Seven performance reasons to change to a C10 plasticizer

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Superior technical performance of PVC plasticizers is critical to many applications, particularly outdoors (roofing membranes and tarpaulins) where longevity and low maintenance are demanded. 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 ideal for use in higher operating temperature applications, such as cables, wires and automotive interiors.

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 plasticizers the clear favorite in the Auto Industry.

4. **UV/Ageing** – DPHP in particular offers excellent UV stability and ageing performance compared to other general-purpose plasticizers making it preferred for roofing membranes and applications where weathering is an important factor.

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

6. **Density** – C10 plasticizers lower density means that higher extrusion rates can be achieved in processing and also overall PVC compound weight can be reduced, which is particularly important in the Auto Industry.

7. **Non-Classified** (toxicologically approved) – significantly C10 plasticizers technical performance and safety profile is non-classified under REACH compared to C8 plasticizers, which are classified.

On the following pages you will find more in-depth proof of the significant performance advantages C10 plasticizers offer.
C10 plasticizers promise a long 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 provides sustainable and low maintenance solutions for tough outdoor applications.

The advantages become more 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 has now become a classified plasticizer.

Long life durability
As a combination the characteristics of softness, flexibility and durability appear to be rather contradictory, but that is exactly 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. Graph 1 confirms the low volatility in terms of weight loss over seven days at elevated temperatures, which clearly shows that DPHP loses approximately 50% less weight than DOP. This low volatility provides the product durability and mechanical property retention needed to promote a long and trouble free life.

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

DPHP’s ability to 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.
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 Graph 2 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 important in PVC products that must 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 ageing added to low water absorption makes C10 plasticizers the premier choice for roofing membranes used in sporting arenas and buildings.

<table>
<thead>
<tr>
<th>UV resistance</th>
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<tbody>
<tr>
<td>DIDP (64 phr)</td>
</tr>
<tr>
<td>6 months</td>
</tr>
<tr>
<td>12 months</td>
</tr>
<tr>
<td>18 months</td>
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<td>24 months</td>
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<tr>
<td>36 months</td>
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<td>48 months</td>
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Table 1: Natural weathering Central Europe, % weight loss (PVC Formula 2) ¹.)

Graph 2: percentage weight change as a result of water absorption.
Safe and secure environment
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.

C10’s 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 Graph 3 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 Table 2 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.

Graph 3: fogging profile of common plasticizers. C10 (DPHP) has a significantly lower fogging profile.

Table 2: Migration of commonly used plasticizers. DPHP shows low migration which contributes to high permanency.

Smooth & Productive Processing
In terms of processing, DPHP plasticizers are an easy switch from C8-9 plasticizers, and even as an alternative for DIDP because only minor compound changes are needed in cable formulations for example. The lower density of DPHP, compared with C8-9 plasticizers, provides PVC compounders with the opportunity to increase extrusions 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, extends the life span of products particularly 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.

The high performance reasons for choosing C10 plasticizers - low volatility, water absorption, fogging, migration, UV/ageing, density and non-classified - give a wide range of opportunities to compounders and extruders when developing their PVC compounds. 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.

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Outstanding properties, outlasting performance
Perstorp's state-of-the-art fully integrated 2-PH platform provides a high level of supply and product reliability. With production and storage in Europe and a new storage facility in the USA Perstorp is offering both markets a premium DPHP C10 plasticizer, Emoltene™ 100. Secure supply and local development support guarantees an excellent service alongside this flagship C10 plasticizer.

In addition Perstorp recently launched an innovative true non-phthalate PVC plasticizer Pevalen™, designed for close-to-consumer applications, such as flooring and coated fabrics where its unbeatable softness and UV stability are key.

Our Swedish roots and values mean we have a great interest in delivering sustainable and environmentally beneficial chemical solutions, and this is equally true when you choose any of our plasticizers. The company commits over 80% of its R&D to finding innovative sustainable solutions.

For more information on Perstorp plasticizers and our storage facilities in Europe and the USA follow this link>>

REFERENCES
2) www2.teknorapex.com/PVC-Plasticizer-Migration