

CYLINK® NH8 Wet Adhesion Monomer

CYLINK NH8 wet adhesion monomer was specifically designed to address the needs of interior and exterior architectural latex coatings markets. When incorporated into the polymer backbone, CYLINK NH8 wet adhesion monomer provides the resulting latex coating with cost effective adhesion to chalky or aged alkyd substrates under wet or humid conditions. While other products are available which address this challenge, CYLINK NH8 wet adhesion monomer combines high wet adhesion performance and efficiency with:

- Copolymerization with a wide range of monomers
- Stability against homopolymerization
- Complete water solubility

These advantages make CYLINK NH8 wet adhesion monomer unparalleled in its ease of use.

Performance/Reactivity

Cytec's technical service laboratories have developed polymerization recipes for CYLINK NH8 wet adhesion monomer in acrylic, vinyl acrylic, and vinyl/VeoVa* monomer latexes. These recipes as well as the physical properties of the latex using CYLINK NH8 wet adhesion monomer, and the physical properties and wet scrub resistance of the resulting paint are given below.

The results show that, in all cases, paint formulated from latex using CYLINK NH8 wet adhesion monomer demonstrates outstanding performance compared to control samples, without degrading other important paint properties. In 100% acrylic latex which contains CYLINK NH8 wet adhesion monomer at levels as low as 0.25%, superior wet adhesion performance is still achieved after 24 hours. Note, too, that due to its unique chemical structure, CYLINK NH8 wet adhesion monomer can be readily polymerized into the backbones of vinyl acetate and vinyl/VeoVa monomer latexes, eliminating the need to blend costly acrylic latex or concentrates that have been specially treated to provide wet adhesion.

Acrylic Latex Paint Performance Data

I. Recipe:	parts per weight
A) Kettle charge:	
deionized water	125
AEROSOL® A-102 surfactant	3.5
ammonium persulphate	0.4
B) Monomer charge:	
deionized water	90
AEROSOL A-102 surfactant	10
CYLINK NH8 wet adhesion monomer - 50%	6
methyl methacrylate (53 p.h.m.)	156
butyl acrylate (46.5 p.h.m.)	138
methacrylic acid (0.5 p.h.m.)	1.6
flush water	15
C) Catalyst charge:	
deionized water	50
AEROSOL MA-80 surfactant	2.5
ammonium persulphate	0.8
Post addition:	
ammonia 25%	pH = 9

II. Procedure:

A) Preparation of Kettle Charge:

Dissolve 3.5 parts AEROSOL A-102 surfactant and 0.4 parts ammonium persulphate in 125 parts deionized water. Purge the solution with nitrogen while stirring, and heat to 74°C.

B) Preparation of pre-emulsion monomer charge:

Dissolve 10 parts AEROSOL A-102 surfactant and 6 parts CYLINK NH8 wet adhesion monomer in 90 parts deionized water, and place in an addition vessel equipped with stirrer. Add to this solution under sufficient stirring a mix of 156 parts methylmethacrylate, 138 parts butyl acrylate, and 1.6 parts methacrylic acid.

C) Preparation of catalyst charge:

Dissolve 2.5 parts AEROSOL MA-80 surfactant and 0.8 parts ammonium persulphate in 50 parts water, and place in an addition flask.

D) Addition of monomer to polymerization flask:

When the contents of the polymerization kettle reach 74°C, the nitrogen flow is reduced to a minimum, and 10% of the monomer pre-emulsion is added to the reactor. After initiation and maximum exotherm, addition of the monomer pre-emulsion and catalyst is started at a rate of 1.8 and 0.25 parts per minute respectively. Total addition time approximately 3 hours for the monomer and 3 hours for the catalyst feed.

Following monomer addition, the addition vessel and lines are flushed with 15 parts deionized water, and the latex is held at 74°C for 1 hour, then cooled to room temperature. The pH is adjusted to pH 9 with 25% ammonia and filtered into a suitable container.

Latex Results Summary

Latex Properties	Control (0% NH8)	1.0% NH8
Total Solids (%)	51.0	49.9
Grit 60 mesh (gms)	<0.1	<0.2
Reactor coat (gms)	1.0	1.0
pH (final)	8.2	9.1
Mean Particle Size (nm) (dynamic light scattering)	130	153
Brookfield Viscosity (mPa,sec, #1, 20rpm)	206	63
Calculated Tg (°C)	9.3	9.3
Paint Test Results		
Type: Semigloss Exterior Trim coat		
Color: White		
PVC: 25.2%		
Paint Properties	Control (0% NH8)	1.0% NH8
Stromer, Ku's (Low shear)	123	122
ICI viscosity (Hi Shear)	1.0	1.45
Contrast Ratio	0.973	0.968
Reflectance	92.0	92.8
Gloss (60°)	71.4	82.0
Wet Adhesion Test Results		
Test Duration	% paint film retained	
	Control (0% NH8)	1.0% NH8
4 hour	0	100
24 hour	0	100

¹ In all these tests, wet adhesion is measured after 4 hours, 24 hours and 7 days. A gloss alkyd on a Laneta scrub chart is cured for 1 week at room temperature. A draw down of the test paint is made perpendicular to the gloss alkyd and allowed to dry for a specified time (4 hours, 24 hours and 7 days). The coating is then cross-hatched into 0.25 inch (0.65mm) squares. The test panel is soaked for 5 minutes (or longer, if specified) in distilled water and tested for wet adhesion on the scrub machine (modified ASTM D2486). The cycles required to remove 25%, 50%, 75% and 100% of the paint, along with the % removed at 1000 cycles, is reported. A paint showing 100% removal at or before 1000 cycles has virtually no wet adhesion. A paint showing 0% removal after 1000 cycles is considered to have excellent wet adhesion. The 4-hour test distinguishes excellent from marginal performers.

Styrene Acrylic Latex Paint Performance Data

I. Recipe:

A) Kettle charge:

	parts per weight
deionized water	185
AEROSOL A-102 surfactant	6.25
styrene	12.0
butyl acrylate	5.0

B) Monomer charge:

deionized water	80
AEROSOL A-102 surfactant	0.5
AEROSOL MA-80 I surfactant	4.0
sodium bicarbonate	0.1
CYLINK NH8 wet adhesion monomer - (50%)	6
styrene	80
butyl acrylate	147
methyl methacrylate	40
acrylonitrile	12
methacrylic acid	7.5
sodium sulfoxylate	
formaldehyde	0.7

flush water 15

C) Catalyst charge:

deionized water	10
t-butyl hydrogen peroxide	0.8
ferrous sulfate	0.04
sodium sulfoxylate	
formaldehyde	0.4

D) Co-feed catalyst charge:

deionized water	50
t-butyl hydrogen peroxide	2.1

E) Chaser catalyst solution:

0.1 parts t-BHP + 0.05 parts sodium sulfoxylate formaldehyde in 10 parts deionized water. Prepare just before use.

F) Neutralizer solution:

NH₄OH (50%) pH = 8.5

II. Procedure:

A) Preparation of Kettle Charge:

Add 6.25 parts AEROSOL A-102 surfactant, 12 parts styrene and 5 parts butyl acrylate to 185 parts deionized water. Purge the solution with nitrogen while stirring, and heat to 62°C.

B) Preparation of pre-emulsion monomer charge:

Add 0.5 parts AEROSOL A-102 surfactant, 4 parts AEROSOL MA-80 I surfactant, 0.1 parts of sodium bicarbonate, and 6 parts CYLINK NH8 wet adhesion monomer in 80 parts deionized water, and place in an addition vessel equipped with stirrer. Add to this solution under sufficient stirring a mix of 80 parts styrene, 147 parts butyl acrylate, 40 parts methyl methacrylate, 7.5 parts methacrylic acid, 12 parts acrylonitrile, and 0.7 parts sodium sulfoxylate formaldehyde.

C) Preparation of initial catalyst charge:

Dissolve 0.8 parts t-butyl hydrogen peroxide, 0.04 parts ferrous sulfate (FeSO₄·7H₂O), 0.4 parts sodium sulfoxylate formaldehyde in 10 parts water, and place in a beaker.

D) Preparation of feed catalyst charge:

Dissolve 2.1 parts t-butyl hydrogen peroxide in 50 parts deionized water, and keep ready for gradual feed.

E) Addition of monomer to polymerization flask:

When the contents of the polymerization kettle reach 62°C, the nitrogen flow is reduced to a minimum, and the initial catalyst charge is added to the reactor. After initiation and maximum exotherm (approx. 15 mins.), start feeding the monomer emulsion and feed catalyst solution to the kettle over a 3 hour period.

Once feeds are complete, flush the emulsion vessel and lines to kettle with 15 parts deionized water, then hold the batch for 1 hour at 62-64°C. Then cool to 55°-56°C and add chaser catalyst system over a 5 min. period. Then hold batch at 55°C for 30 mins. Then cool to room temperature, neutralize to a pH of 8.5 with NH₄OH (50%), and filter through 100 mesh nylon filter.

Latex Results Summary

Latex Properties	Control (0% NH8)	1.0% NH8
Total Solids (%)	44.9	45.4
Grit 60 mesh (gms)	<0.1	<0.2
Reactor coat (gms)	0.4	0.5
pH (final)	8.5	8.5
Mean Particle Size (nm) (dynamic light scattering)	90	83
Brookfield Viscosity (mPa, sec, #1, 20rpm)	75	85
Calculated Tg (°C)	10.5	10.5
Paint Test Results		
Type: Exterior Trim coat		
Color: White		
Paint Properties	Control (0% NH8)	1.0% NH8
Stromer, Ku's (Low shear)	140	137
ICI viscosity (Hi Shear)	1.25	1.45
Contrast Ratio	0.963	0.964
Reflectance	92.4	91.8
Gloss (60°)	87.3	88.3
Wet Adhesion Test Results		
Test Duration	% paint film retained	
	Control (0% NH8)	1.0% NH8
4 hour	0	100
24 hour	100	100

VA/VeoVa Monomer Latex Paint Performance Data

I. Recipe:

A) Kettle charge:

	parts per weight
deionized water	125
AEROSOL A-102 surfactant	3.5
ammonium persulphate	0.4
vinyl acetate	20
VeoVa -10 monomer	5

B) Monomer charge:

deionized water	90
AEROSOL A-102 surfactant	10
CYLINK NH8 wet adhesion monomer- 50%	6
vinyl acetate	190
VeoVa-10 monomer	85
methacrylic acid	1.6

flush water 15

C) Catalyst charge:

deionized water	50
AEROSOL MA-80 surfactant	2.5
ammonium persulphate	0.8

Post addition:

ammonia 25% pH = 8

II. Procedure:

A) Preparation of Kettle Charge:

Dissolve 3.5 parts AEROSOL A-102 surfactant and 0.4 parts ammonium persulphate in 125 parts of deionized water. Purge the solution with nitrogen while stirring, and heat to 74°C. Place a mix of 20 parts vinyl acetate and 5 parts VeoVa-10 monomer aside for initiation.

B) Preparation of pre-emulsion monomer charge:

Dissolve 10 parts AEROSOL A-102 surfactant and 6 parts CYLINK NH8 wet adhesion monomer in 90 parts deionized water, and place in an addition vessel equipped with stirrer. Add to this solution under sufficient stirring a mix of 190 parts vinyl acetate, 85 parts VeoVa-10 monomer, and 1.6 parts methacrylic acid.

C) Preparation of catalyst charge:

Dissolve 2.5 parts AEROSOL MA-80 surfactant and 0.8 parts ammonium persulphate in 50 parts water, and place in an addition flask.

D) Addition of monomer to polymerization flask:

When the contents of the polymerization kettle reach 74°C, the nitrogen flow is reduced to a minimum, and 10% of the monomer pre-emulsion is added to the reactor. After initiation and maximum exotherm, addition of the monomer and catalyst is started at a rate of 1.8 and 0.25 parts per minute respectively. Total addition time approximately 3 hours for the monomer and 3 hours for the catalyst feed.

Following monomer addition, the addition vessel and lines are flushed with 15 parts deionized water, and the latex is held at 74°C for 1 hour, then cooled to room temperature. The pH is adjusted to pH 8 with 25% ammonia and filtered into a suitable container.

Latex Results Summary

Latex Properties	Control (0% NH8)	1.0% NH8
Total Solids (%)	51.9	50.5
Grit 60 mesh (gms)	<0.1	<0.1
Reactor coat (gms)	<1.9	<0.1
pH (final)	7.8	7.5
Mean Particle Size (nm) (dynamic light scattering)	142	193
Brookfield Viscosity (mPa,sec, #1, 20rpm)	335	102
Calculated Tg (°C)	19.6	19.6
Paint Test Results		
Type: Semigloss Exterior Trim coat		
Color: White		
PVC: 25.2%		
Paint Properties	Control (0% NH8)	1.0% NH8
Stromer, Ku's (Low shear)	109	96
ICI viscosity (Hi Shear)	1.10	1.6
Contrast Ratio	0.961	0.962
Reflectance	91.6	92.2
Gloss (60°)	63.8	76.1
Wet Adhesion Test Results		
Test Duration	% paint film retained	
	Control (0% NH8)	1.0% NH8
4 hour	0	35
24 hour	0	100

Vinyl Acrylic Latex Paint Performance Data

I. Recipe:

A) Kettle charge:

	parts per weight
deionized water	125
AEROSOL A-102 surfactant	3.5
ammonium persulphate	0.4

B) Monomer charge:

deionized water	90
AEROSOL A-102 surfactant	10
CYLINK NH8 wet adhesion monomer- 50%	6
vinyl acetate	236
butyl acrylate	57
methacrylic acid (0.5 p.h.m.)	1.6
flush water	15

C) Catalyst charge:

deionized water	50
AEROSOL MA-80 surfactant	2.5
ammonium persulphate	0.8

Post addition:

ammonia 25% pH = 8

II. Procedure:

A) Preparation of Kettle Charge:

Dissolve 3.5 parts AEROSOL A-102 surfactant, and 0.4 parts ammonium persulphate in 125 parts deionized water. Purge the solution with nitrogen while stirring, and heat to 74°C.

B) Preparation of pre-emulsion monomer charge:

Dissolve 10 parts AEROSOL A-102 surfactant and 6 parts CYLINK NH8 wet adhesion monomer in 90 parts deionized water, and place in an addition vessel equipped with stirrer. Add to this solution under sufficient stirring a mix of 236 parts vinyl acetate, 57 parts butyl acrylate, and 1.6 parts methacrylic acid.

C) Preparation of catalyst charge:

Dissolve 2.5 parts AEROSOL MA-80 surfactant and 0.8 parts ammonium persulphate in 50 parts water, and place in an addition flask.

D) Addition of monomer to polymerization flask:

When the contents of the polymerization kettle reach 74°C, the nitrogen flow is reduced to a minimum, and 10% of the monomer pre-emulsion is added to the reactor. After initiation and maximum exotherm, addition of the monomer and catalyst is started at a rate of 1.8 and 0.25 parts per minute respectively. Total addition time approximately 3 hours for the monomer and 3 hours for the catalyst feed.

Following monomer addition, the addition vessel and lines are flushed with 15 part deionized water, and the latex is held at 74°C for 1 hour, then cooled to room temperature. The pH is adjusted to pH 8 with 25% ammonia and filtered into a suitable container.

Latex Results Summary

Latex Properties	Control (0% NH8)	1.0% NH8
Total Solids (%)	49.9	51.0
Grit 60 mesh (gms)	<0.1	<0.1
Reactor coat (gms)	<0.1	<0.2
pH (final)	7.3	8.4
Mean Particle Size (nm) (dynamic light scattering)	130	156
Brookfield Viscosity (mPa.sec, #1, 20rpm)	100	305
Calculated Tg (°C)	9.4	9.4
Paint Test Results Type: Semigloss Exterior Trim coat Color: White PVC: 25.2%		
Paint Properties	Control (0% NH8)	1.0% NH8
Stromer, Ku's (Low shear)	95	126
ICI viscosity (Hi Shear)	1.10	1.3
Contrast Ratio	0.957	0.96
Reflectance	92.1	91.9
Gloss (60°)	54.2	71.8
Wet Adhesion Test Results Test Duration		
	% paint film retained	
	Control (0% NH8)	1.0% NH8
4 hour	0	10
24 hour	0	100

Performance at Varying Levels of CYLINK NH8 Wet Adhesion Monomer in Acrylic Copolymers

I. Recipe:

	parts per weight
A) Kettle charge:	
deionized water	125
AEROSOL A-102 surfactant	3.5
ammonium persulphate	0.4
B) Monomer charge:	
deionized water	90
AEROSOL A-102 surfactant	10
CYLINK NH8 wet adhesion monomer- 50%	1.5 or 3 or 6
methyl methacrylate (53 p.h.m.)	156
butyl acrylate (46.5 p.h.m.)	138
methacrylic acid (0.5 p.h.m)	1.6
flush water	15
C) Catalyst charge:	
deionized water	50
AEROSOL MA-80 surfactant	2.5
ammonium persulphate	0.8

Post addition:

ammonia 25% pH = 9

II. Procedure:

A) Preparation of Kettle Charge:

Dissolve 3.5 parts AEROSOL A-102 surfactant and 0.4 parts ammonium persulphate in 125 parts of deionized water. Purge the solution with nitrogen while stirring and heat to 74°C.

B) Preparation of pre-emulsion monomer charge:

Dissolve 10 parts AEROSOL A-102 surfactant and 1.5 or 3 or 6 parts CYLINK NH8 wet adhesion monomer in 90 parts deionized water, and place in an addition vessel equipped with stirrer. Add to this solution under sufficient stirring a mix of 156 parts methyl methacrylate, 138 parts butyl acrylate, and 1.6 parts methacrylic acid.

C) Preparation of catalyst charge:

Dissolve 2.5 parts AEROSOL MA-80 surfactant and 0.8 parts ammonium persulphate in 50 parts water, and place in an addition flask.

D) Addition of monomer to polymerization flask:

When the contents of the polymerization kettle reach 74°C, the nitrogen flow is reduced to a minimum, and 10% of the monomer pre-emulsion is added to the reactor. After initiation and maximum exotherm, addition of the monomer and catalyst is started at a rate of resp. 1.8 and 0.25 parts per minute. Total addition time approximately 3 hours for the monomer and 3 hours for the catalyst feed.

Following monomer addition, the addition vessel and lines are flushed with 15 parts deionized water, and the latex is held at 74°C for 1 hour, then cooled to room temperature. The pH is adjusted to pH 9 with 25% ammonia and filtered into a suitable container.

Latex Results Summary

Latex Properties	% (weight) NH8 polymerized in Latex backbone			
	0.0%	0.25%	0.5%	1.0%
Total Solids (%)	51.0	51.2	51.6	49.9
Grit 60 mesh (gms)	<0.1	<0.1	<0.1	<0.2
Reactor coat (gms)	1.0	0.2	0.7	1.0
pH (final)	8.2	9.1	9.4	9.1
Mean Particle Size (nm) (dynamic light scattering)	130	141	120	153
Brookfield Viscosity (mPa,sec, #1, 20rpm)	206	173	231	63
Calculated Tg (°C)	9.3	9.3	9.3	9.3
Paint Test Results Type: Semigloss Exterior Trim coat Color: White PVC: 25.2%				
Paint Properties	% (weight) NH8 polymerized in Latex backbone			
	0.0%	0.25%	0.5%	1.0%
Stromer, Ku's (Low shear)	123	126	138	123
ICI viscosity (Hi Shear)	1.00	1.30	1.50	1.45
Contrast Ratio	0.973	0.967	0.969	0.968
Reflectance	92.0	92.6	92.6	92.8
Gloss (60°)	71.4	82.4	73.5	82.6
Wet Adhesion Test Results Test Duration				
	% paint film retained			
	0.0% NH8	0.25% NH8	0.5% NH8	1.0% NH8
4 hour	0	60	60	100
24 hour	0	100	100	100

Stability/Handling

CYLINK NH8 wet adhesion monomer is readily soluble in water, an important advantage for latex systems. CYLINK NH8 wet adhesion monomer does not require stabilization with an inhibitor, enabling greater flexibility in the design of latex recipes.

The favorable physical and handling properties of CYLINK NH8 wet adhesion monomer provide the latex manufacturer with a product that is both user-friendly and consistently delivers high performance. In addition, the versatility of this product enables polymer producers to more readily evaluate the use of wet adhesion monomers in applications beyond architectural coatings, such as adhesives and sealants.

For more detailed technical information on the performance and applications of CYLINK NH8 wet adhesion monomer, please contact your local Cytec sales representative or sales office.

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