

# Eastman OPTIFILM™

enhancers

## A non-phthalate alternative

Concerns with the potentially negative health and environmental effects of *ortho*-phthalate plasticizers continue to increase. Recently, California’s Office of Environmental Health Hazard Assessment (OEHHA) added two of the most commonly used *ortho*-phthalate plasticizers, BBP (butyl benzyl phthalate) and DBP (*di-n*-butyl phthalate), to the Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986) list of chemicals. These products have been used in a wide variety of coatings, caulks, and adhesives because they are easy to incorporate, have a high boiling point, and are compatible with a broad range of solventborne (SB) and waterborne (WB) resins.

Increasing regulatory pressures have prompted some formulators to look for an alternative. Eastman Optifilm™ enhancer 400 is the ideal choice for coatings applications. Like BBP and DBP, Optifilm 400 is easy to incorporate, has a high boiling point, and is compatible with a broad range of solventborne and waterborne resins, allowing its use in a variety of different applications. Optifilm 400 is a non-HAP, non-phthalate, low-odor, nonyellowing alternative with less than 1% VOC.<sup>1</sup> Table 1 shows that Optifilm 400 is also safe to use under a variety of regulatory criteria.

<sup>1</sup>For the neat material as determined by ASTM D2963-03

**Table 1. Regulatory comparison**

	Optifilm 400	BBP	DBP
SARA 313	No	No	Yes
HAP List CAAA Title III	No	Yes	Yes
OEHHA Proposition 65	No	Yes	Yes
VOC	0.7% <sup>a</sup>	2.3% <sup>b</sup>	~16% <sup>a</sup>
EPA Reportable Quantity CERCLA Section 102(a) Hazardous Substances	Not listed	100 lb	10 lb
Acute aquatic effects, 96h LC-50 (fathead minnow)	>96.7 mg/L	1.5 mg/L <sup>b</sup>	0.92 mg/L
DOT classification	Class not regulated	Environmentally hazardous substance <sup>b,c</sup>	Environmentally hazardous substance <sup>c</sup>
Allowed in Green Seal certified paints	Yes	No	No

<sup>a</sup>For the neat material as determined by ASTM D2963-03

<sup>b</sup>Information from SDS for Santicizer™ 160 (Ferro Corporation, Polymer Additives Division)

<sup>c</sup>Meets the definition of a marine pollutant

## Key attributes

Eastman Optifilm™ enhancer 400 offers comparable or improved performance in both waterborne and solventborne systems. The physical properties of Optifilm 400 are compared with BBP and DBP (see Table 2).

**Table 2. Physical property comparison**

Property	Optifilm 400	BBP	DBP
Boiling point, °C	374 – 381	370	340
Freezing point, °C	–50	–35	–35
Specific gravity	0.967	1.12	1.047
Vapor pressure (mmHg)	<0.0001	<0.0001	<0.0001
Water solubility (weight %)	Negligible	Negligible	Negligible
Viscosity (cps)	16	42	15

## Performance

Optifilm 400 is an effective, near-zero VOC coalescent that reduces the MFFT (minimum film formation temperature) of a latex. Reducing the MFFT facilitates good film formation of the paint while improving film integrity at room temperature and allowing good film formation under adverse conditions such as low temperature or high humidity. Different products will vary in their efficiency to reduce the MFFT. The efficiency of Optifilm 400 is similar to DBP and significantly better than BBP. Results of MFFT testing on a variety of latexes are summarized in Table 3.

**Table 3. Minimum film formation temperature results**

	Rhoplex™ <sup>a</sup> HG-74	Rhoplex <sup>a</sup> WL-51	Rhoplex <sup>a</sup> WL-91	Maincote™ <sup>a</sup> HG-54D	UCAR™ <sup>b</sup> 4510
Initial MMFT, °F	86	125	125	86	97
Parts per hundred resin (phr) required to reduce latex MFFT to 40°F					
Optifilm 400	6.5	18.6	22.4	12.8	13.6
BBP	9.6	25.8	27.4	>25	21.7
Efficiency improvement Optifilm 400 vs. BBP	32%	28%	18%	>48%	37%
DBP	6.2	15.3	17.0	10.1	14.4

<sup>a</sup>Rohm & Haas

<sup>b</sup>Dow Chemical

Because Eastman Optifilm™ enhancer 400 is an integral part of the paint film, it also helps maintain coating flexibility. This allows it to replace BBP and DBP in a number of applications. For example, Optifilm 400 can easily be incorporated into a waterborne industrial maintenance (IM) topcoat. In this testing, Optifilm 400 was substituted for BBP on an equal wet pounds basis. Some key properties are summarized in Table 4.

Optifilm 400 also works well in solventborne acrylic systems. In these systems, Optifilm 400 is nearly 20% more efficient than either BBP or DBP. Pendulum hardness test results indicated that the coating with Optifilm 400 was softer. When the level of Optifilm 400 was reduced by 10% or 20%, the hardness values increased accordingly. Since a harder film can indicate a loss of flexibility, the formulas were also tested for T-bend flexibility. The T-bend results confirmed that the Optifilm 400 level can be reduced by as much as 20% without sacrificing performance. These results are summarized in Table 5.

### Conclusion

Eastman Optifilm™ enhancer 400 is an efficient, safe-to-use replacement for *ortho*-phthalate plasticizers. It has the added benefits of being non-HAP and low VOC. Optifilm 400 is the perfect choice to maintain performance in either solventborne or waterborne formulations that may require an alternative to *ortho*-phthalate plasticizers.

Eastman offers quality products and a knowledgeable technical service department to help you with your formulation problems.

**Table 4. Waterborne industrial maintenance coating results**

Component	Pendulum hardness <sup>a</sup> (average)	T-bends <sup>b</sup> (average)	Prohesion <sup>c</sup> (unscrubbed, 500 hours)	
			Blisters	Rust
Optifilm 400	43	0T	8F	9
BBP	50	0T	8F	7.7
DBP	47	0T	6–8F	8

<sup>a</sup>ASTM D4366-95 test method

<sup>b</sup>ASTM D4145-84 test method

<sup>c</sup>ASTM G-85 test method

**Table 5. Solventborne lacquer results**

Component	Pendulum hardness <sup>a</sup> (average)	T-bends <sup>b</sup> (average)
Optifilm 400	65	2T
Optifilm 400 (10% less)	68	2T
Optifilm 400 (20% less)	73	2T
BBP	71	2T
DBP	68	2T

<sup>a</sup>ASTM D4366-95 test method

<sup>b</sup>ASTM D4145-84 test method



**Eastman Chemical Company  
Corporate Headquarters**

P.O. Box 431  
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)  
Other Locations, +(1) 423-229-2000

[www.eastman.com/locations](http://www.eastman.com/locations)

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