

Overcoming the Formulation Difficulties related to the use of Non-Phthalate General Purpose Plasticizers: DOTP

Purpose

Diethyl terephthalate (DOTP) is a general purpose plasticizer. It can be compared to products such as DINCH and DEHCH in today's market place. Santicizer® Platinum P-1400 and Santicizer® Platinum P-1700 are fast fusing, non-phthalate plasticizers that can be used in conjunction with a general-purpose plasticizer. We have evaluated DOTP against blends of DOTP with Santicizer® Platinum P-1400 or Santicizer® Platinum P-1700.

Samples Evaluated

- DOTP
- Blend – 70% DOTP, 30% Santicizer® Platinum P-1400 (Note – 51 phr was kept constant)
- Blend – 70% DOTP, 30% Santicizer® Platinum P-1700 (Note – 51 phr was kept constant)

Formulations

Plastisol

Description	Amount (phr)
Resin – K Value 81	80
Resin – K Value 65	20
Plasticizer	51
ESBO	3
Heat Stabilizer	2
Total	156

Testing

- Viscosity – Valtris Test
- Fusion Time and Temperature – Valtris Test
- Water Sensitivity – ASTM D1239
- Carbon Volatility – ASTM D1203
- Shore A – ASTM D2240
- Tensile and Elongation – ASTM D638
- Loop Compatibility – ASTM D3291

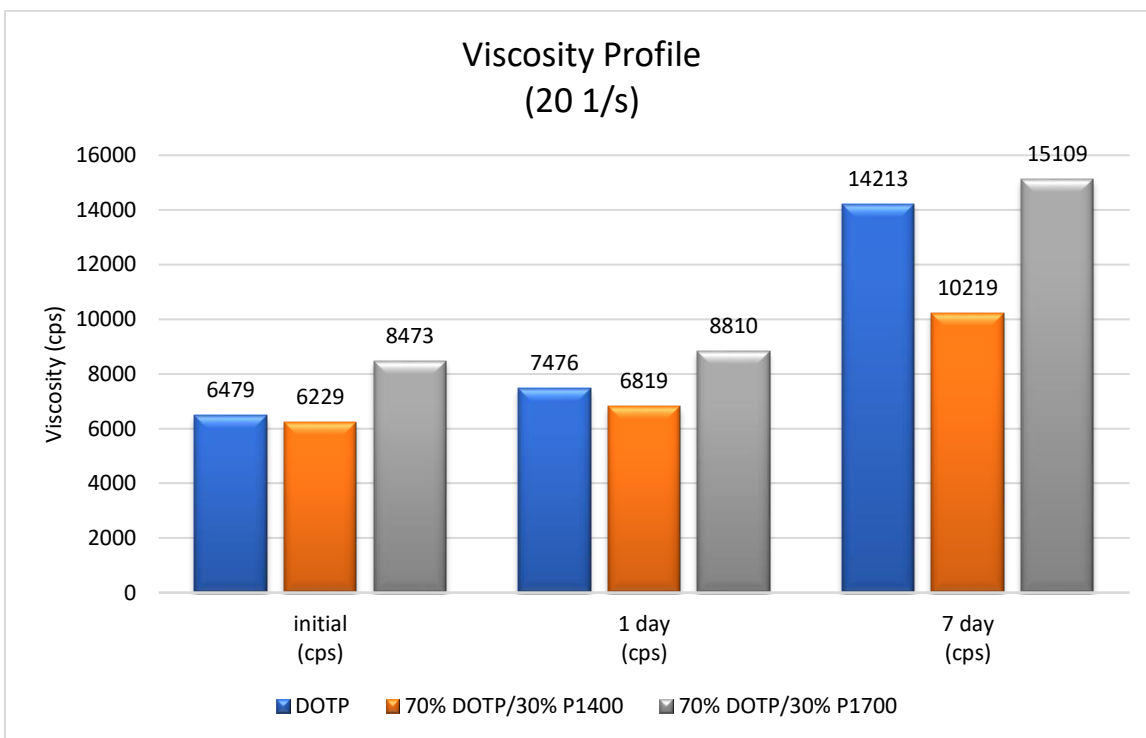


Executive Summary

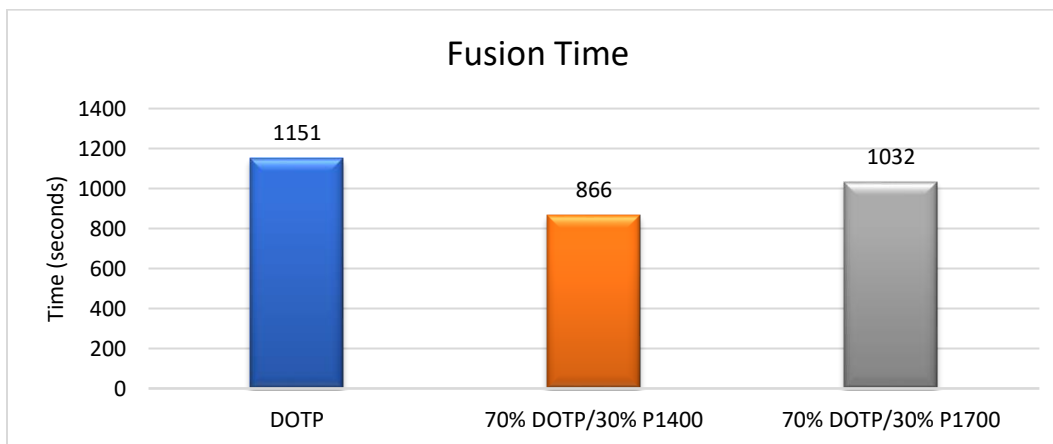
Blend of 70% DOTP and 30% Santicizer® Platinum P-1400 or P-1700 shows better fusion time and temperature compared to the 100% DOTP sample tested. Adding 30% Santicizer® Platinum P-1400 will improve the viscosity stability of DOTP, and adding 30% Santicizer® Platinum P-1700 will improve volatility of DOTP.

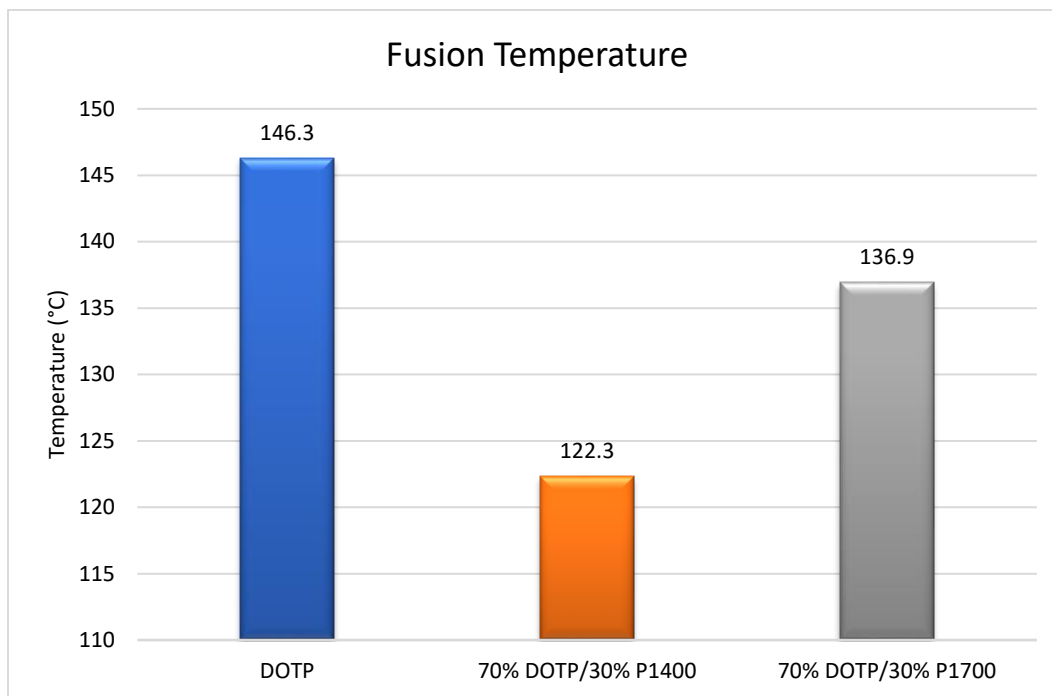
Plastisol Testing

Viscosity



Fusion Time & Temperature





Sample Description	Tensile Strength (psi)	Break Strain (%)	Shore A Average
DOTP	2335	265.3	85
70% DOTP/30% P-1400	2468	290.6	82
70% DOTP/30% P-1700	2307	235.6	85

Sample Description	Volatility – Carbon Method		Water Sensitivity	Compatibility – Loop Testing		
	% Loss 1 day	% Loss 6 days	% Absorption	4 hrs	1 day	7 days
DOTP	4.56	14.47	1.72	0	0	0
70% DOTP/30% P-1400	12.02	34.46	1.71	0	0	0
70% DOTP/30% P-1700	4.37	13.63	1.72	0	0	0



Conclusions

- Viscosity stability for a plastisol is an important test to determine how the product would handle being stored over time. We looked at initial, 1 day, and 7 day viscosity changes on a TA Discovery HR-2 rheometer. Samples were run at 25°C at increasing shear rates. All data was recorded at 20 1/s. 70/30 DOTP/Santicizer® Platinum P-1400 performs better in viscosity stability than DOTP itself, while the 70/30 DOTP/Santicizer® Platinum P-1700 performs similarly to the DOTP itself.
- Adding 30% Santicizer® Platinum P-1400 decreases fusion time by 25% and temperature by 10°C compared to the 100% DOTP control. Adding 30% Santicizer® Platinum P-1700 decreases fusion time by 10% and temperature by 9.4°C compared to the 100% DOTP control.
- Tensile Strength and Elongation show similar results with all plasticizers tested. By adding 30% Santicizer® Platinum P-1400 or P-1700, elongation does not change significantly.
- Shore A hardness is not significantly changed when Santicizer® Platinum P-1400 or P-1700 is included by 30%. Please keep in mind that the amount of plasticizer has not changed. They are all at 51 phr.
- Water sensitivity (ASTM D-1239) results are the same for DOTP and 70/30 blends of DOTP with Santicizer® Platinum P-1400 or P-1700.
- Carbon Volatility (ASTM D1203) was tested at 1 and 6 days. % loss was recorded. The 70/30 DOTP/Santicizer® Platinum P-1700 sample is less volatile than the 100% DOTP sample tested, while the 70/30 DOTP/Santicizer® Platinum P-1400 sample is more volatile.
- Loop Compatibility (ASTM D-3291) - When a plasticized PVC sheet is stressed by folding into a loop, the sheet may relieve the stress by migration on the plasticizer from the loop, or what we can refer to as exudation. As you can see under compression or tension both samples showed no issues with exudation.

Valtris Overview

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