



Interior and Exterior Emulsion Paints

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Interior Emulsion Paints:

**Silfit Z 91 vs. Na/Al-Silicate and Alumosilicate
in low cost, solvent-free straight acrylic paint**

Author: Bodo Essen

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Assessment of the performance of the Calcined Neuburg Siliceous Earth grade Silfit Z 91 compared to precipitated sodium aluminum silicate and an aluminosilicate in an interior straight acrylic emulsion paint:

- 6 % Titanium dioxide
- PVC 83 %
- Solids content 58 %
- Solvent-free

Special attention is paid to optical properties as well as resulting formulation costs while evaluating further relevant properties

Base Formulation

		Parts by weight
Water deionized	-	300
Natrosol 250 HBR	Thickener	4
Sodium hydroxide, 20 % in water	Neutralising agent	2
Joncryl 8078	Dispersing additive	9
Parmetol MBX	Can preservation	1
Foamaster MO 2134	Defoamer	2
Tronox CR-828	TiO ₂ Pigment	60
Prec. Na/Al-Silicate	TiO ₂ Extender	20
Special Aluminosilicate	Matting agent	20
Socal P2	TiO ₂ Extender	50
Plustalc H15	Filler	90
Omyacarb 2 GU	Filler	80
Omyacarb 5 GU	Filler	210
Foamaster MO 2134	Defoamer	2
Acronal ECO 6270 (Straight acrylic)	Emulsion binder	84
Water deionized	-	66
Total		1000

Formulation Variations

Replacement of Na/Al-Silicate + Aluminosilicate / TiO₂ content varied
All other ingredients remain unchanged

Control		Silfit Z 91					
		Full TiO ₂			TiO ₂ reduced		
					- 10 %	- 15 %	- 20 %
TiO ₂	60	60	60	80	54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Aluminosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80
Solids content w/w [%]	58.3	58.3	59.2	59.9	59.2	59.2	59.3
PVC [%]	83.5	83.2	83.8	84.3	83.9	83.9	84.0

TiO₂-Extender,
Matting agent 

Processing Properties and Storage Stability

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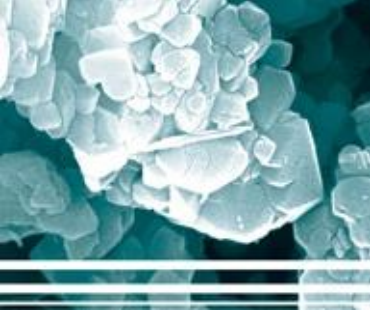
RESULTS

SUMMARY

Results			
Incorporation Pigment / Filler	moderat (Control) - good (Silfit Z 91)		
Dispersing process 20 min 15 m/s	no agglomerates, no foam formation		
Fineness of grind	30 μm (Control) - 15 μm (Silfit Z 91)		
Viscosity 23°C	Shear rate at	0.1 s ⁻¹	8.6 - 10.7 [Pa*s]
		1000 s ⁻¹	0.09 - 0.13 [Pa*s]
Storage stability 6 months at 23°C	Low phase separation; settling of sediment easy to re-stir and to homogenize		

Preparation and Testing

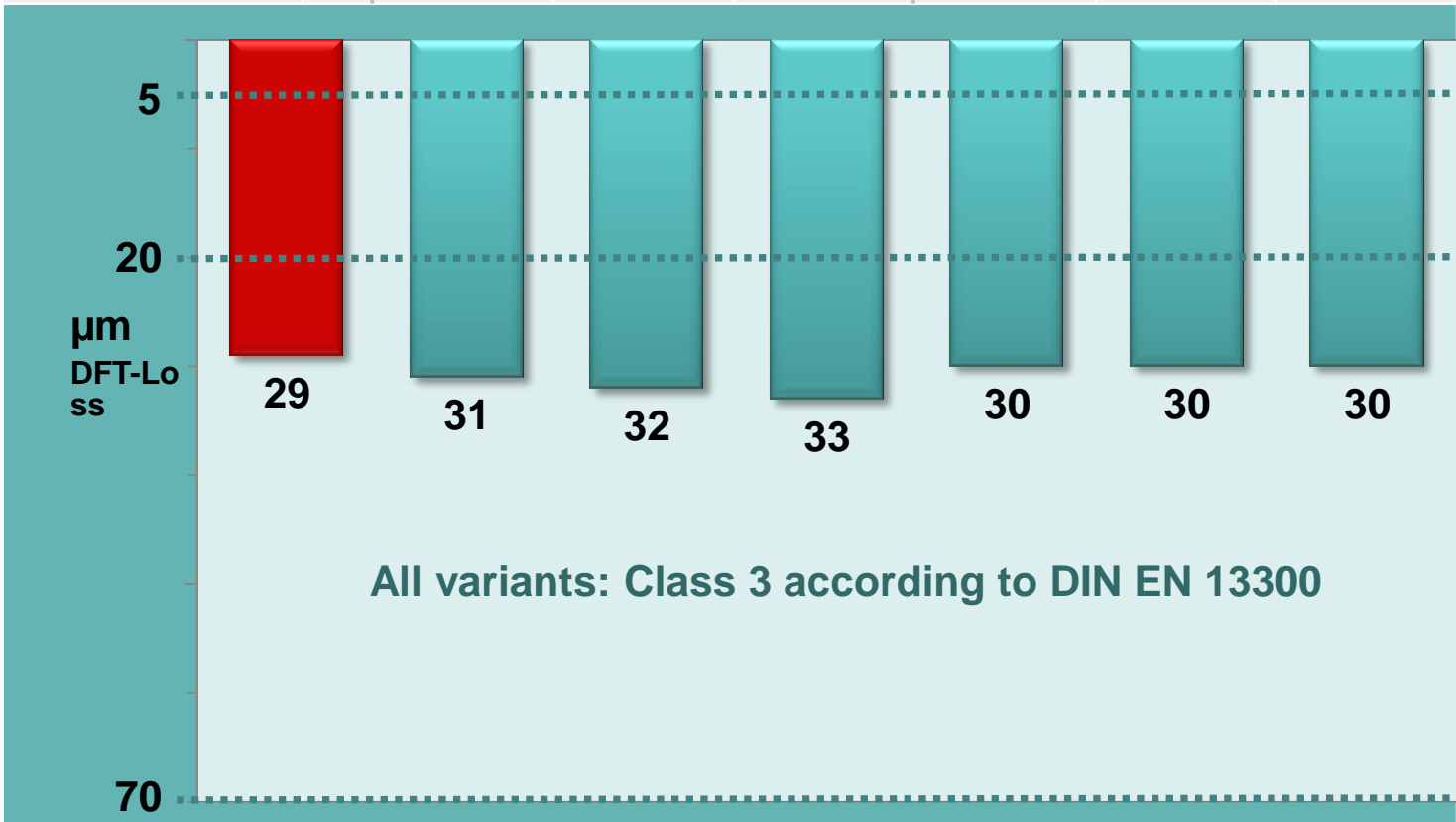




Wet-Scrub Resistance

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TiO ₂	60		60		54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Alumosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80

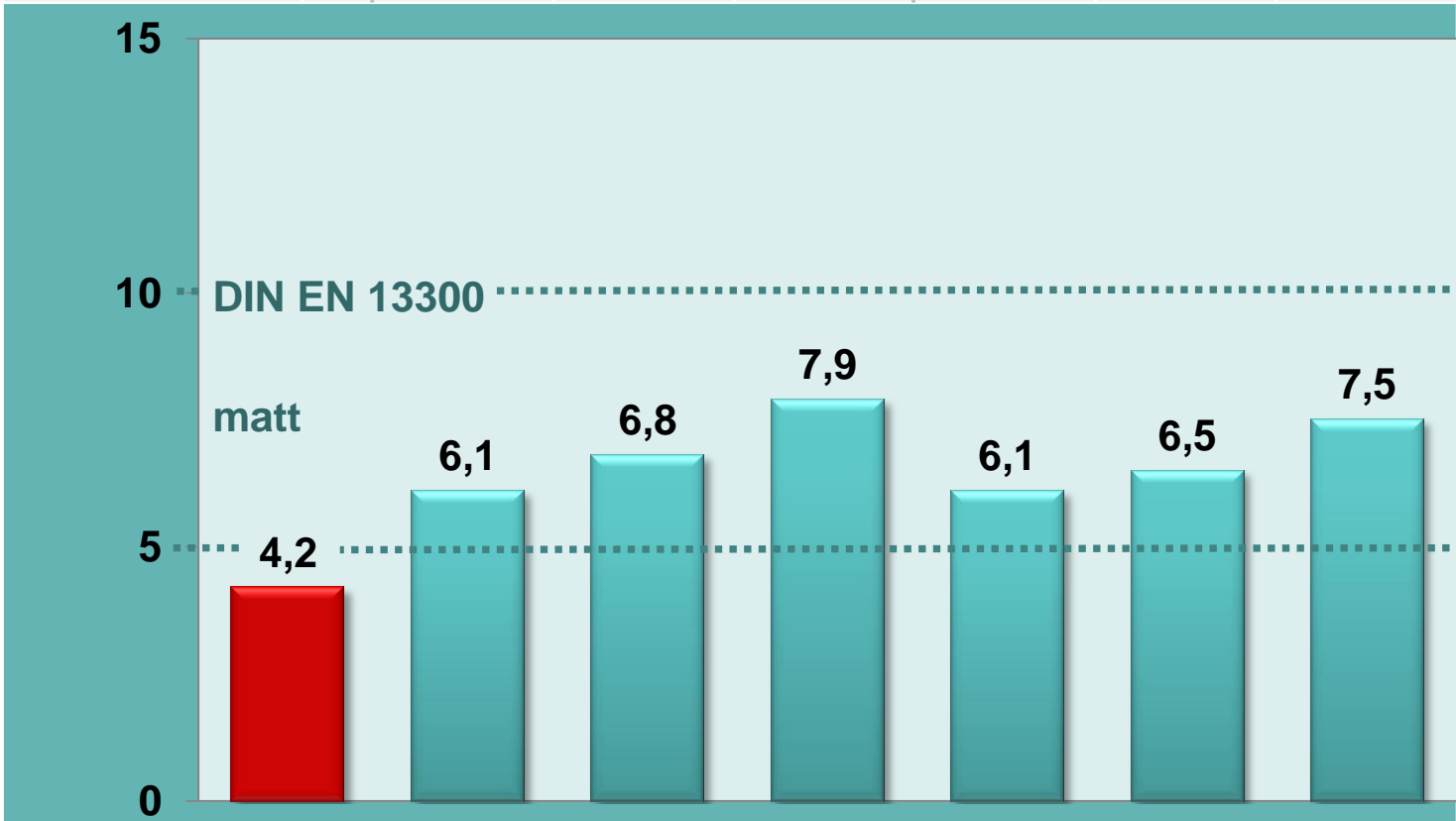




Gloss 85° (Sheen)

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TiO₂	60		60		54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Alumosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80





Color

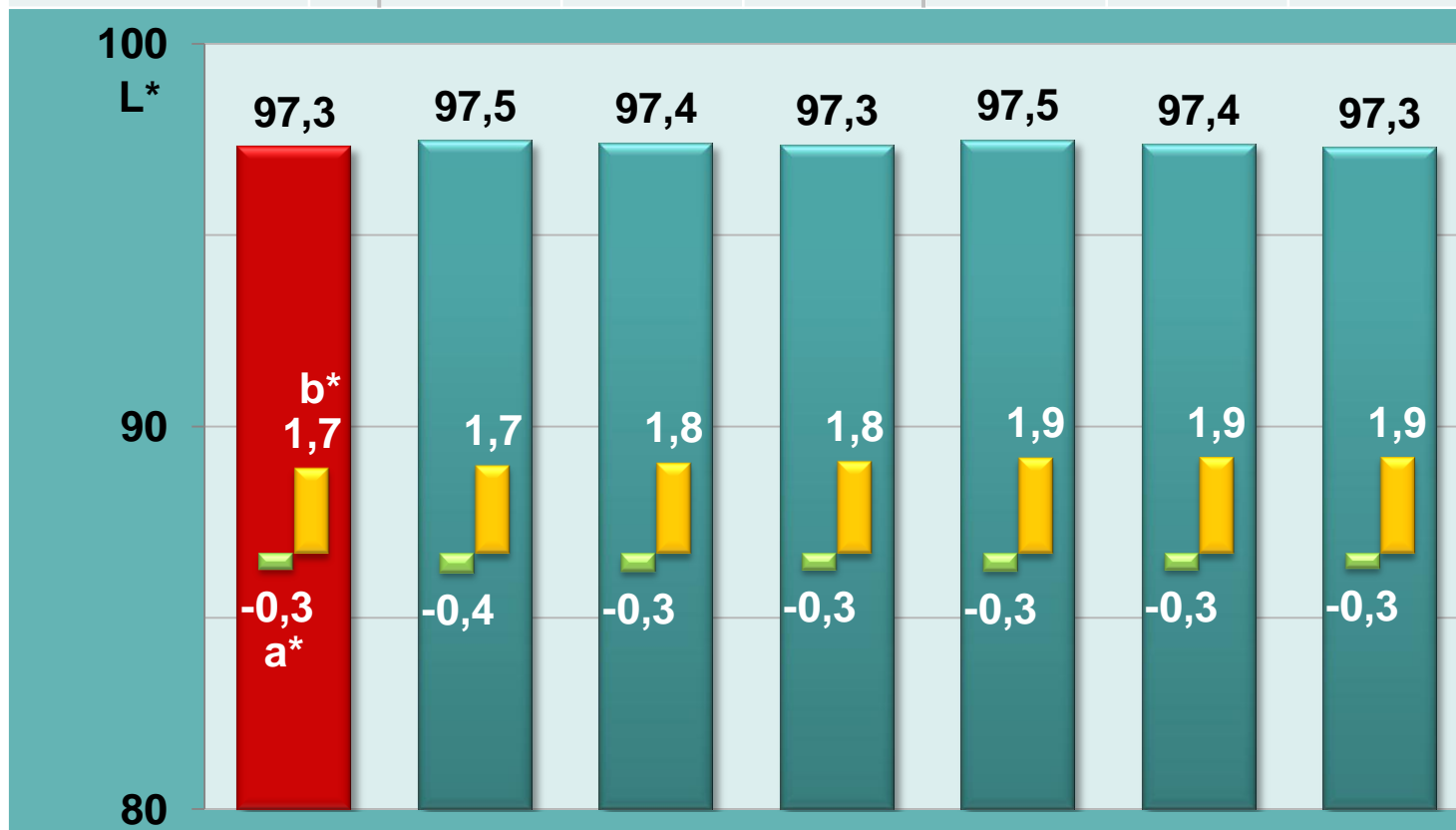
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TiO ₂	60		60		54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Alumosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80



Spreading Rate at Contrast Ratio 98 %

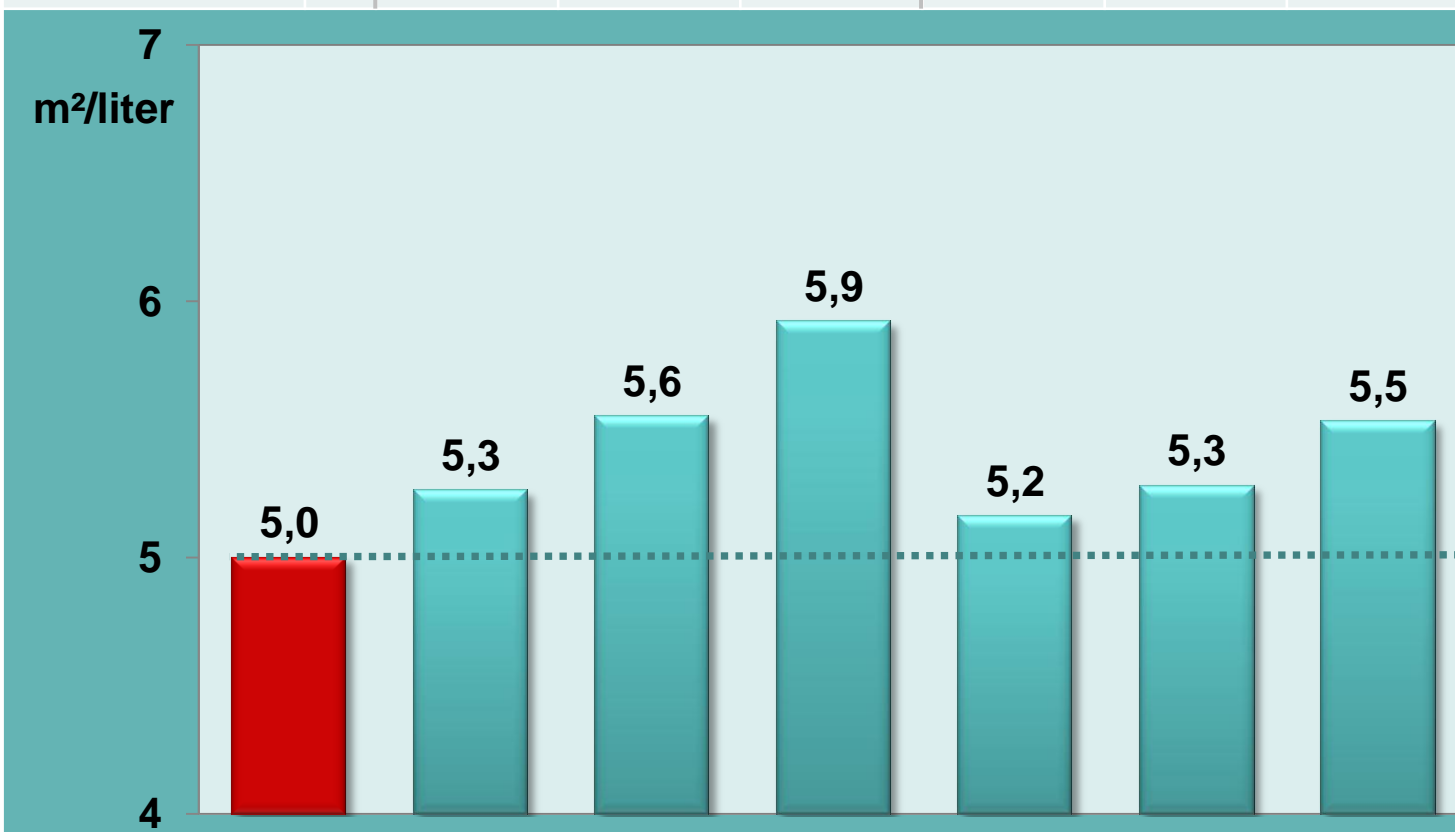
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TiO ₂	60		60		54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Alumosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80



Cost / Performance

Germany 2014 at Contrast Ratio 98 %

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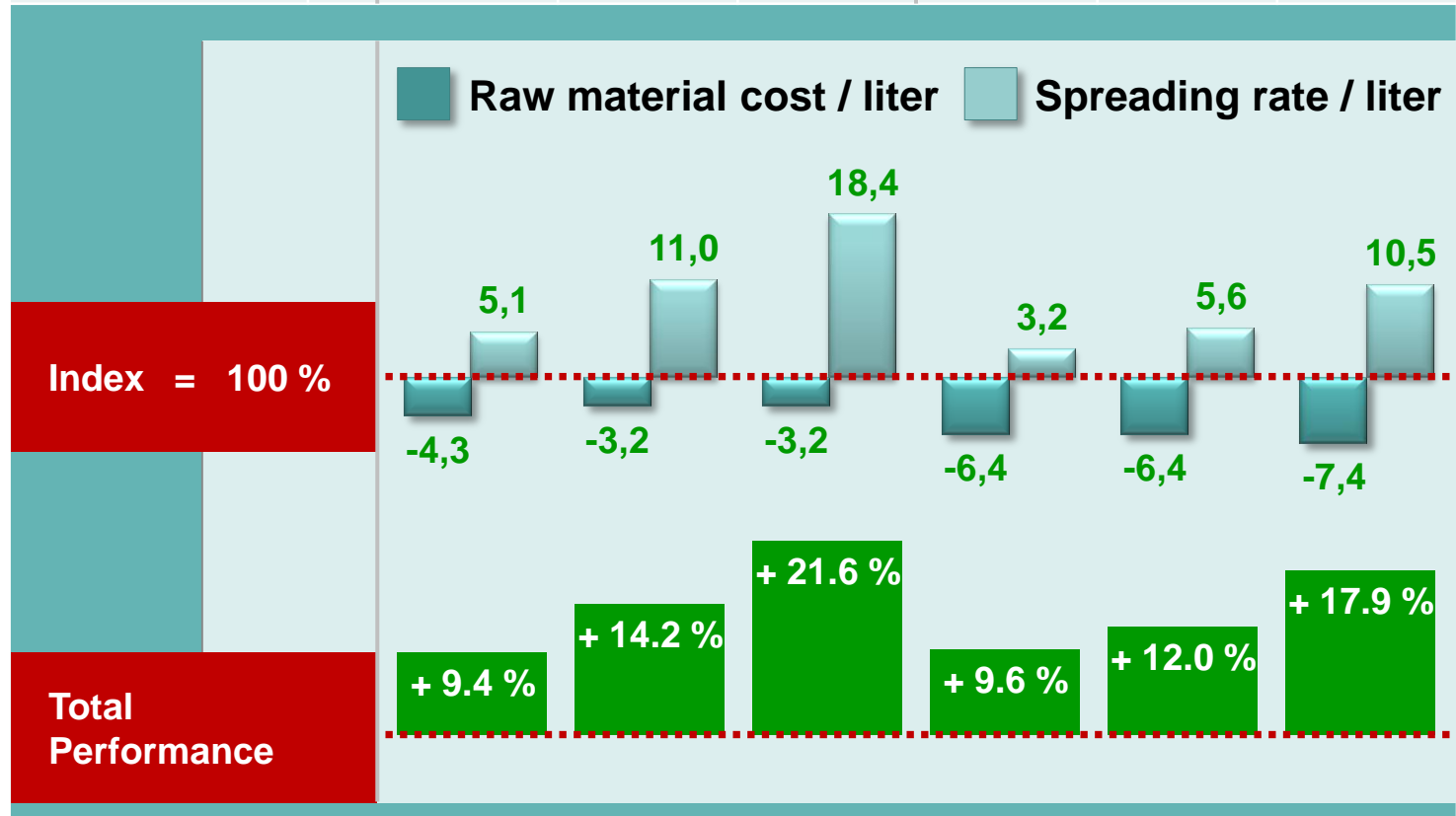
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TiO ₂	60		60		54	51	48
Na/Al-Silicate	20	---	---	---	---	---	---
Alumosilicate	20	---	---	---	---	---	---
Silfit Z 91	---	40	60	80	40	60	80



Summary

Compared to a combination of Na/Al-Silicate and Aluminosilicate **Silfit Z 91** leads to:

- Almost equal processing properties, storage stability, color and wet-scrub resistance
- Slightly higher gloss level; matting with adaptive dosage of natural cellulosic fibers such as “Arbocel B 600” if needed

Silfit Z 91 additionally offers:

- Marked improvement of hiding power and spreading rates whilst at the same time lowering formulation cost
- Despite 10 - 20 % white pigment reduction even better efficiency with additional cost-saving effect

Silfit Z 91 gains the following benefits when used as TiO₂ extender:

- ✓ Improved performance, regardless of further TiO₂ reduction
- ✓ Real high cost-cutting potential for even more cost-effective interior emulsion paints

Starting Formulations

[1] Highest brightness and matting * [2] Best hiding power / spreading rate [3] TiO ₂ -reduction for high cost saving with good hiding power	[1]	[2]	[3]	
Water deionized		300		
Natrosol 250 HBR		4		
Sodium hydroxide, 20 % in water		2		
Joncryl 8078		9		
Parmetol MBX		1		
Foamaster MO 2134		2		
Tronox CR-828	60	60	48 (to 54)	
Silfit Z 91	40	80	(40 to) 80	
Socal P2		50		
Plustalc H15		90		
Omyacarb 2 GU		80		
Omyacarb 5 GU		210		
Foamaster MO 2134		3		
Acronal ECO 6270 (Straight acrylic)		84		
Water deionized		66		
Total	1000	1040	1028	
Solids content w/w	[%]	58.3	59.9	59.3
PVC	[%]	83.2	84.3	84.0

* Dosage of +/- 20 pbw Arbocel B 600 if required



Facade Emulsion Paints:

Silfit Z 91 vs. Precipitated Sodium Aluminum Silicate

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Assessment of the performance of the Calcined Neuburg Siliceous Earth grade Silfit Z 91 compared to precipitated sodium aluminum silicate

Special attention is paid to optical properties as well as resulting formulation costs while evaluating further relevant properties

Evaluation in European standard emulsion paint for facades based on a styrene acrylic dispersion with

- 19 % Titanium dioxide
- PVC 50 %
- Solids content 61 %

Base Formulation

		Parts by weight
Water deionized	-	180
Natrosol 250 HR	Thickener	2
Ammonia, conc. 25 %	Neutralising agent	2
Dispex AA 4030	Dispersing additive	2
Calgon N New, 10 % in water	Wetting- / Dispersing	3
Parmetol MBX	Can preservation	2
Foamaster MO 2134	Defoamer	2
Propylene glycol : Butyl diglycol : Texanol = 1 : 1 : 1	Cosolvent	30
Kronos 2190	TiO ₂ Pigment	190
TiO₂-Extender		varied X
Omyacarb 5 GU	Filler	220
Finntalc M 15	Filler	50
Acronal S 790 (Styrene acrylic)	Emulsion Binder	320
Foamaster MO 2134	Defoamer	3
Acticide MKB 3	Film preservation	10
Rheovis PE 1330	Thickener	12
Water deionized	-	12
Total		1040 + X

Formulation Variations

Variation of the Pigment / TiO₂-Extender package
All other formulation ingredients remain unchanged

Control, without TiO ₂ -Extender		with TiO ₂ -Extender									
		Full TiO ₂					- 10 % TiO ₂		- 20 % TiO ₂		
TiO ₂	190	190					171		152		
Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98
Solids content w/w [%]	61.0	61.8	62.5	61.8	62.5	63.1	61.1	61.8	62.5	63.8	63.2
PVC [%]	49.6	51.2	52.7	50.9	52.1	53.3	50.5	52.0	52.6	54.8	54.2

TiO₂-Extender

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	Particle size		Oil absorption [g/100g]	Density [g/cm ³]	Specific Surface BET [m ² /g]	Color		
	d ₅₀ [μm]	d ₉₇ [μm]				L*	a *	b*
Precipitated Na/Al Silicate	5.0	18	140	2.1	95	98.9	- 0.1	0.6
Silfit Z 91	2.0	10	55	2.6	8	95.5	- 0.1	0.7

Other Fillers in Formulation (for comparison only)

Omyacarb 5 GU	5.5	26	16	2.7	2	96.0	- 0.2	0.7
Finntalc M 15	4.5	17	41	2.8	6	92.8	- 0.5	1.1

Results

Preparation and Storage

Incorporation Pigment / Filler	good to moderate
Foam formation	none
Fineness of grind	25 μm
Storage stability 23°C, 6 months	no phase separation, settling or sediment

Properties without significant differences

Viscosity 23°C	Shear rate at 0.1 s^{-1}	40 - 60 [Pa*s]
	1000 s^{-1}	0.3 - 0.4 [Pa*s]
Liquid Water Permeability DIN EN 1062-1	Class W ₃ Low	0.020 - 0.026 [kg/(m ² *h ^{0,5})]
Water Vapor Transmission Rate DIN EN 1062-1	Class V ₂ Medium	20.0 - 23.5 [g/(m ² *d)]
Gloss	dull matt, DIN EN 13000	85° < 5

*Preparation and
Testing*



Wet-Scrub Resistance

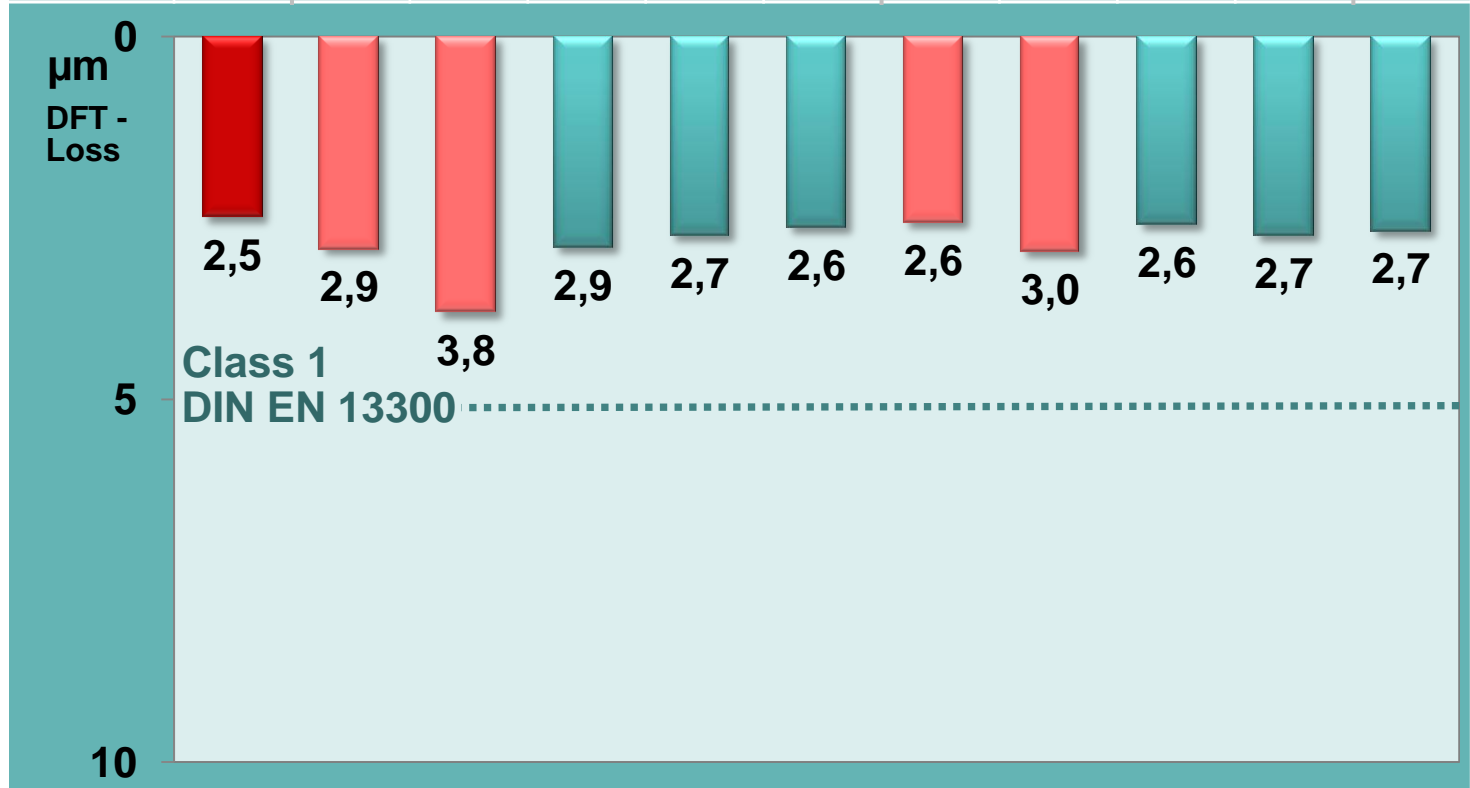
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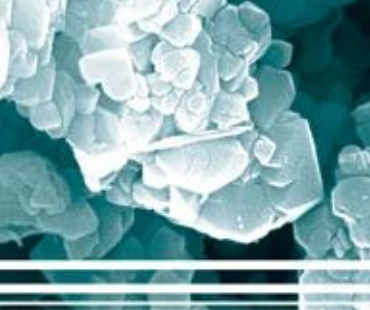
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TiO ₂	190	190					171				152
Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98





Color

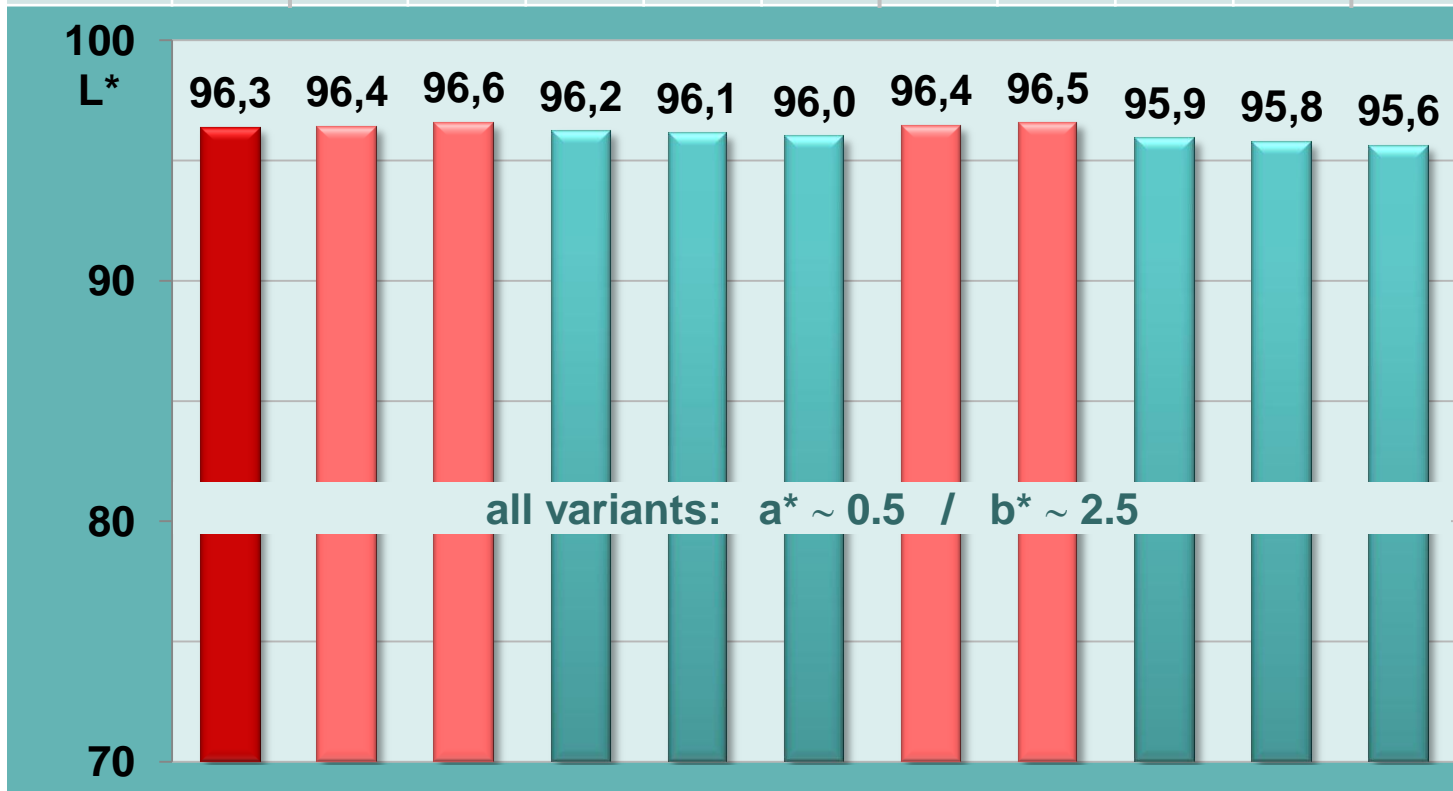
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TiO ₂	190	190					171				152
Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98



Hiding Power EU Ecolabel

General:

- Identifies products that meet high standards of environmental performance and quality

Criteria relating to facade paints:

- Spreading rate
≥ **6 m² / liter** at contrast ratio 98 %
- Content of white pigments (refractive index ≥ 1.8)
≤ **38 g / m²** dried paint film at contrast ratio 98 %



Spreading Rate at Contrast Ratio 98 %

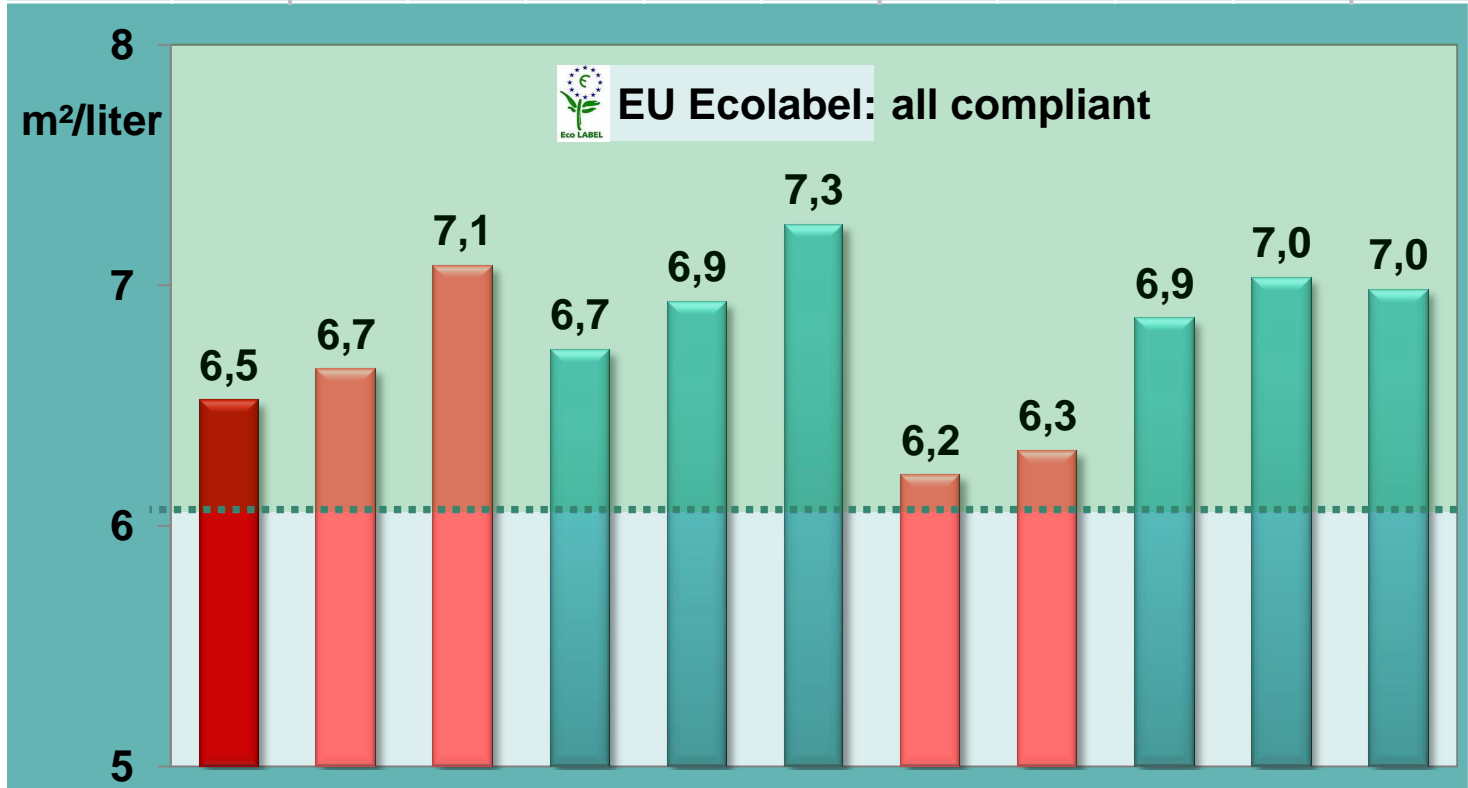
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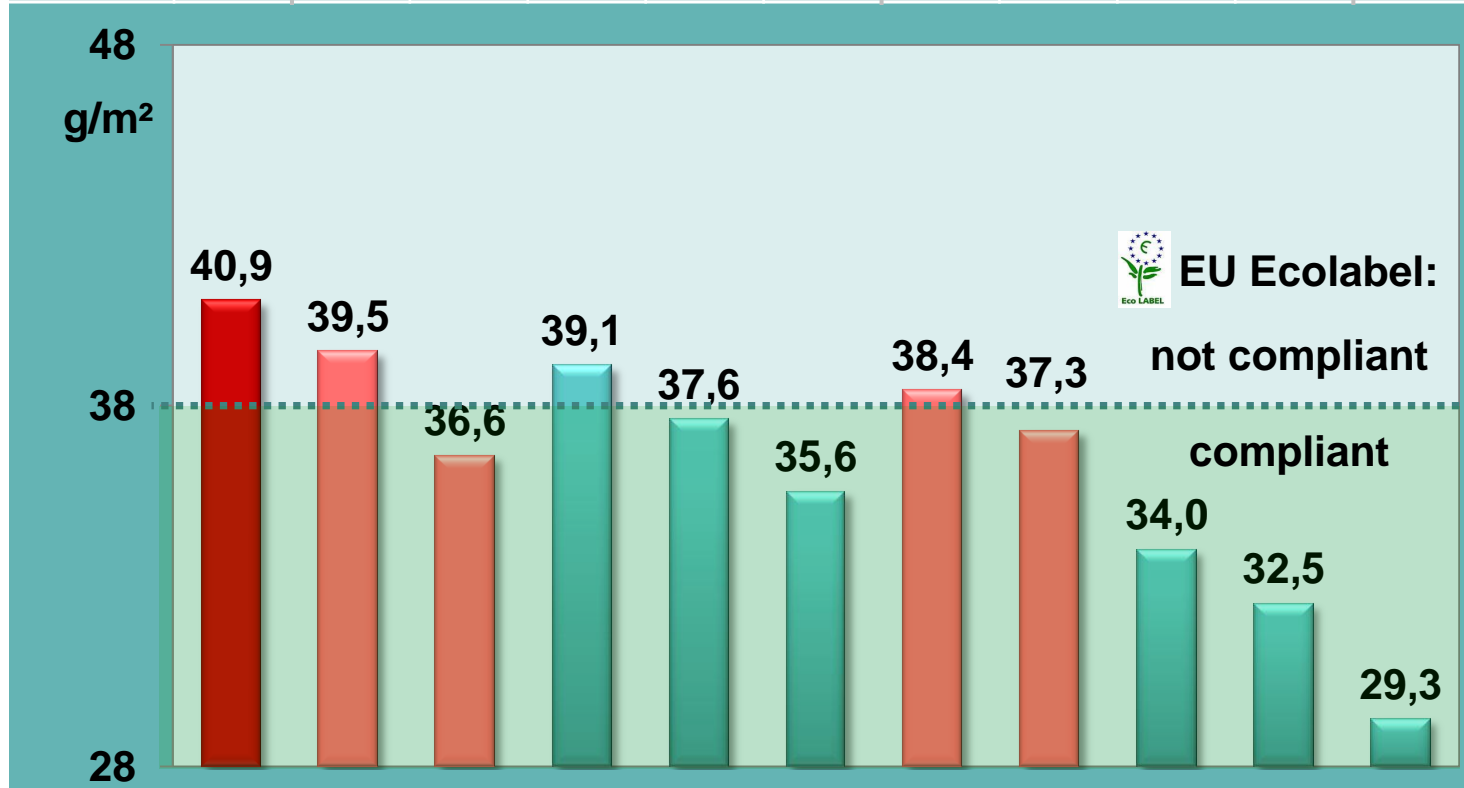
TiO ₂	190	190					171				152
Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98



TiO₂-Content per m² at Contrast Ratio 98 %

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Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98



Cost / Performance

Germany 2014 at Contrast Ratio 98 %

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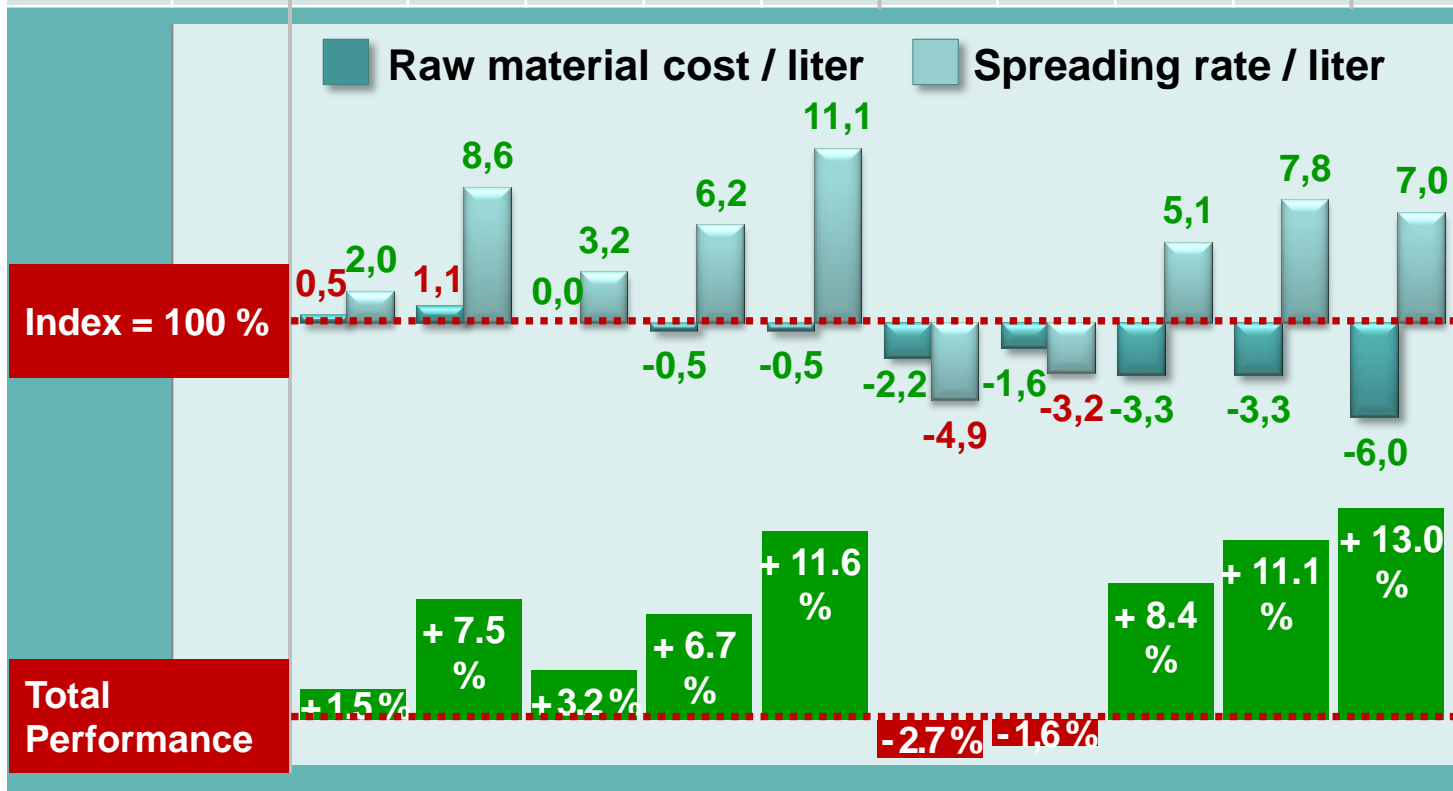
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TiO ₂	190	190					171				152
Na/Al Silicate	---	20	40	---	---	---	20	40	---	---	---
Silfit Z 91	---	---	---	20	40	60	---	---	60	98	98



Conclusion

Compared to precipitated Sodium Aluminum Silicate the

Silfit Z 91 gains the following combined benefits when used as a TiO₂-Extender in facade paints

- ✓ Maintaining mechanical resistance and durability of the coating
- ✓ Markedly improvement of hiding power and spreading rates while reducing formulation costs
- ✓ TiO₂ reduction offering real white pigment savings without losing performance
- ✓ Paint meeting EU Ecolabel requirements clearly below limits for white pigments

Starting Formulations

[1] highest brightness
 [2] best hiding power + high brightness
 [3] high cost savings + high hiding power


[1]

[2]

[3]

Water deionized		180	
Natrosol 250 HR		2	
Ammonia, conc. 25 %		2	
Dispex AA 4030		2	
Calgon N New, 10 % in water		3	
Parmetol MBX		2	
Foamaster MO 2134		2	
Propylene glycol : Butyl diglycol : Texanol = 1 : 1 : 1		30	
Kronos 2190	190	190	171 to 152
Silfit Z 91	20 to 40	40 to 60	60 to 98
Omyacarb 5 GU		220	
Finntalc M 15		50	
Acronal S 790		320	
Foamaster MO 2134		3	
Acticide MKB 3		10	
Rheovis PE 1330		12	
Water deionized		12	
Total	1060 - 1080	1080 - 1100	1081 - 1100
Solids content w/w	[%]	61.8	63.1
PVC	[%]	50.9	54.2

Thank you
very much!



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