EASTMAN

Eastman TXIB™ formulation additive

for vinyl plastisols

Eastman TXIB™ formulation additive

Eastman TXIB™ formulation additive is a superior low-viscosity additive for PVC with plasticizing abilities. It has good compatibility with polyvinyl chloride (PVC) and is compatible with all common primary and secondary plasticizers. Eastman TXIB provides low-viscosity characteristics in plastisols with good viscosity stability over time.

Figure 1

Structure of TXIB

CAS 6846-50-0

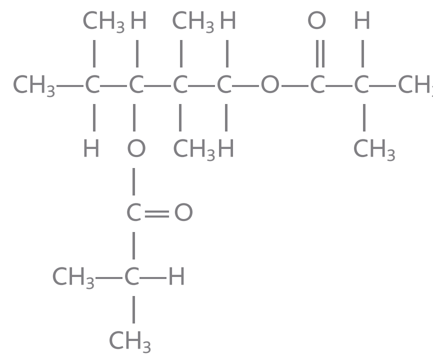


Table 1

Typical properties of TXIB[a]

General	
Molecular weight (theoretical)	286.4
Empirical formula	$C_{16}H_{30}O_4$
Physical	
Form	Liquid
Color, APHA ppm	30 max.
Appearance	Free from insoluble matter and haze
Purity, % by weight	98 min.
Acidity, as isobutyric acid, % by weight	0.05 max.
Refractive index, *n*25°C/D	1.430
Specific gravity @ 20°C/20°C	0.942–0.948
Wt/vol @ 20°C (68°F) lb/gal (U.S.) kg/L lb/gal (Imperial)	7.86 0.94 9.43
Boiling point @ 760 mm, °C (°F)	281.5 (538.7)
Freezing point, °C (°F)	−70 (−94)
Solubility in water @ 20°C, g/L	0.42
Evaporation rate @ 100°C (g/1,000 cm2)/h	0.674
Flash point, Pensky-Martens closed cup, °C (°F)	128 (262)
Fire point, Cleveland open cup, °C (°F)	152 (305)
Autoignition temperature, °C (°F)	424 (795)
Brookfield viscosity on No. 1 spindle @ 25°C, cP	9
Electrical	
Volume resistivity, ohm-cm (ASTM D257)	1.5×10^{11}
Dielectric constant @ 1 MHz (ASTM D150)	4.5
Dissipation factor @ 1 MHz (ASTM D150)	0.13×10^{22}

[a]*Properties are reported for information only. Eastman makes no representation that the material in any particular shipment will conform exactly to the values given.*

Performance properties imparted by Eastman TXIB™ formulation additive

In flexible vinyl, TXIB is similar in plasticizing efficiency to many general-purpose plasticizers, including Eastman 168™ non-phthalate plasticizer (DOTP) and DINP.

Other similarities include:

- Tensile strength
- Ultimate elongation
- Tear resistance
- Brittleness temperature

Table 2 compares the performance of plastisols with blends of TXIB and Eastman 168 to a plastisol with only Eastman 168. Additionally, Table 3 shows similar performance data for blends of TXIB and Jayflex™ DINP in a plastisol.

Table 2

Performance of TXIB/Eastman 168 plasticizer blends in typical PVC plastisols

	Parts per hundred resin (phr)		
Formulation			
PVC homopolymer dispersion resin, k-value = 71	100	100	100
Eastman 168[a]	50	45	40
TXIB[a]	—	5	10
Ba, Zn heat stabilizer[b]	3	3	3
Plasticizer concentration	50	50	50
Mechanical properties			
Tensile strength, psi (MPa)	2,520 (17.4)	2,540 (17.5)	2,610 (18.0)
Ultimate elongation, %	336	327	341
Tear resistance, ppi (kN/m)	384 (67.3)	373 (65.2)	356 (62.4)
Efficiency			
100% modulus, psi (MPa)	1,280 (8.8)	1,300 (9)	1,380 (9.5)
Shore A durometer hardness	81	78	80
Permanence			
1% soap solution extraction, loss %	0.3	0.5	0.6
Hexane extraction, loss %	34	26	24
Cottonseed oil extraction, loss %	6.4	5	3.8
Activated carbon extraction, loss %	1.3	2.5	3.6
Low temperature flexibility			
Brittleness temperature, °C	−34	−34	−35

[a]*Eastman Chemical Company*
[b]*Akcros Chemicals*

Table 3

Performance of TXIB/Jayflex DINP plasticizer blends in typical PVC plastisols

	Parts per hundred resin (phr)		
Formulation			
PVC homopolymer dispersion resin, k-value = 71	100	100	100
Jayflex DINP plasticizer[a]	50	45	40
TXIB[b]	—	5	10
Ba, Zn heat stabilizer[c]	3	3	3
Plasticizer concentration	50	50	50
Mechanical properties			
Tensile strength, psi (MPa)	2,490 (17.2)	2,410 (16.6)	2,350 (16.2)
Ultimate elongation, %	319	308	296
Tear resistance, ppi (kN/m)	385 (67.6)	391 (68.5)	385 (67.6)
Efficiency			
100% modulus, psi (MPa)	1,410 (9.7)	1,380 (9.5)	1,350 (9.3)
Shore A durometer hardness	80	80	80
Permanence			
1% soap solution extraction, loss %	0.5	0.8	0.9
Hexane extraction, loss %	26	24	22
Cottonseed oil extraction, loss %	5.3	4.1	3.7
Activated carbon extraction, loss %	1.4	3	4
Low-temperature flexibility			
Brittleness temperature, °C	−30	−30	−28

[a]*ExxonMobil Chemical*
[b]*Eastman Chemical Company*
[c]Ackros Chemicals

Plastisol viscosity

Adding TXIB to plastisol formulations lowers overall plastisol viscosity and improves viscosity stability over time. The lower viscosity improves handling characteristics, making pumping and pouring of the plastisol easier. Additionally, the lower viscosity can allow for improved flow into small mold cavities. The addition of TXIB also permits the use of higher amounts of filler which can be an economical benefit. Figures 2 and 3 show plastisol viscosities from the formulations in Tables 2 and 3.

Figure 2
Brookfield viscosity (cP) vs. time
(TXIB with Eastman 168)

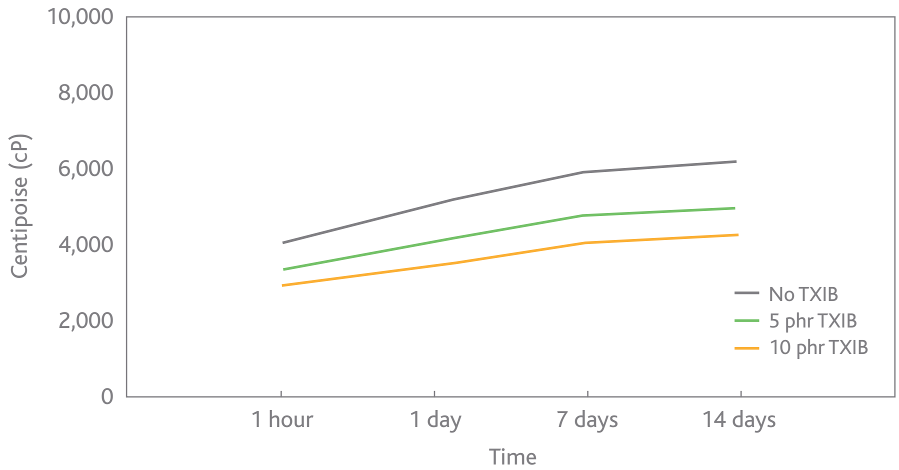
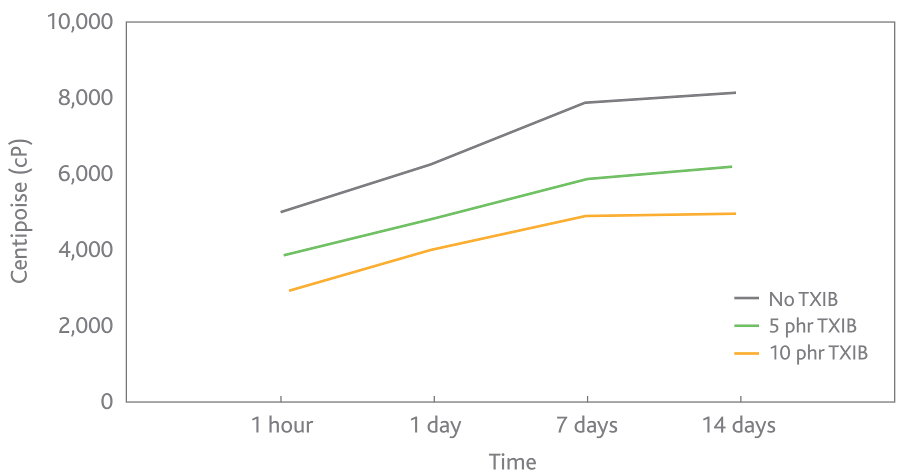


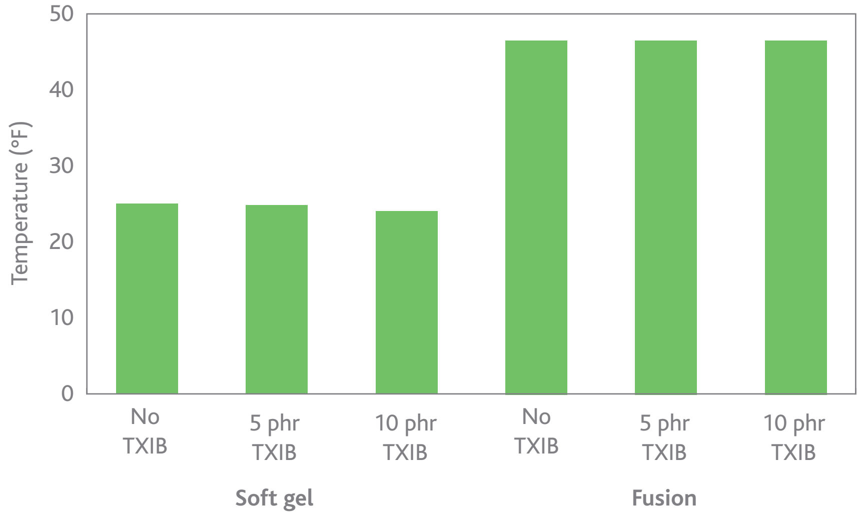
Figure 3
Brookfield viscosity (cP) vs. time
(TXIB with Jayflex DINP)



Gelation and fusion properties

The addition of Eastman TXIB™ formulation additive to plastisols has minimal effect on the gelation and fusion characteristics of the formulation. Figure 4 shows the gelation and fusion temperature of the formulations outlined in Table 2 (Eastman 168 and TXIB). The added TXIB has minimal effect on these properties.

Figure 4
Gelation and fusion properties of plastisols



Using Eastman TXIB™ formulation additive to lower plastisol formulation costs

Manufacturers of PVC plastisols are constantly looking for ways to reduce costs. A common way to reduce formulation cost is the addition of filler, primarily calcium carbonate. However, the addition of filler can increase the plastisol's viscosity above that which is desired for proper processing. TXIB can significantly lower the viscosity of the plastisol when substituted for a portion of the primary plasticizer. Thus the addition of filler along with the correct amount of TXIB can reduce the overall formulation cost while holding the viscosity to the desired level. Figure 5 shows the amount of filler needed to maintain equivalent viscosity (using the formulations from Table 2).

The substitution of some general-purpose plasticizer with TXIB along with the addition of filler can provide a lower plastisol formulation cost. This is shown in Table 4, where three formulations (with equivalent viscosities) show improvement in unit cost per pound of plastisol as the substitution of TXIB and addition of filler are both increased. These three formulations were generated from data points taken off the curve in Figure 5.

Figure 5

TXIB: Filler ratios needed to maintain equivalent viscosity

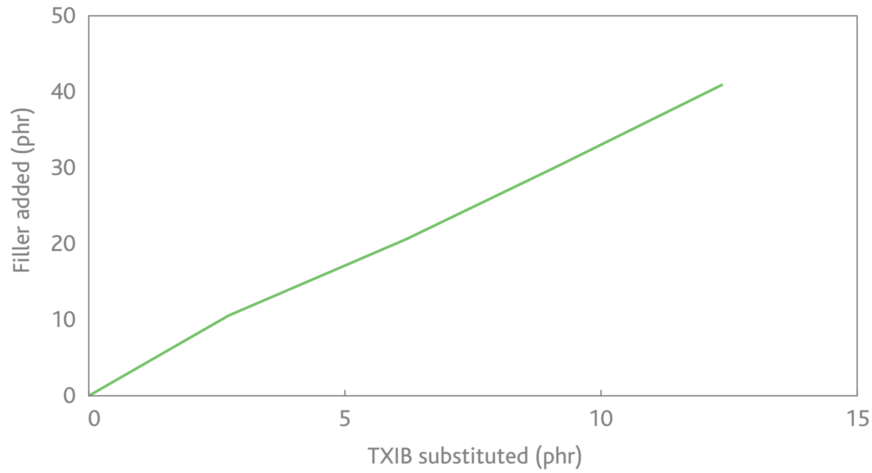


Table 4

Plastisol formulation weights, lb

Material	Formulation 1	Formulation 2	Formulation 3
PVC resin	100	100	100
General-purpose plasticizer	50	44	38
Heat stabilizer	3	3	3
TXIB	0	6	12
Filler	0	20	40
Total weight	153	173	193

To speak with a representative or for more information on Eastman TXIB™ formulation additive, call 1-800-Eastman or visit www.eastman.com.

EASTMAN
The results of **insight**™

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