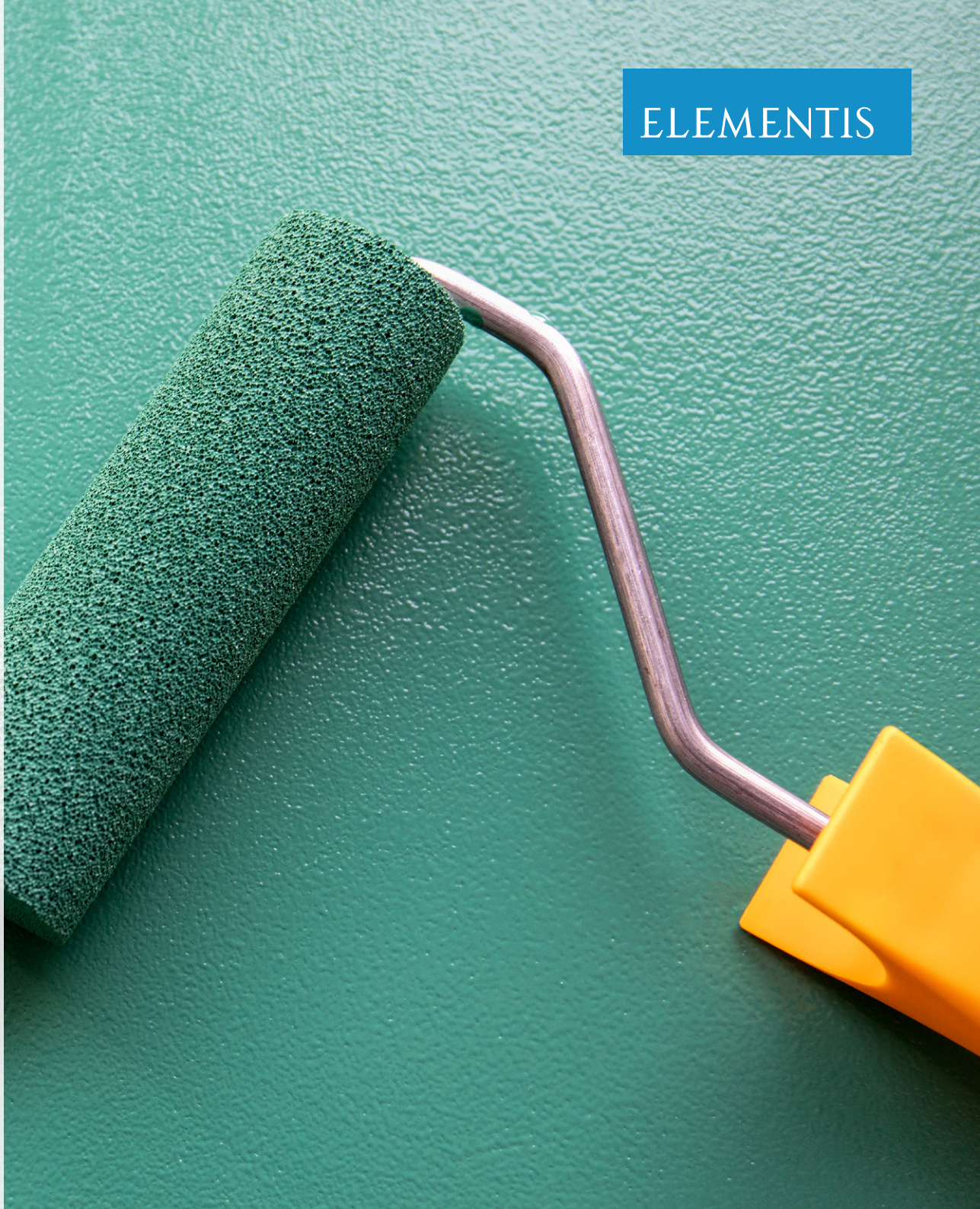
Application Leaflet

Biobased polyurethane thickeners for architectural coatings

Increase biobased carbon content to paint formulation



Unique chemistry, sustainable solutions

Key Benefits

- Sustainability
  > 90% biobased carbon content, C14 verified, Solvent free
- Safer Ingredients
  Compliance Ecolabel, Nordic Swan, VOC- Tin- APEO, MIT/BIT, TEA- Free
- Trusted NiSAT Performance
  Up to 15% higher KU efficiency

Chemical & Physical Properties	RHEOLATE® BIO 5010	RHEOLATE® BIO 5075
Appearance	Translucent off-white to white liquid	Opaque liquid
Active content	0.2	0.175
Total Solids	20 %	22 %
Specific Gravity	1.03	1.03
Viscosity (cps)	< 6,000	< 4,000
PH Value	5,9	5,3

* Viscosity:Brookfield RVT, spindle 4, 20 rpm, 25 °C
** Biobased carbon content: ASTM D6866-22 Method B (AMS) TOC

Introduction

RHEOLATE® Biobased NiSAT range has a C14 measurable biobased carbon content over 90%. This biobased carbon content is largely based on bio-ethanol, originated from sugarcane molasses which is not competing with food supply.

Per ISCC Plus definition, the sugarcane molasses is classified as waste or residue, as it is not intentionally produced.

This new series complies with Ecolabel, Nordic Swan, VOC- Tin- APEO, MIT/BIT, TEA- Free requirements.

Features

RHEOLATE® BIO 5075
- Efficient viscosity build at mid shear rate
- >90% biobased carbon content, C14 verified
- Good sedimentation control
- Excellent sag control
- Improve Spray application
- Shear Thinning / Pseudoplastic

RHEOLATE® BIO 5010
- Efficient viscosity build at high shear rate
- >92% biobased carbon content, C14 verified
- Good syneresis control
- Excellent flow and levelling
- Newtonian
- High film build

Target systems

- Zero to low VOC architectural paints
- Increase the biobased carbon content of formulation until 10%
- Ecolabel, Nordic Swan, VOC, Tin, APEO, MIT/BIT TEA free formulations
- High quality paints
- Trusted NiSAT performance

Incorporation and levels of use

Both RHEOLATE® BIO 5010 and 5075 can be used as supplied. Addition can take place at any time during the manufacturing process but incorporation during the mill base before the letdown is recommended.

Newtonian RHEOLATE® BIO 5010 and the Pseudoplastic RHEOLATE® BIO 5075 can be combined to achieve a balanced rheological profile. To achieve the best performance is also recommended to combine with other rheological modifiers, e.g. such as clay-based thickeners or cellulosic thickeners.

Although RHEOLATE® Biobased NiSAT range has high efficiency, the performance is directly influenced by the chemical nature of the emulsion and particle size of the latex polymer. The effectivity of NiSAT increases as the latex particle size decreases.

Other ingredients in the formulation will impact the effectiveness of RHEOLATE® Biobased NiSAT range such as co-solvents and surfactants.

Typical uses of RHEOLATE® BIO 5010 are in the range of 0,1% to 2% and RHEOLATE® BIO 5075 0,1% to 1,5% both as supplied on total system weight.

TABLE 1: Stormer, ICI and Brookfield viscosity results for all thickeners combinations, in PVC=50% Styrene Acrylic Paint

Thickener	Loading %	Thickener	Loading %	KU Units	ICI Poise	Brookfield (mPa), S04 20 rpm
RHEOLATE® 658	0.66	RHEOLATE® 212 IF	1.0	107	0.7	3480
			1.5	106	0.9	3300
			2.0	106	1.1	3200
RHEOLATE® BIO 5075	0.66	RHEOLATE® BIO 5010	1.0	106	0.7	3480
			1.5	105	0.8	3220
			2.0	104	1.0	3100
Competitor Newtonian	0.66	Competitor Pseudoplastic	1.0	95	0.6	1860
			1.5	94	0.8	1700
			2.0	91	1.0	1560

Products tested

An intensive study was carried out comparing our RHEOLATE® Biobased NiSAT range to our standard RHEOLATE® one and against market references.

The project studied the behavior of each thickener independently, comparing Newtonian with Newtonian and Pseudoplastic with Pseudoplastic and then a combination of Newtonian and Pseudoplastic to correlate more to a real paint formulation.

The studies were made under different formulations varying the PVC and type of emulsion.

The performance tests carried out were differentiated according to interior or exterior formulations.

The same load of RHEOLATE® Biobased NiSAT, standard RHEOLATE® and competitor thickener was used to compare efficiency in the same formulation. The load was different in each formulation regarding the nature and amount of the polymer and the PVC of the formulation.

In all formulations were tested Rheological profile, viscosity in STORMER, ICI and BROOKFIELD (10, 20, 50 and 100 RPM), Sagging, Levelling, Brush out, Spattering, Rub- Out and Storage Stability.

Also performed Blocking test to the enamel formulation, Stain resistance, Wet Scrub Resistance and Dry Burnish to interior formulation; and Dirt Pick Up test and Water Absorption to exterior formulations.

The **TABLE 1** present the viscosity in KU, ICI and Brookfield for three different combination loads on a paint formulated at PVC 50% in Syrene Acrylic.

FIGURE 1: KU and ICI results for the thickeners combination for the PVC=50% Styrene Acrylic Paint

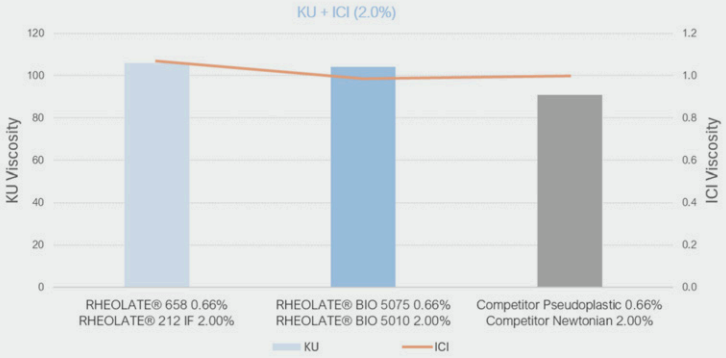
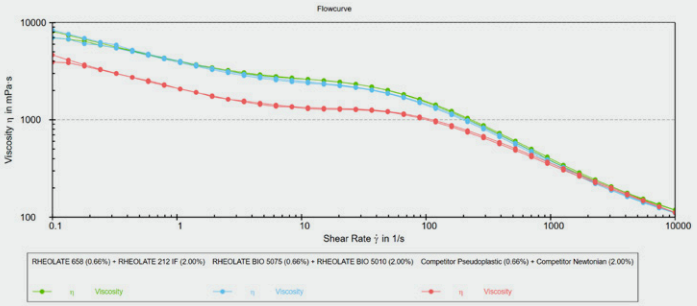


FIGURE 2: Flow curve for thickeners combination for the PVC=50% Styrene Acrylic Paint



On **FIGURE 1** is possible to compare KU and ICI viscosity of three paints with 0.66% Pseudoplastic thickener and 2.00% Newtonian Thickener. Both RHEOLATE® range products present 14.0% to 16.0% more efficiency in KU viscosity and 10.0% in ICI viscosity compared to Competitor thickener.

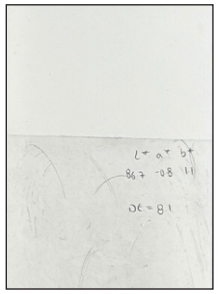
The flow curve in **FIGURE 2** represents the viscosity profile from 0.1 to 10.000 s^{-1} shear rate. The values on mid and high shear rate are in line with KU and ICI viscosity shown on **FIGURE 1**. Also, from this graph it is possible to validate the similar performance between the combination of RHEOLATE® 658 + RHEOLATE® 212 IF and RHEOLATE® BIO 5075 + RHEOLATE® BIO 5010 and higher performance on mid and low shear rate than competitor thickener combination to the same load level.

The Dirt Pick up test was performed on the exterior formulation PVC 50% in pure Acrylic Paint - **FIGURE 3**.

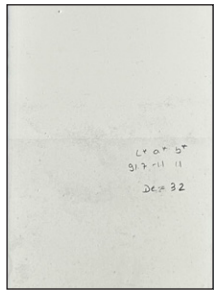
The color difference from the untested area to the exposed to charcoal area are the same for all three applications.

FIGURE 3: Dirt Pick-up results for thickeners combination in PVC=50% Acrylic Paint

RHEOLATE® 658 0.66%
RHEOLATE® 212 IF 2.00%



RHEOLATE® BIO 5075 0.66%
RHEOLATE® BIO 5010 2.00%



Pseudoplastic Competitor 0.66%
Newtonian Competitor 2.00%

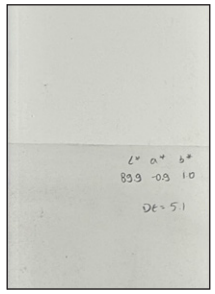


FIGURE 4: Gloss Increase and Water Absorption results for thickeners combination in PVC=30% Acrylic Paint

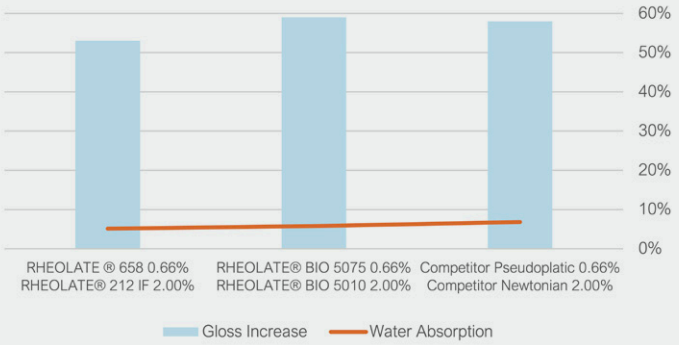
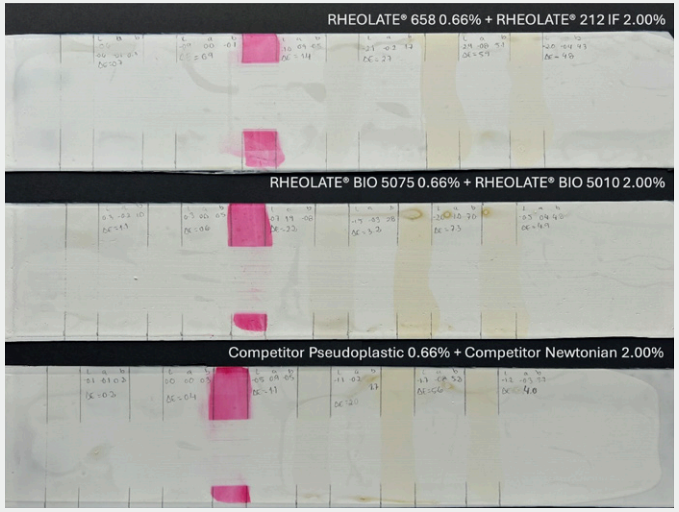


FIGURE 5: Stain Resistance results for thickeners combination in PVC=50% Styrene Acrylic Paint



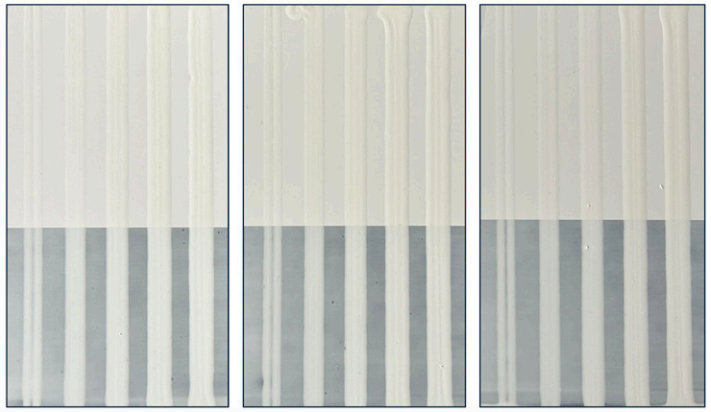
In order to check the level of gloss increase in % between the paint without thickener and with thickener the graph on **FIGURE 4** was plotted. On this graph was also plotted the water absorption for each pair of thickeners used.

Both the gloss and water uptake show very similar performance, slightly better results for both RHEOLATE® Biobased NiSAT and standard compared to Competitor.

In all interior formulations stain resistance test was performed with Tea, Coffee, Red Wine, Lipstick, Mustard and Ketchup – **FIGURE 5**. The main difference observed were related to differences on different PVC formulations and not in thickeners combinations.

Levelling and storage stability were evaluated, and the results show similar performance in all formulations, see **FIGURE 6 AND 7**.

FIGURE 6: Leveling results for thickeners combination in PVC=50% Styrene Acrylic Paint



RHEOLATE® 658 0.66%
RHEOLATE® 212 IF 2.00%

RHEOLATE® BIO 5075 0.66%
RHEOLATE® BIO 5010 2.00%

Pseudoplastic Competitor 0.66%
Newtonian Competitor 2.00%

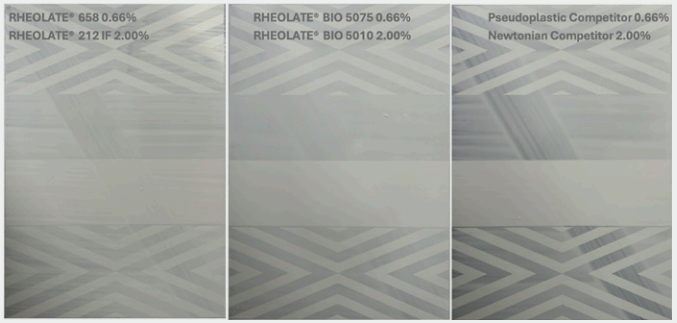
FIGURE 7: Storage stability for 28days at 50°C for combination in PVC=50% Styrene Acrylic Paint

RHEOLATE® 658 0.66%
RHEOLATE® 212 IF 2.00%

RHEOLATE® BIO 5075 0.66%
RHEOLATE® BIO 5010 2.00%

Pseudoplastic Competitor 0.66%
Newtonian Competitor 2.00%

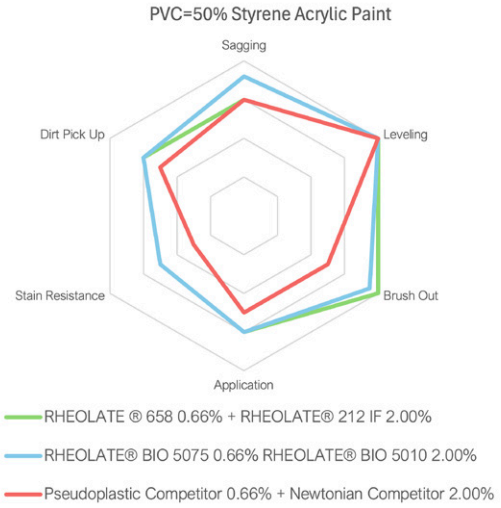
FIGURE 8: Brush-out results for thickeners combination in PVC=50% Styrene Acrylic Paint



To check levelling and brush out from the application point of view, all three combinations were applied by brush starting with the same amount of paint and then measured the real amount of paint transferred to too opacity chart.

In **FIGURE 8** it is possible to see the combination of RHEOLATE® Biobased NiSAT presents the better result in levelling and RHEOLATE® standard range the better opacity. Competitor application showed the brush marks and low opacity.

FIGURE 9: Radar chart with overall results



Conclusion

The resume of all the performance tested done shown clearly that the RHEOLATE® Biobased NiSAT range are in line with the RHEOLATE® Standard range and 16% higher efficiency in KU builder viscosity, less water absorption and less brush marks compared to the Competitor thickener.

APPENDIX

PVC=19% PU-Alkyd Gloss Paint

TABLE 2: Formulation for a PVC=19% PU Alkyd Gloss Paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Dispersion (Pos. 1-4)				
1	Dem. Water	5.45	Diluent	
2	DAPRO DF 52	0.30	Defoamer	Elementis Specialties
3	NUOSPERSE FX 610	1.10	Dispersing Agent	Elementis Specialties
4	Kronos 2190	22.60	Pigment	Kronos International
Grind Pos. 1-4 for 30 min at 10 m/s				
Letdown (Pos. 5-10)				
5	NeoPac PU485	57.50	Binder	Covestro
6	Borchi Oxy-Coat (1:9 water)	1.20	Dryer	Borchers
7	SUPREAD 2059	1.00	Wetting agent	Elementis Specialties
8	Propylene glycol	1.00	Org. Co-solvent	BASF
9	Tint Ayd WD 2018	0.03	Toner	Chromaflo Technologies
10	Dem. Water	8.82	Diluent	
Add Pos. 5-10 under stirring in the denoted order				
Add Letdown (Pos. 5-10) to Dispersion (Pos. 1-4)				
11	Rheological Additive	1.00	Rheo. Additive	Elementis Specialties
Add Pos. 11 and stir for 10 min (liquid) or 20 min (powder) at low speed				
		100.00		

PVC 30% Pure Acrylic

TABLE 3: Formulation for a PVC=30% Acrylic Paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Millbase Stage				
1	Tap Water	7.40	Diluent	
Add Pos. 2-11 under stirring in the denoted order				
2	NUOSPERSE FX 504	0.10	Wetting Agent	Elementis Specialties
3	DAPRO BIO 9910	0.20	Defoamer	Elementis Specialties
4	Calgon N neu, 10% H_2O	0.50	Softener	BK Giulini
5	Kronos 2190	4.10	Pigment	Kronos International
6	Omyacarb 2 GU	6.80	Extender	Omya
7	Omyacarb 5 GU	8.10	Extender	Omya
8	Hydrocarb	4.10	Extender	Omya
9	Micro Talc - IT Extra	2.40	Extender	Elementis Specialties
10	Socal P2	2.70	Extender	Solvay
11	Sipernat 820 A	1.10	Extender	Evonik
Grind Pos. 1-11 for 15 min at 10 m/s				
12	DAPRO BIO 9910	0.05		
13	Tap water	10.00		
Add Pos. 12 and 13 and stir further 10 min at low speed				
Add Pos. 13-16 under stirring				
14	Mowilith LDM 7717	51.55	Binder	Celanese
15	Dowanol DPnB	0.55	Coalescing agent	Valente e Ribeiro
Add Pos. 17-18 and stir slightly for 10 min				
16	Rheological Additive	X	Rheo. Additive	Elementis Specialties
17	Ammonia Solution w=25%	0.15	pH Adjustment	
18	Acticide SR 3388	0.20	Biocide	Troy
		100.00		

PVC 50% Styrene Acrylic

TABLE 4: Formulation for a PVC=50% Styrene Acrylic based paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Millbase Stage				
1	Tap Water	14.80	Diluent	
Add Pos. 2-11 under stirring in the denoted order				
2	Calgon N neu, 10% H2O	0.10	Softener	BK Giulini
3	Acticide SR 338	0.20	Biocide	Troy
4	NUOSPERSE FX 504	0.10	Wetting Agent	Elementis Specialties
5	DAPRO BIO 9910	0.30	Defoamer	Elementis Specialties
6	Kronos 2190	5.80	Pigment	Kronos International
7	Omyacarb 2 GU	9.60	Extender	Omya
8	Omyacarb 5 GU	11.70	Extender	Omya
9	Hydrocarb	5.80	Extender	Omya
10	Micro Talc - IT Extra	3.40	Extender	Elementis Specialties
11	Socal P2	3.80	Extender	Solvay
12	Sipernat 820 A	1.50	Extender	Evonik
Grind Pos. 1-12 for 15 min at 10 m/s				
13	Texanol	0.80	Org. Co-Solvent	Eastmann
14	Acronal S 790	32.10	Resin	BASF
15	DAPRO BIO 9910	0.10	Defoamer	Elementis Specialties
16	Tap Water	9.70	Diluent	
Add Pos. 13 and 16 and stir further 10 min at low speed				
Add Pos. 13-16 under stirring				
Add Pos. 17-18 and stir slightly for 10 min				
17	Rheological Additive	X	Rheo. Additive	Elementis Specialties
18	Ammonia Solution w=25%	0.20	pH Adjustment	
		100.00		

PVC 50% Vinyl Ester of Versatic acid

TABLE 5: Formulation for a PVC=50% Vinyl Ester of Versatic Acid based paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Millbase Stage				
1	Tap Water	14.80	Diluent	
Add Pos. 2-11 under stirring in the denoted order				
2	Calgon N neu, 10% H2O	0.10	Softener	BK Giulini
3	Acticide SR 338	0.20	Biocide	Troy
4	NUOSPERSE FX 504	0.10	Wetting Agent	Elementis Specialties
5	DAPRO BIO 9910	0.30	Defoamer	Elementis Specialties
6	Kronos 2190	5.80	Pigment	Kronos International
7	Omyacarb 2 GU	9.60	Extender	Omya
8	Omyacarb 5 GU	11.70	Extender	Omya
9	Hydrocarb	5.80	Extender	Omya
10	Micro Talc - IT Extra	3.40	Extender	Elementis Specialties
11	Socal P2	3.80	Extender	Solvay
12	Sipernat 820 A	1.50	Extender	Evonik
Grind Pos. 1-12 for 15 min at 10 m/s				
13	Texanol	0.80	Org. Co-Solvent	Eastmann
14	IQLIT 200	32.10	Resin	IQLIT
15	DAPRO BIO 9910	0.10	Defoamer	Elementis Specialties
16	Tap Water	9.70	Diluent	
Add Pos. 13 and 16 and stir further 10 min at low speed				
Add Pos. 13-16 under stirring				
Add Pos. 17-18 and stir slightly for 10 min				
17	Rheological Additive	X	Rheo. Additive	Elementis Specialties
18	Ammonia Solution w=25%	0.20	pH Adjustment	
		100.00		

PVC 50% Vinyl Acetate and Ethylene

TABLE 6: Formulation for a PVC=50% Vinyl Acetate and Ethylene based paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Millbase Stage				
1	Tap Water	14.80	Diluent	
Add Pos. 2-11 under stirring in the denoted order				
2	Calgon N neu, 10% H2O	0.10	Softener	BK Giulini
3	Acticide SR 338	0.20	Biocide	Troy
4	NUOSPERSE FX 504	0.10	Wetting Agent	Elementis Specialties
5	DAPRO BIO 9910	0.30	Defoamer	Elementis Specialties
6	Kronos 2190	5.80	Pigment	Kronos International
7	Omyacarb 2 GU	9.60	Extender	Omya
8	Omyacarb 5 GU	11.70	Extender	Omya
9	Hydrocarb	5.80	Extender	Omya
10	Micro Talc - IT Extra	3.40	Extender	Elementis Specialties
11	Socal P2	3.80	Extender	Solvay
12	Sipernat 820 A	1.50	Extender	Evonik
Grind Pos. 1-12 for 15 min at 10 m/s				
13	Texanol	0.80	Org. Co-Solvent	Eastmann
14	Mowilith LDM 1871	32.10	Resin	Celanese
15	DAPRO BIO 9910	0.10	Defoamer	Elementis Specialties
16	Tap Water	9.70	Diluent	
Add Pos. 13 and 16 and stir further 10 min at low speed				
Add Pos. 13-16 under stirring				
Add Pos. 17-18 and stir slightly for 10 min				
17	Rheological Additive	X	Rheo. Additive	Elementis Specialties
18	Ammonia Solution w=25%	0.20	pH Adjustment	
		100.00		

PVC 50% 100% Acrylic

TABLE 7: Formulation for a PVC=50% Acrylic based paint

Pos.	Raw Material	Weight (%)	Function	Supplier
Millbase Stage				
1	Tap Water	12.17	Diluent	
Add Pos. 2-11 under stirring in the denoted order				
2	Calgon N neu, 10% H2O	0.10	Softener	BK Giulini
3	Acticide SR 338	0.20	Biocide	Troy
4	NUOSPERSE FX 504	0.10	Wetting Agent	Elementis Specialties
5	DAPRO BIO 9910	0.31	Defoamer	Elementis Specialties
6	Kronos 2190	5.98	Pigment	Kronos International
7	Omyacarb 2 GU	9.90	Extender	Omya
8	Omyacarb 5 GU	12.06	Extender	Omya
9	Hydrocarb	5.98	Extender	Omya
10	Micro Talc - IT Extra	3.51	Extender	Elementis Specialties
11	Socal P2	3.92	Extender	Solvay
12	Sipernat 820 A	1.55	Extender	Evonik
Grind Pos. 1-12 for 15 min at 10 m/s				
13	Texanol	0.82	Org. Co-Solvent	Eastmann
14	Mowilith LDM 7717	33.09	Resin	Celanese
15	DAPRO BIO 9910	0.10	Defoamer	Elementis Specialties
16	Tap Water	10.00	Diluent	
Add Pos. 13 and 16 and stir further 10 min at low speed				
Add Pos. 13-16 under stirring				
Add Pos. 17-18 and stir slightly for 10 min				
17	Rheological Additive	X	Rheo. Additive	Elementis Specialties
18	Ammonia Solution w=25%	0.21	pH Adjustment	
		100.00		

NOTE:

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