EASTMAN

Standing the test of time

Eastman Texanol™ ester alcohol — The premier coalescent

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Timeless—
Eastman Texanol™ ester alcohol

For more than 40 years, Eastman Texanol™ ester alcohol has been the name to trust for architectural coatings. It delivers superior performance with regulatory compliance to meet today's needs and tomorrow's challenges. Versatile, efficient, and easy to use, Texanol remains the industry standard.

Eastman Texanol™ ester alcohol is compatible with all types of latexes and is appropriate for use in all architectural applications. Paints with Texanol ester alcohol have consistent performance over a wide range of application conditions and substrates. Texanol provides an unmatched balance of properties and delivers superior value for performance.

What makes Eastman Texanol™ ester alcohol the most recognized and most widely used coalescent in the world? Eastman Texanol™ ester alcohol is

- Versatile
  Effective with most latexes
- Efficient
  Low levels required to obtain excellent film integrity, color formation, touch-up properties, and scrub resistance
- Easy to use in manufacturing
  Low risk of shocking paints
  Non-hazardous
  Low flammability rating
  Low freezing point
- Minimally water soluble
  Partitions with latex to maximize coalescence regardless of application conditions or substrate porosity
- Hydrolytically stable
  Chemically stable in low-to-high pH latex paints
- Ideally suited to waterborne paints in terms of evaporation rate

Eastman Texanol™ ester alcohol is the foundation of the Eastman™ coatings film technologies coalescent portfolio.

Regulatory and environmental

Eastman Texanol™ ester alcohol is a low vapor pressure, low flammability material. It is readily biodegradable and is unlikely to persist in the environment. Laboratory studies have shown that Texanol has low acute toxicity by all routes of exposure. Texanol meets the criteria for an LVP-VOC (exempt) under California Consumer Products Regulations. Texanol also has a low Maximum Incremental Reactivity (MIR) value of 0.89.

Since methods of VOC classification vary by region, the VOC content of Eastman Texanol™ ester alcohol also varies. When VOC classification is based on an initial boiling point of >250°C (such as the European Union Directive 2004/42/EC), Texanol is not considered a VOC. When tested as a neat material according to the US standard (EPA Method 24), Texanol is considered 100% VOC. When tested in a formulated system using EPA Method 24, substantially less Texanol is volatile, although it is difficult to accurately determine the actual VOC contribution.

The Chinese government has awarded Eastman Chemical Company a certificate of Environmental Labeling Type II, known in China as the "Green Label," for Eastman Texanol™ ester alcohol. The certificate constitutes the official recognition of Texanol as safe and environmentally friendly. Under Green Label definitions, Texanol is not considered a VOC and is recognized as having low toxicity and being biodegradable.

Other uses

In addition to being the market leader in architectural coatings, Eastman Texanol™ ester alcohol also finds use in a number of other markets. Texanol offers a good balance of performance properties in ink applications and as a tail solvent in nail polish. The unique balance of properties also makes Texanol useful for a variety of chemical specialty applications such as floor polishes, wood preservative carriers, intermediates for synthesis of ester derivatives, ore flotation/frothing, and oil-drilling muds.

The benefits of coalescent

Coalescent enhances the film formation of latex paints. At room temperature, some paints may form a film without coalescent. In these paints, coalescent improves the film integrity at room temperature and allows good film formation under adverse conditions, such as low temperatures or high humidity. Other paints may require coalescent to form a film even at room temperature. Enhanced coalescence will significantly improve the overall performance of the paint, decreasing porosity and improving film properties, such as scrub resistance, washability, and gloss.

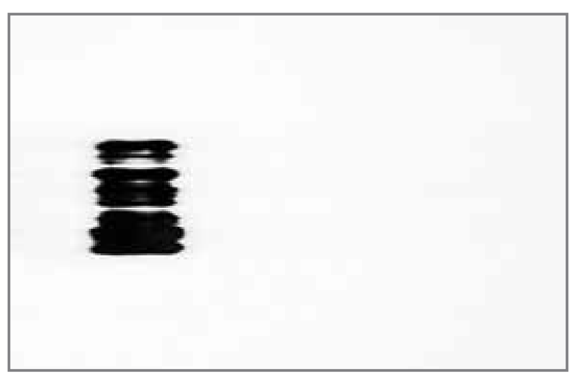
Coalescence is defined as the process by which latex particles come into contact with one another and unite to form a continuous, homogeneous film. Latexes are essentially fine dispersions of high molecular weight polymers. As water evaporates from the system, the latex particles are forced together. To form a continuous film, the particles must flow into each other or coalesce. The ability of the particles to form a film is affected by the application conditions. The lowest temperature at which the particles can fuse together and form a coherent film is known as the minimum film formation temperature (MFFT). The MFFT is affected by many properties of the latex, including particle size and morphology, but is most significantly affected by the glass transition temperature (T_g) of the latex. The T_g is the temperature where the latex goes from being a "glass," in which the polymer molecules have limited mobility, to a "rubber," in which the polymer molecules are free to move. In order for a paint film to coalesce, the latex polymer must have sufficient mobility under a variety of temperature and humidity conditions. Coalescent temporarily softens the latex particles, reducing the T_g and MFFT of the latex below that of the drying temperature and allowing the particles to fuse into a continuous film. Increasing the coalescent concentration leads to a nearly linear reduction in the MFFT. After film formation, conventional coalescent evaporates and allows the latex film to return to the initial T_g. Higher T_g latexes may yield harder, tougher films.

The following properties demonstrate the value of using coalescent in paint.

Scrub resistance

These pictures illustrate one of the benefits of improving film integrity with coalescent. The upper panel shows the scrub resistance of a paint made with Eastman Texanol™ ester alcohol. The lower panel shows the scrub resistance of the same paint made without Texanol. Both paints were allowed to dry for one week before being tested for 500 scrub cycles by ASTM D2486. The paint with Texanol has significantly better scrub resistance than the paint without Texanol. Paints which are properly coalesced are more durable.

With Eastman Texanol™ ester alcohol

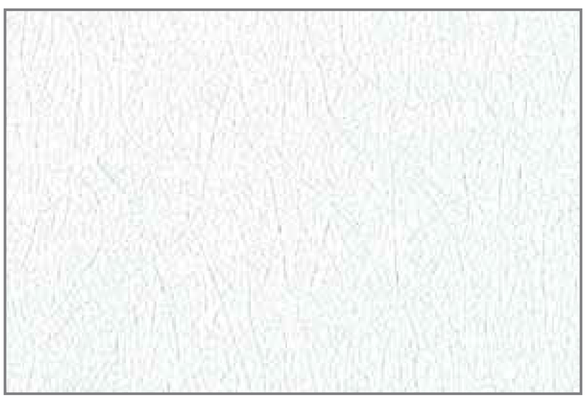


Without coalescent

Low-temperature coalescence

Some latex paints will form films at room temperature but will not coalesce at lower temperatures. Applying paints below the MFFT can result in cracked films, as seen in these pictures. Adding coalescent reduces the MFFT and allows for film formation over a wider range of temperatures.

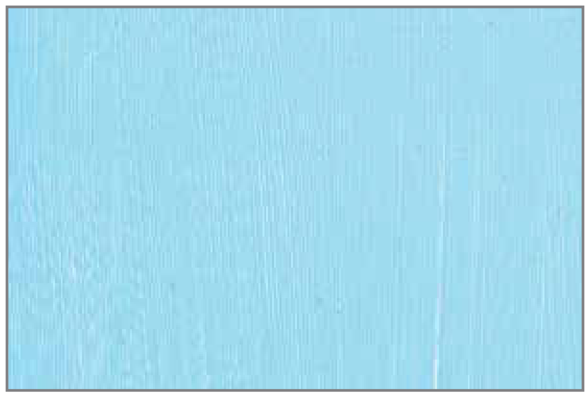
With Eastman Texanol™ ester alcohol



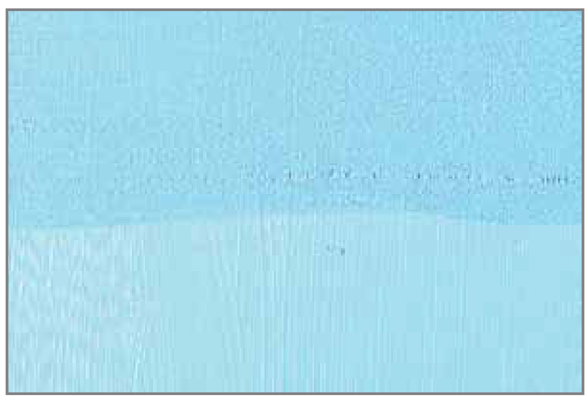
Without coalescent

Color development

Proper coalescence will also impact the color of a tinted paint. If the paint is applied at different temperatures and does not coalesce equally well at the different temperatures, the color may be different. Lack of uniformity in surface topography caused by variability in the extent of coalescence could lead to the observed differences in color. To illustrate, one portion of these panels was allowed to dry under normal conditions with the temperature at about 21°C (70°F). The other portion was allowed to dry at about 4°C (40°F). The paint containing Eastman Texanol™ ester alcohol has very little variation in color, but the paint without Texanol shows a visible color difference.



With Eastman Texanol™ ester alcohol



Without coalescent

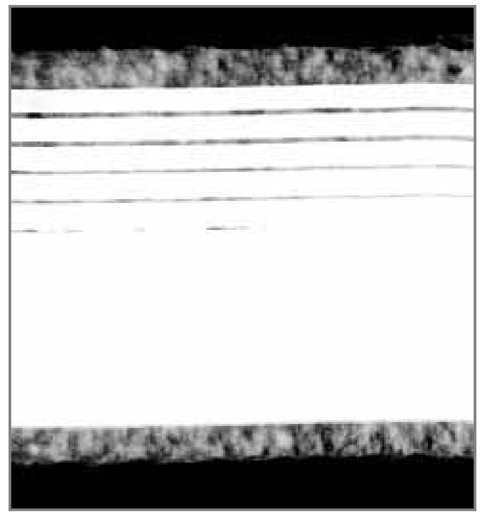
Advantages of using Eastman Texanol™ ester alcohol

Eastman Texanol™ ester alcohol is a slow-evaporating, water-immiscible coalescent. The most effective coalescents are water-immiscible, because they penetrate the polymer particle and effectively soften the particle from the inside out. Water-soluble coalescents stay in the water phase of the paint and soften the latex particle surface from the outside. Preferably, coalescents also evaporate slower than water so that they leave the film after the water. Other important properties of coalescents include hydrolytic stability, ease of use, and compatibility with a wide range of latex types and paint additives.

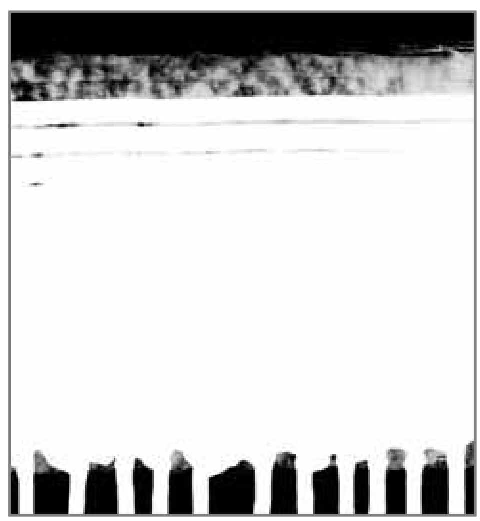
Associative thickener efficiency

Eastman Texanol™ ester alcohol has better associative thickener efficiency than many other types of coalescents. When a paint made with Texanol is compared with a paint made with Dowanol DPnB (dipropylene glycol n-butyl ether), using equal amounts of thickener, the Stormer viscosity of the paint with Texanol is significantly higher. Even when 40% more thickener is added to the paint made with DPnB, the paint made with Texanol still has higher viscosity. These viscosity trends also exist at lower and higher shear rates.

To illustrate the difference in viscosity of the paints, sag resistance was tested on the two paints containing an equivalent amount of thickener. In this example, the higher sag resistance of the paint containing Eastman Texanol™ ester alcohol is directly related to the difference in paint viscosity.



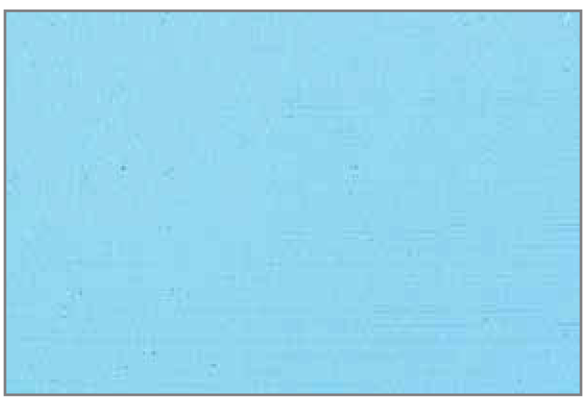
With Eastman Texanol™ ester alcohol



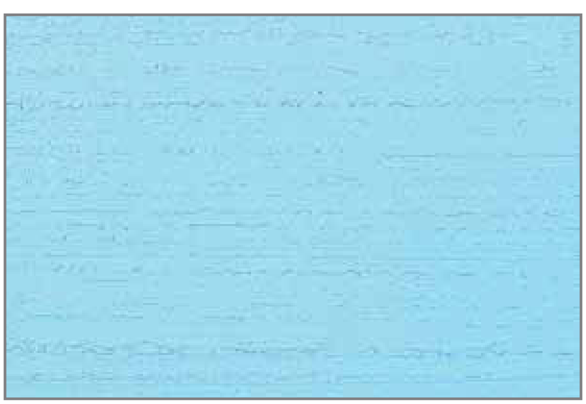
With Dowanol DPnB at equivalent levels of thickener as Eastman Texanol™ ester alcohol sample above

Water solubility

The use of water-soluble coalescent can affect several paint performance properties. One property that can suffer from higher water solubility is film formation over a porous surface, especially at non-optimum temperature and humidity. These photographs show a paint made with Eastman Texanol™ ester alcohol and a paint made with DB acetate (diethylene glycol monobutyl ether acetate). Texanol is $<$0.1% water soluble, while DB acetate is 6.5% soluble. Even though both paints were formulated to the same MFFT, changes in application temperature and humidity can affect the final film appearance as a function of coalescent hydrophilicity.



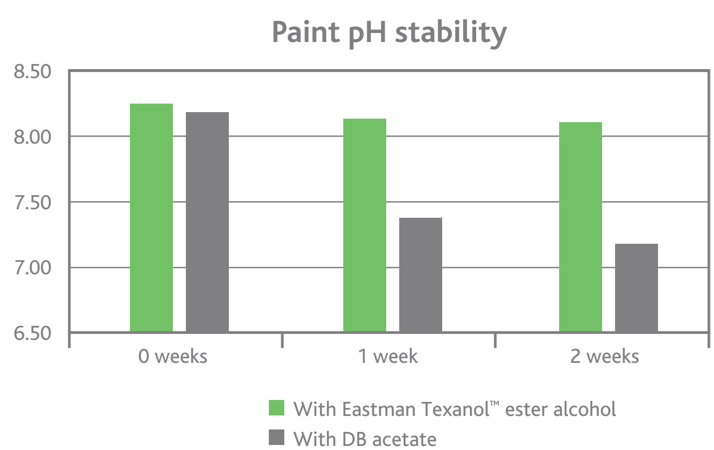
With Eastman Texanol™ ester alcohol



With DB acetate

Hydrolytic stability

All paint additives provide certain properties within the paint and need to remain stable over time. Using coalescent that is not hydrolytically stable can be detrimental to the overall performance of the paint. Coalescent that is pH sensitive may hydrolyze in architectural paints, which are commonly formulated to pH 9 or above. DB acetate is a good example of a pH sensitive coalescent. When paints include alkali-swellable thickeners, the pH drop could result in a decrease in viscosity. Paints with lower pH may also make the paint more susceptible to biological contamination. This graph shows the impact of DB acetate on the pH of the formulated paint as compared with the effect of Eastman Texanol™ ester alcohol in the same formulation.



Compatibility

For a coalescent to work effectively, it must be compatible with the latex. Eastman Texanol™ ester alcohol is compatible with a wide range of latexes. Other materials, such as mineral spirits, may not be compatible with the latex. The pictures below are of systems that contain either Texanol or mineral spirits and illustrate what can happen if the coalescent is not compatible with the latex. In the neat latex, a visible layer of mineral spirits is present, while the Texanol is incorporated into the latex. If films are made, the latex with Texanol produces good, clear films while the latex with mineral spirits separates and produces hazy films with pockets of undispersed liquid. The second set of pictures demonstrates how significantly this can affect the films of the fully-formulated paints.

Paint with mineral spirits

Paint with Eastman Texanol™ ester alcohol

Latex with mineral spirits

Latex with Eastman Texanol™ ester alcohol

Shocking

Some coalescents can shock the latex, resulting in gel particles in formulated paints. To minimize this risk, the coalescent may require extra handling, such as being added very slowly or premixing with other ingredients. Eastman Texanol™ ester alcohol is unlikely to cause shocking in latex paints.

Latex with Dalpad A ethylene glycol phenyl ether

Latex with benzyl alcohol

Latex with Eastman Texanol™ ester alcohol

Evaporation rate

When selecting a coalescent, it is important to choose one with the correct evaporation rate. The evaporation rate of Eastman Texanol™ ester alcohol is 0.002 (*n*BuOAc = 1), which makes it ideal for most architectural latex paint applications. Ideally, a coalescent will evaporate slower than water, so it remains in the paint film longer. Generally speaking, the slower the evaporation rate and/or the higher the boiling point of the coalescent, the longer the coalescent remains in the film. If the coalescent evaporates too slowly, it may negatively impact hardness properties, especially in higher-sheen paints. If a coalescent evaporates too quickly, film formation may be compromised.

Non-yellowing properties

Some coalescents are marketed as reactive components. These coalescents typically contain an unsaturated portion, much like an alkyd resin, that could oxidatively cure while drying. These coalescents tend to yellow in certain systems, much like an alkyd paint. Paint testing indicates that these products do not appear to generate any significant crosslink density and do not have any of the properties typically associated with a crosslinking system.

Paint with Eastman Texanol™ ester alcohol

Paint with unsaturated coalescent

Consistency

Eastman Texanol™ ester alcohol, a clear, clean liquid, is one of the purest, most consistent coalescents in the industry. Texanol is, at minimum, 98.5% pure by weight. The purity of competitive products can vary, with some as low as 90%. Texanol is made by a continuous process, with each step of the process constantly monitored to produce quality material time after time.

Comparison of conventional coalesced paints with coalescent-free paints

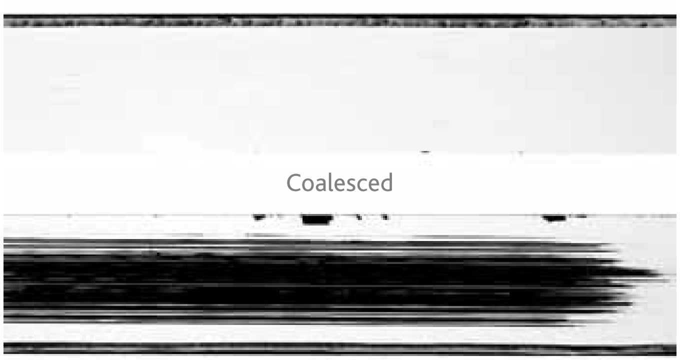
In typical waterborne architectural formulations, glycols and coalescents represent the two most significant contributions to volatile organic content. One method of reducing VOC is to use latexes designed to work without coalescent. These latexes are typically softer so they can coalesce at lower temperatures. Lower T_g latexes may have soft, tacky films, lower cohesive strength, poor block resistance, and increased dirt pickup.

An independent study compared the performance of architectural paint formulations with conventional latex and coalescent to paints with latexes designed for use without coalescent. Experimental interior matt (flat) and silk (semi-gloss) architectural paint formulations were prepared. To make an equal comparison, the formulations were kept constant with differences only in the type of polymer, coalescent, and neutralizing agent. These paints were tested to understand the differences in the performance. The results from this independent study illustrate the advantages of coalesced systems over coalescent-free architectural paints. Paints with Eastman Texanol™ ester alcohol have robust performance across a wide range of application conditions and a clear performance advantage compared with coalescent-free systems.

Scrub resistance

Scrub resistance is the ability of a paint to resist abrasive cleaning. It can be severely reduced if the paint is not sufficiently coalesced or if the latex is too soft. The following examples were tested by BS EN ISO 11998, which measures loss of film weight. As shown in the following pictures, the coalesced systems produced excellent scrub resistance which continued to develop over a six-week period. The coalescent-free paints exhibited very poor scrub performance initially. Even after additional dry time, the paint with Eastman Texanol™ ester alcohol still had superior scrub resistance. Texanol improves film integrity and provides excellent scrub resistance.

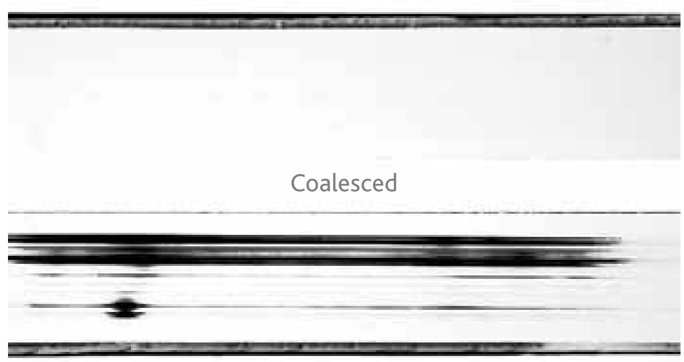
One week at 25°C



Coalesced

Coalescent free

Six weeks at 25°C



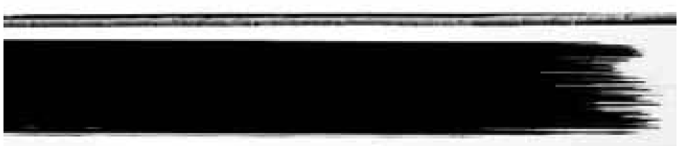
Coalesced

Coalescent free

Scrub resistance of experimental matt paints aged at 25°C for one or six weeks

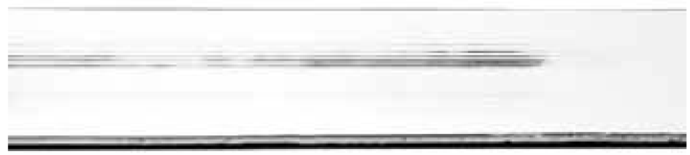
10°C for 48 hours + 5 days at ambient

Coalesced



Coalescent free

10°C for 48 hours + 5 weeks at ambient



Coalesced

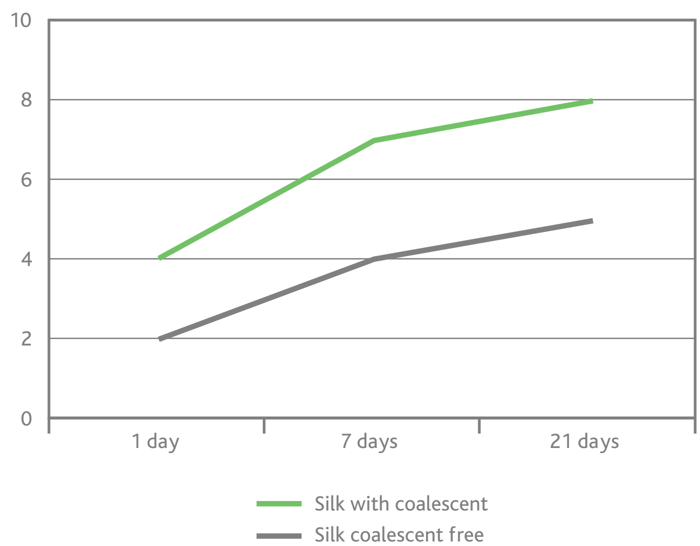
Coalescent free

Scrub resistance of experimental matt paints dried initially (48 hours) at 10°C/50% RH and then dried for either 5 days or approximately 5 weeks at 25°C

Print resistance

The print resistance test is a measure of the tendency of paint film to take on the imprint of an object that is placed on it (e.g., a cabinet, shelf, table, window sill, or countertop with books, dishes, and other objects). In general, the coalesced and coalescent-free matt paint systems produced similar print test performance. In the silk paint systems, however, there were significant differences. The print resistance of the coalescent-free silk paints was poor and the paint films were very soft. The coalesced paints had much harder films and, consequently, the print resistance values were much higher. These results are illustrated in the graph to the right.

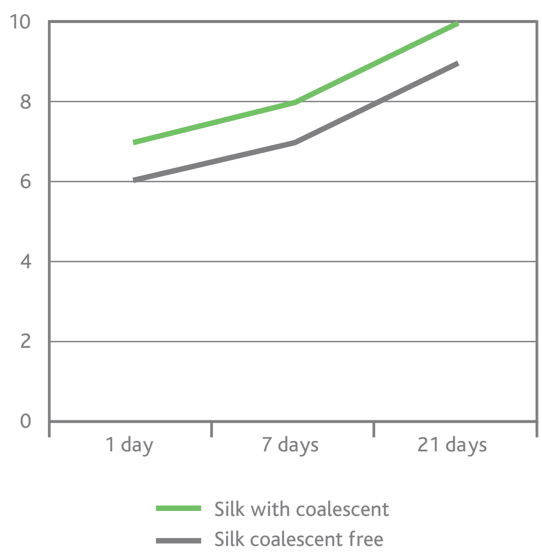
Print resistance of experimental silk paints
Degree of print resistance against time



Block resistance

Blocking is a term used to describe the undesirable sticking together of two painted surfaces when pressed together (e.g., a door sticking to the jamb). Good block resistance is essential for a paint when applied to two surfaces so that the surfaces do not stick together on contact when pressure is applied. In this testing, the block resistance of the coalescent-free silk paint was lower than the paint with Eastman Texanol™ ester alcohol. The coalesced paint maintained higher values at various dry times.

Block resistance of experimental silk paints
Block resistance vs. time

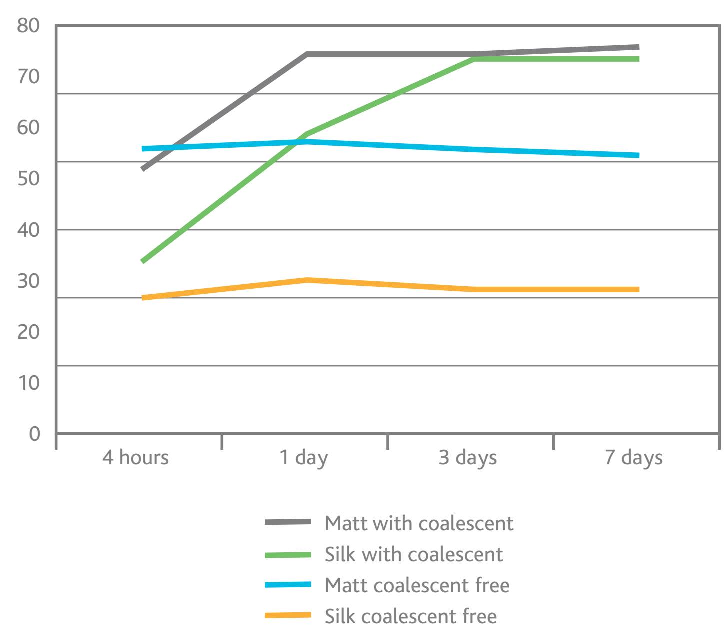


Pendulum hardness

The König pendulum hardness test is based on the principle that the amplitude of the pendulum's oscillation will decrease more quickly when supported on a softer surface. The hardness of any given coating is given by the number of oscillations made by the pendulum within the specified limits of amplitude determined by accurately positioned photo sensors. An electronic counter records the number of swings made by the pendulum.

The König hardness of both the matt and silk coalescent-free paints was poor. The paints coalesced with Eastman Texanol™ ester alcohol demonstrated superior hardness in both the matt and the silk formulation. The hardness of the coalesced systems continued to improve over time, but the coalescent-free systems remained at a constant level. Softer paint films can lead to an increase in mar and scratch resistance and, as already illustrated, can also lead to poor print, block, and scrub resistance.

Pendulum hardness test of experimental silk paints



Summary

Many properties other than those illustrated here can also be affected by using coalescent-free resins. The paints may be more porous than comparable systems coalesced with Eastman Texanol™ ester alcohol. Paints with coalescent may also have superior resistance to mudcracking. In exterior systems, coalescent-free systems may have increased dirt pickup and decreased resistance to grain cracking on wood.

Some of the most popular commercial European DIY brands of interior, water-based wall paints were also tested. The commercial paints included products both with and without coalescent. Testing was also completed on these paints, with similar results.

In both experimental and commercial systems, there are serious performance issues with coalescent-free systems. Paints containing Eastman Texanol™ ester alcohol have excellent performance, even when applied in the most demanding conditions.

Typical properties

Typical properties	Typical value, units
Specific gravity @ 20°C/20°C	0.95
Solubility/in water @ 20°C	0.1 wt%
Solubility/water in @ 20°C	3.0 wt%
Evaporation rate (*n*-butyl acetate = 1)	0.002
Refractive index @ 20°C	1.4423
Boiling point @ 760 mm hg	254°C
Vapor pressure @ 20°C	0.01 mm Hg (0.0013 kPa)
Freezing point	−50°C
Flash point, Cleveland open cup	120°C
Autoignition temperature	393°C
Liquid viscosity @ 20°C	13.5 cP

Eastman Texanol™ ester alcohol—the trusted industry standard!

Are you looking to improve the performance of your coating?

Call Eastman today.

Eastman Chemical Company

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

Telephone:
U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, (1) 423-229-2000
Fax: (1) 423-229-1193

Eastman Chemical Latin America
9155 South Dadeland Blvd.
Suite 1116
Miami, FL 33156 U.S.A.

Telephone: (1) 305-671-2800
Fax: (1) 305-671-2805

Eastman Chemical B.V.
Fascinatio Boulevard 602-614
2909 VA Capelle aan den IJssel
The Netherlands

Telephone: (31) 10 2402 111
Fax: (31) 10 2402 100

Eastman (Shanghai) Chemical Commercial Company, Ltd. Jingan Branch
1206, CITIC Square
No. 1168 Nanjing Road (W)
Shanghai 200041, P.R. China

Telephone: (86) 21 6120-8700
Fax: (86) 21 5213-5255

Eastman Chemical Japan Ltd.
AIG Aoyama Building 5F
2-11-16 Minami Aoyama
Minato-ku, Tokyo 107-0062 Japan

Telephone: (81) 3-3475-9510
Fax: (81) 3-3475-9515

Eastman Chemical Asia Pacific Pte. Ltd.
#05-04 Winsland House
3 Killiney Road
Singapore 239519

Telephone: (65) 6831-3100
Fax: (65) 6732-4930

www.eastman.com

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Material Safety Data Sheets providing safety precautions, that should be observed when handling and storing Eastman products, are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

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