



# A COMPARISON OF **EXTENDERS** IN SEMI-GLOSS EMULSION PAINTS

A variety of different extenders is used in semi-gloss and silk emulsion paints. Extenders can have a significant influence on the rheology, opacity and gloss of these paints. This report gives a comparison of some of the more commonly used kaolin (china clay) and calcium carbonate extenders. The comparison was made in a solvent-free, semi-gloss emulsion paint.

## EXPERIMENTAL

A list of the extenders compared and their physical analyses are given in Table 1.

Extenders can be grouped according to their particle size. Those extenders with a  $d_{50}$  of below 1 micron can be classified as

ultrafine, whereas those with a  $d_{50}$  of 1 - 3 micron can be classified as fine.

Supreme™ and Speswhite™ kaolins, CP 1 and CP 2 calcium carbonates all have an ultrafine particle size.

TABLE 1: ANALYSIS OF EXTENDERS

Extender	Supreme™	Speswhite™	CP 1	CP 2	CP 3	CP 4	Carbital™ 110
Type	Ultrafine kaolin	Ultrafine kaolin	Ultrafine CaCO <sub>3</sub>	Ultrafine CaCO <sub>3</sub>	Fine CaCO <sub>3</sub>	Fine CaCO <sub>3</sub>	Fine CaCO <sub>3</sub>
ISO Brightness,%	87.6	85.5	92.5	92.2	91.9	91.2	93.8
+20µm, %	0.01	0.02	0.02	0.03	0.05	0.4	0.07
+10µm, %	0.03	0.04	0.06	0.05	4	1.5	0.7
- 2µm, %	93	81	94	93	59	47	53
- 1µm, %	84	62	63	61	40	25	31
- 0.5µm, %	58	40	24	23	18	12	15
Mean particle size $d_{50}$ , µm	0.4	0.7	0.8	0.8	1.4	2.1	1.8

## COMPARISON IN A SEMI-GLOSS EMULSION PAINT

The extenders were tested at 10 weight % in the formulation in Table 2. This formulation is solvent free; it does not contain either coalescing solvents or glycols and is based on Vinamul 3697, a vinyl acetate-ethylene- acrylate terpolymer, with an MFFT of <1°C.

The effects of the extenders on the viscosity and dry film properties of the semi-gloss paint are shown in Table 3.

Paint properties were influenced by the type of extender, as follows:-

### Viscosity

- At low shear rates, Supreme and Speswhite gave the highest viscosity. At high shear rates(104 sec<sup>-1</sup>) there was little difference between the extenders. The thixotropic behaviour of Supreme and Speswhite is typical of ultrafine kaolins in aqueous media.

### Opacity

There were significant differences in the effects of the extenders on the opacity of these paints. These differences can be linked to the particle shapes and sizes of the various extenders.

The ultrafine kaolins gave the best light scattering and opacity. Supreme gave 2 units higher opacity than the ultrafine CaCO<sub>3</sub> extenders, CP 1 and CP 2. This large opacity benefit is due to the improved TiO<sub>2</sub> spacing effect.

CP 3, CP 4 and Carbital 110 all gave slightly lower opacity than the ultrafine calcium carbonates.

### Gloss

The finest extenders, Supreme, CP 1 and CP 2 gave the highest gloss. CP 3 gave the lowest.

TABLE 2: SEMI-GLOSS PAINT FORMULATION

	Weight %
Water	12.5
Dispex G40 dispersant	0.4
Potassium hydroxide	0.3
Foamaster NDW defoamer	0.2
Acticide BX(N) biocide	0.1
Kronos 2063 TiO <sub>2</sub>	17.0
<b>Extender</b>	<b>10.0</b>
Disperse for 15 mins using Cowles - add:	
Water	7.5
Vinamul 3697 latex (55% solids)	40.0
Mix for 5 mins then add & mix together:	
Acrysol RM5 associative thickener	4.0
Water	8.0
	<b>100.0</b>
PVC, %	29
Specific gravity, g/cm <sup>3</sup>	1.28
Solids, weight %	50.9
Solids, volume %	34.7

Other Properties

All the extenders had a similar effect on the burnishing resistance. Since these paints are formulated well below the critical PVC, they all had excellent scrub resistance.

CONCLUSIONS

Both particle shape and size have an influence on the performance of extenders in semi-gloss emulsion paints. Kaolins give the best opacity, due to their platy particle shape. Extenders with an ultrafine particle size give the highest gloss.

In this evaluation, Supreme kaolin gives the best performance. Supreme has a combination of platy particle shapes and ultrafine particle size. Consequently, it gives the highest opacity and equal highest gloss. These benefits give the potential for savings in TiO<sub>2</sub> and latex binder levels.

The ultrafine calcium carbonates, CP 1 and CP 2, give similar gloss to Supreme but gave considerably lower opacity due to their nodular particle shape. The fine calcium carbonates, CP 3, CP 4 and Carbital 110 give the lowest gloss and opacity.

TABLE 3: EFFECT OF EXTENDERS ON PAINT PROPERTIES

Extender	Supreme	Speswhite	CP 1	CP 2	CP 3	CP 4	Carbital 110
<b>Viscosities in poise</b>							
Brookfield 1 rpm (0.3sec <sup>-1</sup> )	950	830	520	430	370	320	400
Rotothinner (150 sec <sup>-1</sup> )	8.8	7.5	6.6	6.7	6.3	6.0	5.9
Cone & Plate (10000 sec <sup>-1</sup> )	1.5	1.5	1.7	1.6	1.5	1.4	1.3
<b>Dry Film Properties</b>							
Contrast ratio at 20m <sup>2</sup> /l, %	90.8	90.4	88.9	88.8	88.2	88.3	88.2
Light scattering coeff. S, cm <sup>2</sup> /g	1245	1205	1090	1090	1050	1050	1040
Colour L*	95.6	95.5	95.7	95.7	95.7	95.7	95.8
b*	+2.6	+2.6	+2.5	+2.5	+2.5	+2.5	+2.4
Gloss at 20°, %	8	6	8	8	4	5	5
Gloss at 60°, %	42	34	42	42	22	28	28
Gloss at 85°, %	86	81	86	87	39	62	65
Increase in 85° gloss on burnishing,%	4	4	6	5	5	5	5
DIN Scrub resistance, cycles	>20,000	>20,000	>20,000	>20,000	>20,000	>20,000	>20,000

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