ANGUS® CHEMICAL COMPANY

Key Performance Advantages

- Powerful co-dispersant
- Improves overall paint performance
- Excellent for low- and ultra low-VOC formulations
- AMP is exempt from regulation as a VOC by U.S. EPA and Environment Canada

Paints and Coatings

AMP™

2-AMINO-2-METHYL-1-PROPANOL SOLUTION
CAS Registry No.124-68-5
Multifunctional Additive for Latex Paints

AMP™ Dispersant is widely recognized as a multifunctional additive for all types of latex emulsion paints. In a formulation, AMP can be used as a powerful co-dispersant to prevent re-agglomeration of pigments. At the same time, AMP will contribute significant benefits to the overall performance of the coating.

The benefits and performance improvements made possible by AMP in different stages of paint manufacture are:

AMP In the Grind

- Reduces dispersant demand when used in conjunction with conventional dispersants
- Optimizes pigment dispersion
- Reduces foam (through dispersant reduction)
- Provides effective pH control

AMP In the Letdown

- Improves thickener performance
- Eliminates need for ammonia, resulting in a lower odor paint
- Improves color acceptance of shading pastes

AMP and Coating Performance

- Improves scrub, water, and block resistance through formula optimization
- Reduces in-can corrosion
- Effective in low odor systems

When formulating a latex paint, it is important to consider all the effects of dispersants and surfactants on the paint and on its final performance. AMP can be used to reduce the levels of some commonly used paint additives through paint formulation optimization, potentially lowering raw material costs while improving paint performance.

Typical Properties

The following are selected properties of AMP.
They are not to be considered product specifications.

Specific gravity @ 25/25°C (77°F) (with ~5% water)	0.942
Weight per gallon @ 25°C (77°F) (with ~5% water)	7.85 lb
APHA color	<20
Coefficient of expansion, 20 to 90°C (68 to 194°F)	0.00096/°C
Flash Point, Tag Closed Cup	83°C (182°F)
Flash Point, Setaflash Closed Cup, neat	76.7°C (170.1°F)
Vapor pressure @ 20°C (68°F), mm Hg/Pascal	0.34 / 45.33
Freezing point (with ~5% water)	-2°C (28°F)
Surface tension, neat	~36-38 dynes/cm
Surface tension, 10% aqueous solution	~58 dynes/cm
pH of 0.1 *M* aqueous solution @ 20°C (68°F)	11.3
pKa @ 20°C (77°F)	~9.82
Refractive index *n*, @ 20°C (68°F)	1.4568

Recommended Use Levels

In the Grind

To take full advantage of AMP as a co-dispersant, up to 30% of the existing dispersant solids can be replaced by an equal weight of AMP. This generally amounts to 0.05 to 0.1 percent of AMP on the total weight of the formulation.

In the Letdown

Typical formulations require 0.1 to 0.3 percent (on total formulation weight) of AMP for optimum pH stability, for associative thickener neutralization, and to eliminate in-can corrosion. For control of flash rusting, an additional 0.1 to 0.2 percent (on total formulation weight) of AMP may be required.

Efficient Pigment Dispersion

AMP improves pigment dispersion in the production of latex paints. Combining AMP with a conventional anionic dispersant in a grind paste is more effective than using any dispersant alone.

AMP enhances the performance of anionic dispersants so that dispersant demand is reduced. Six commonly-used dispersants were tested in a typical dispersion. As shown in the table at the top of the next column, small quantities of AMP in a TiO_2, calcined clay and calcium carbonate blend significantly reduced dispersant demand. Specific dispersant requirements vary with the pigment grade type and lot.

Using AMP in the grind produces a paint with maximum hiding power, color acceptance and stability at considerably lower anionic dispersant levels than are normally required to achieve similar results. AMP also stabilizes the grind at a mildly alkaline pH. This reduces the tendency for pigment re-agglomeration or "shock" when the grind is added to a moderately alkaline letdown.

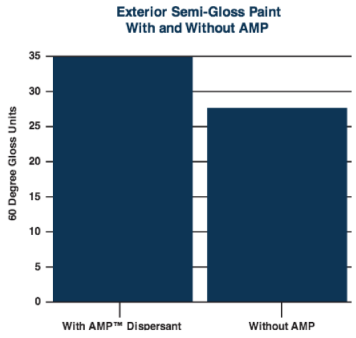
Dispersant Demand for 70% NVM TiO_2, Calcined Clay and Calcium Carbonate Blend

% Dispersant Required (Solids)/Wt. of Pigment			
Dispersant	Without AMP	With AMP*	% Dispersant Reduction
Tamol 731 [A]	0.118	0.085	28
Nopcosperse 44 [B]	0.113	0.087	23
Tamol 963 [A]	0.100	0.075	25
KTPP [D]	0.165	0.123	25
Rhodoline 226 [C]	0.142	0.100	29
Tamol 1124 [A]	0.133	0.100	25
*AMP added at 0.05% by wt. of pigment			

Key to suppliers:
[A] Dow Chemical Company [B] Cognis [C] Rhodia [D] Astaris LLC

Gloss Enhancement

AMP functions as a powerful co-dispersant and then can partially evaporate from the paint film upon drying. In gloss systems, the gloss is improved by the more efficient dispersion of the pigment through the use of AMP. Therefore, gloss can be enhanced as demonstrated in the following graph.



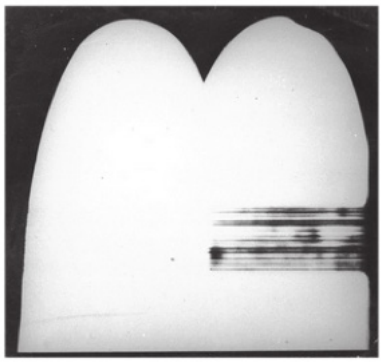
Reactive Pigment Stabilization

AMP helps to stabilize some paint systems containing reactive pigments such as zinc oxide. Typical improvements are demonstrated in the following photo; the addition of AMP inhibited gelling even for paint subjected to heat aging.

With AMP Without AMP

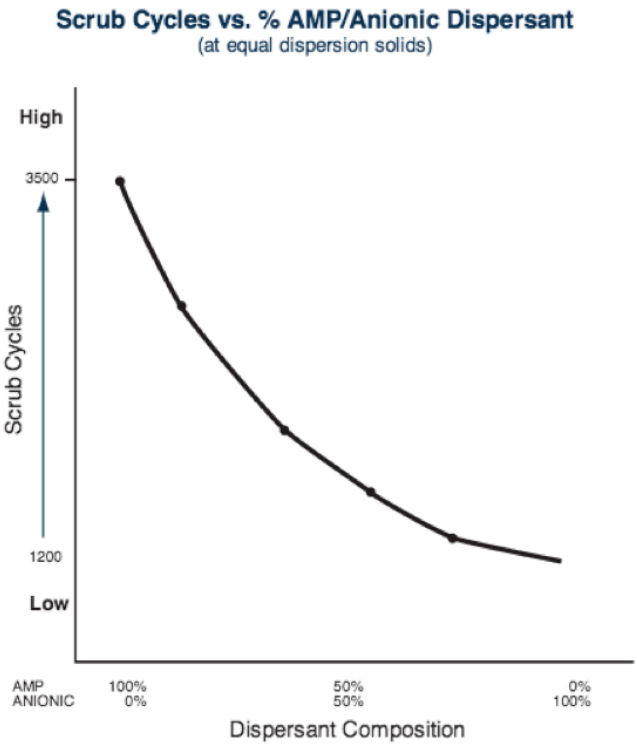
Film Performance

Most dispersants and surfactants contain 25 to 50% non-volatile, hygroscopic components, which remain in the dried paint film and contribute to poor scrub resistance and water spotting. Therefore, it is important to keep these additives to a minimum. AMP used in conjunction with reduced levels of conventional dispersants accomplishes this objective. The results are improved scrub resistance, water resistance, and reduced water spotting of the paint film as illustrated below.



With AMP™ Dispersant | Without AMP

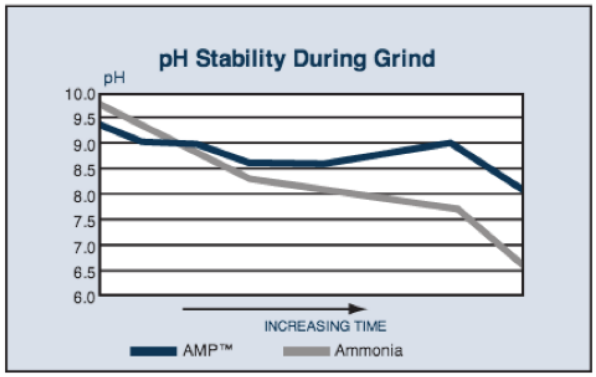
AMP exhibits its superior scrub resistance properties in this interior flat formulation.



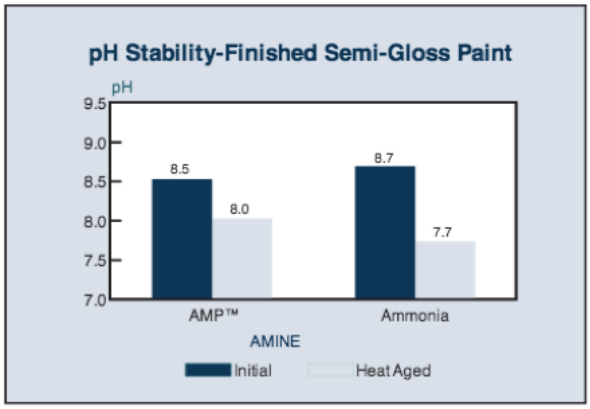
Improves Thickener Performance

AMP is an outstanding replacement for ammonia when neutralizing alkali swellable associative thickeners. Not only does AMP eliminate the problems associated with the handling of ammonia, but pH control and subsequent stability of the associative thickener are often enhanced.

Thickeners are often added at the dispersion stage to provide the required milling viscosity. As shown in the graph below, AMP provides greater pH stability than ammonia during the dispersion, thus contributing to improved performance of the associative thickener.



In associative thickener-containing systems, effective neutralization and pH control are important to the long-term stability of the coating. Accelerated aging studies demonstrate that AMP provides optimum pH stability in these finished coatings. In one comparison study, semi-gloss paints containing associative thickener and AMP or ammonia were aged 14 days at 130°F (54.5°C). The AMP system exhibited improved pH stability in comparison to the ammonia-based system as shown below.



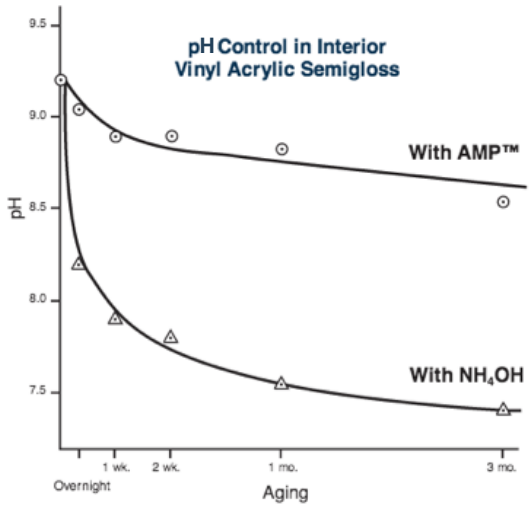
pH Stabilization

AMP imparts excellent pH stability to latex paints. Ammonia is a weaker base and is more fugitive than AMP, therefore, ammonia-based paint has poorer pH stability and a stronger odor than does paint based on AMP. Controlling pH is very important because most paint formulations require a stable alkaline pH to control:

- Pigment dispersion
- Vehicle stability
- Package corrosion
- Viscosity stability

The control of pH with AMP also provides coatings with virtually no yellowing compared to many other commonly-used amines and amino alcohols, which is important for many types of quality paints being produced for the marketplace.

A comparison of the pH control performance of AMP and ammonia in a vinyl-acrylic semi-gloss paint (below) shows AMP is clearly superior to ammonia. After aging one month at an elevated temperature, and then two months at ambient temperature, the pH of the ammonia formulation had dropped from 9.2 to 7.4 while the pH of the paint with AMP did not go below 8.5.



Reduced Corrosion

AMP reduces corrosion problems because AMP reduces pH drift in latex paints. It effectively stops in-can rusting in areas such as seams and edges.

Effective in Low Odor/ Low VOC Systems

With the ever-tightening VOC regulations and the consumer preference for low-odor products, AMP is an excellent alternative to ammonia. On June 25, 2014, AMP was exempted from regulation as a VOC by the U.S. EPA. Environment Canada followed suit by exempting AMP in the summer of 2016.

At a typical use level of 0.2% on total formulation weight, AMP makes a minimal contribution to total formulation VOC, in regions where AMP is included in VOC calculations. In addition, the use of AMP allows for the optimization of other additives, which may further reduce VOC and provide significant improvements to low odor systems. The use of AMP in low-VOC paint formulations allows for the manufacture of paints well within current and proposed VOC-regulatory targets.

Product Stewardship

ANGUS encourages its customers to review their applications of ANGUS products from the standpoint of human health and environmental quality. To help ensure that ANGUS products are not used in ways for which they are not intended, ANGUS personnel will assist customers in dealing with environmental and product safety considerations. For assistance, Safety Data Sheets, or other information, please contact your ANGUS representative at the numbers provided in this document. When considering the use of any ANGUS product in a particular application, review the latest Safety Data Sheet to ensure that the intended use is within the scope of approved uses and can be accomplished safely. Before handling any of the products, obtain available product safety information including the Safety Data Sheet(s) and take the necessary steps to ensure safety of use.

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