight loss over a 7 day period




# Weather resistance

A good measure of weather resistance is the plasticizer's ability to resist absorbing water and the effects of UV, which can degrade both the performance and aesthetics, leading to higher maintenance costs and early replacement.

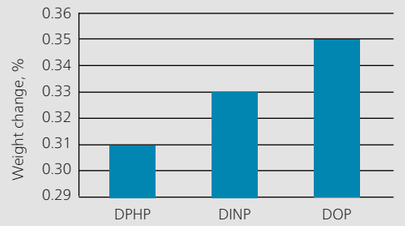
In the graph to the right, the C10 plasticizer not only offers low water absorption properties but also is significantly better than the competitive plasticizers sampled. This ability to prevent the ingress of water becomes vital in PVC products if they are to survive harsh outdoor conditions over many years.

DPHP, in particular, provides impressive UV resistance to prolonged sunlight without degrading or breaking down. This ensures the mechanical properties of the PVC are retained across the lifetime of the product.

The ability to resist aging added to low water absorption makes C10 plasticizers the premier choice for roofing membranes used in sporting arenas, industrial facilities, commercial, and residential buildings. The weather resistance properties of DPHP contribute directly to product sustainability by extending its useful life.

Water absorption

Percentage weight change as a result of water absorption




UV resistance

Natural weathering Central Europe, % weight loss (PVC Formula 2)

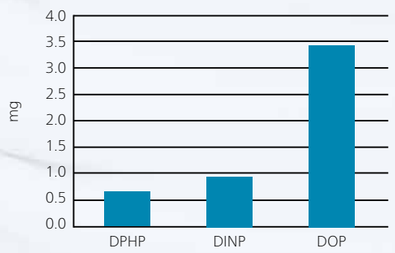
| | DIDP (64 phr) | DPHP (64 phr) |
|---|---|---|
| 6 months | 0.32 | 0.23 |
| 12 months | 0.81 | 0.46 |
| 18 months | 1.51 | 0.74 |
| 24 months | 1.35 | 0.73 |
| 36 months | 2.90 | 1.07 |
| 48 months | 11.90 | 2.70 |

Emoltene™ 100 increases extrusion and calendering rates by 2-3% compared to C8-9 plasticizers.

# Safe and secure environment

### Fogging

Fogging profile of common plasticizers.
C10 (DPHP) has a significantly lower fogging profile.




### Migration

Migration of commonly used plasticizers. DPHP shows low migration which contributes to high permanency

| ABS | PC | PS | Acrylic |
|---|---|---|---|
| TOTM | Polymeric | Polymeric | Polymeric |
| DPHP | TOTM | TOTM | TOTM |
| DOTP | DPHP | DOTP | DPHP |
| DEHP | DINP | DINP | DINCH |
| DINCH | DINCH | DPHP | DINP |
| DINP | DOTP | DEHP | DOTP |
| Polymeric | DEHP | DINCH | DEHP |
| DOA | ATBC | DOA | DOA |
| ATBC | DOA | ATBC | ATBC |
| Benzoate | Benzoate | Benzoate | Benzoate |

C10 plasticizers are preferred in cables for safety reasons. Their exceptional low water absorption maintains the cable's isolation properties, thus preventing the risk of electrical shock.

C10s  are also known for their anti-fogging or low fogging capabilities, which is due to the exceptionally low volatility. This makes C10 plasticizers particularly suitable for car interiors. As the graph on the left, highlights DPHP has a significantly lower fogging profile than C8-9 alternatives, especially against DOP.

Additionally, low migration contributes to high permanency, and as can be seen in the table on the left, DPHP is highly suitable for ABS, PC, and acrylic plastics. DPHP has been tested toxicologically and is safe to use and handle. It was one of the first plasticizers registered under the European chemicals regulation REACH and is non-classified.

# Smooth and productive processing

In terms of processing, a DPHP plasticizer is easy to switch to from C8-9 plasticizers and even as an alternative for DIDP because only minor compound changes are necessary in cable formulations, for example. The lower density of DPHP, compared with C8-9 plasticizers, provides PVC compounders with the opportunity to increase extrusion and calendering rates, and contribute to a greater number of square meters of product.



# Adding lifetime value to PVC products & applications

C10 plasticizers are premium general-purpose plasticizers that add real value to a wide range of PVC products and applications. The underlying durability and reliability, due to the chemistry and mechanical properties, extend the life span of products mainly in tough environments. This extension of life and lower maintenance requirements contribute to the sustainability of the application or product, helping to reduce both the carbon and cost footprints. In effect, a win-win for business and the environment.

Our C10 plasticizers offer a wide range of opportunities to our customers when developing their PVC compounds. Some of the high-performance benefits we guarantee are low volatility, water absorption, fogging, migration, UV/aging and density. Ultimately product performance and reliability with low risk attached are sought in premium applications, such as cables, roofing membranes, and automotive interiors. And that is where C10 plasticizers win both in the short and long term.

## Contact us

For more information about this article or plasticizers contact us on+46 435 380 00 or email technicalsalessupport@perstorp.com

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# One molecule can change everything

Perstorp believes in improving everyday life – making it safer, more convenient and more environmentally sound for billions of people all over the world. As a world leading specialty chemicals company, our innovations provide essential properties for products used every day and everywhere. You'll find us all the way from your car and mobile phone to towering wind turbines and the local dairy farm. Simply put, we work to make good products even better, with a clear sustainability agenda.

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