

# 03

## Dispersion Control Additives

When dispersing pigments, one frequently encounters problems such as flocculation, insufficient color or transparency, poor rheological qualities or stability. With our dispersion control additives, you can ensure your pigment and filler particles will keep apart for quite long and thus avoid any (re)-flocculation or settling that may occur in your liquid formulations.

Delta Specialties offer a comprehensive range of dispersion control additives (low and high molecular weight) for solvent and water-based systems to help you optimize your dispersions in coatings, printing inks and plastics (composite).





# Types of Dispersion Control Additives

Delta Specialties manufactures 2 types of dispersion control additives:

## 1 - Low molecular weight wetting and dispersing agents (DELTA DC® 4000 series)

### Properties:

- 800 g/mol < Molecular weight < 2,000 g/mol.
- Categorized according to their chemical structure and the nature of their hydrophilic groups (amphoteric, cationic ... etc).
- The interaction of their polar groups with the pigment surface and the behavior of the non-polar chains in the medium determine their effectiveness.
- Only used for stabilizing inorganic pigments and extenders.

### Mode of Action:

- The polar heads will form hydrogen bonding interactions between different pigment units resulting in a network that enhances the separation of the particles (controlled flocculation).

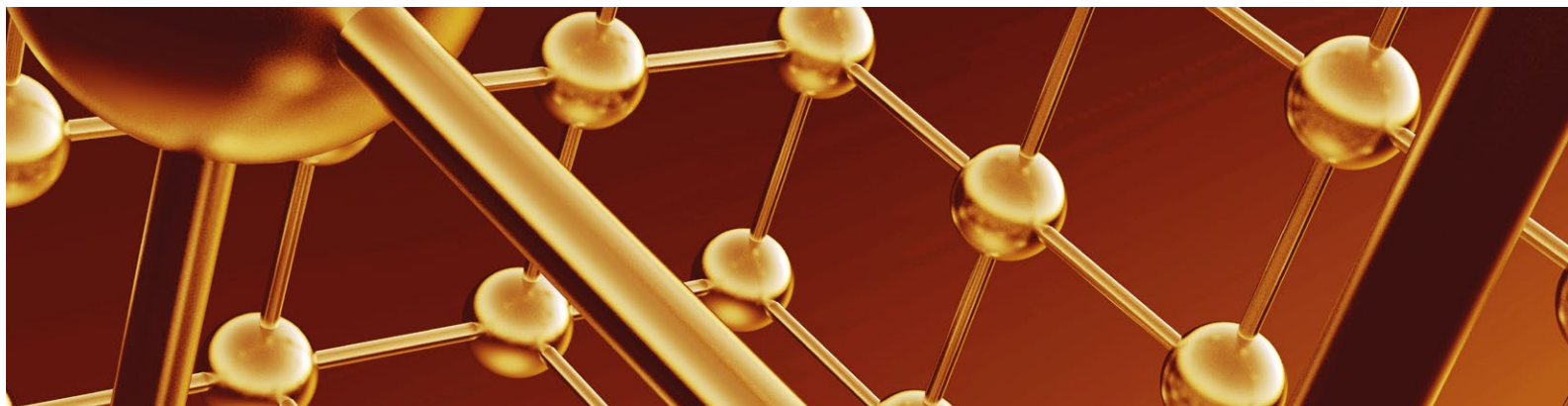
- This interaction is of great importance in this class of dispersion control additives since the relatively low molecular weight will not give sufficient steric hindrance.
- Inorganic pigments are usually metal oxides, which contain positive metal ions and negative oxide ions. These ions are good anchoring points, where the anchoring groups that build-up the polar head of the dispersion control additive can attach to (polar interactions).
- Unfortunately this type of charge interaction is not possible with organic or black pigments.



Anchoring group

Non-polar tail

DELTA DC® 4000 series



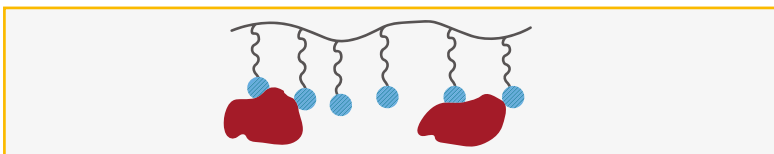
## 2 - High molecular weight wetting and dispersing agents (DELTA DC® 3000 series)

### Properties:

- 5,000 g/mol < Molecular weight < 30,000 g/mol.
- They are built of branched or long linear molecules, which in general have a polyurethane or polyacrylate structure.
- Designed to adsorb via special groups with high affinity towards specific sites on the pigment surface. These are called anchoring groups, and are built in at strategic points on the polymer backbone.
- Suited for inorganic and organic pigments, in addition to carbon black pigments.

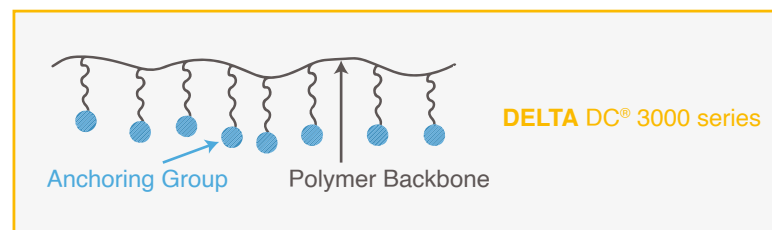
### Mode of Action:

- Anchoring groups enable strong interaction between the dispersion control additive and the pigment surface.
- This interaction is much stronger than in the case of the low molecular weight types as the dispersion control additive is bound to numerous sites on the surface via the anchoring groups, assuring an efficient steric hindrance between the solid particles by keeping them apart.



- The remaining parts of the dispersion control additive act as a steric barrier to the surroundings by stretching into the liquid phase preventing flocculation.
- These parts have a good affinity with the solvent and the resin system, so the compatibility with the liquid phase is increased and the viscosity of the paint system is reduced as a desired side effect.
- Organic pigments molecules consist mainly of the elements C, H, O and N. These atoms are not charged and are connected to each other through covalent bonds. Despite the fact that the main interaction between the anchoring groups and pigment surface is hydrogen bonding, this mechanism applies for both organic and inorganic pigments.

- Inorganic pigments are usually treated with different types of polar organic compounds which enable this interaction to take place as it does by the organic pigments.



The compatibility of the dispersion control additive chain in various vehicles is determined by its chemical nature. Therefore different chemistries were developed by Delta Specialties, which are divided according to their chemical composition into two groups:

- **Polyurethane-based:** They have a branched backbone, with a 3 dimensional network structure. On various places of this network structure, different anchoring groups are introduced. They are compatible with systems from medium to high polarity. They reduce the viscosity of the mill-base greatly and therefore promote the use of higher pigment loading during grinding (pigment concentrate applications). However, since viscosity and tendency for settling may increase in the case of high density pigments (inorganic pigments), it is essential to use a rheological modifier or an anti-settling agent next to the polyurethane-based dispersion control additives.
- **Polyacrylate-based:** They have linear structures with a carbon-carbon backbone, which bears various functional side groups and short chains. They bear groups, which participate in the anchoring of the pigment. Others play a role in the solvation of the acrylate in the liquid medium, or induce a sterical hindrance, that thwarts the re-agglomeration, after the adsorption of the polymer onto the pigment surface. They are compatible with systems from non-polar to very high polar systems and do not reduce the viscosity as much as in the first class. This allows the polyacrylate-based dispersion control additives to promote anti-settling behaviour as well.

# Choosing a Dispersion Control Additive

**To achieve the best de-flocculation/stability effect of pigment dispersions, one must consider three main points:**

- Compatibility of the dispersion control additive with the vehicle
- Quantity of the dispersion control additive in relation to pigment
- Proper application procedure

A quick preliminary test can be carried out to ensure that no major errors are made in the initial choice of the dispersion control additive. The test is done by mixing the dispersant with the main letdown vehicle in the ratio 90:10. The mixture should be clear. It might be necessary in some cases to shake the mixture with glass beads (1:1 by weight) using a shaker like Skandex® for 1 hour. The mixture must then be clear. The extra mixing is needed to find out whether the dispersant is difficult to incorporate or is completely incompatible.

This test, however, is not indicative of the effectiveness of the dispersing agent. It can only predict possible deficiencies in de-flocculation performances (loss of gloss) and, in the case of mixed pigments, the risk for floatation.

Addition levels used in the case of low molecular weight dispersion control additives are generally low and thus can easily be determined. In the case of high molecular weight dispersion control additives, it is of prime importance to use the right addition level in order to achieve an optimum pigment dispersion.

From past experience, a handy calculation method has been developed that will minimize initial testing trials.

For inorganic pigments, the percentage of high molecular weight dispersant (as active material) used on pigment is usually 10% of the oil absorption value\*.

For carbon black pigments, the minimum percentage (as active material) used on pigment is 20% of the DBP-value\*\*.



(\*)Oil Absorption (OA) value of a pigment is defined as the number of grams of linseed oil absorbed by 100g of the pigment.

(\*\*)DBP (Dibutylphthalate) -value is defined as being the volume of Dibutylphthalate absorbed by 100g of carbon black pigment.

The required percentage for organic pigments is more difficult to determine. The BET-value\*\*\* is a good starting point. For yellow, orange and red pigments, the percentage (as active material) used on pigment is 50% of the BET-value. For phthalo-cyanine blue, phthalo-cyanine green, maroon and violet pigments, with BET-values lower than 50 m<sup>2</sup>/g, the percentages(as active material) used on pigment are 50% of the BET-value.

The general guideline for calculating the amount of high molecular weight dispersion control additive required to stabilize a certain type and quantity of pigment will be correct in most cases. However, organic pigments might require amounts of dispersants beyond or below the calculated ones.

Such unexpected required amounts are dependant on the way the pigment is pre-treated. Many pigments are pre-treated nowadays, in such a way that they can be dispersed easier than the untreated ones.

Please take a look at our website [www.delta-specialties.com](http://www.delta-specialties.com) (select 'Technical Information' and then 'Pigment list') where you can have

access to a list (sorted by pigment color) containing a large number of commercially known pigments with their respective technical information (color index, supplier name, BET-value...etc).

In case a pigment is not listed in, please contact your pigment supplier to get the required value (OA, BET or DBP) for your calculation of dispersant dosage.

We will be delighted to establish a tailored formulation for you should you find difficulties collecting the technical information from your supplier. All you have to do is to send our Technical Service team a small sample of your pigment.



(\*\*\*) BET-value is defined as being the surface area of a pigment per its weight; and is determined by N<sub>2</sub> adsorption method according to Brunauer, Emmet and Teller.

## High-Molecular Weight Wetting & Dispersing Agents

# Dispersion Control Additives

- **Highly Recommended**
- **Potentially Suitable**

[illegible]



## Low-Molecular Weight Wetting & Dispersing Agents

# Dispersion Control Additives

- **Highly Recommended**
- **Potentially Suitable**

[illegible]



# 04

## Specialty Additives

This range represents specialty additives with unique chemistries and exceptional technical features.





# Multi-Purpose Additives

## DELTA S® 5220 & DELTA S® 5225

**DELTA S® 5220 and DELTA S® 5225 are multi-functional additives, both can be used as:**

- Color acceptance improver
- Dispersant of choice for transparent iron oxides

**DELTA S® 5225** can be used as sole dispersion control additive for the manufacturing of universal colorants.

**DELTA S® 5220** is excellent dispersion control additive for inorganic pigments and extenders in water and solvent-based systems, also for preparation of slurries and matting agent dispersions.

Both **DELTA S® 5225** and **DELTA S® 5220** are 100% active, APE-free dispersion control additives. They are based on unsaturated fatty acids having polar tertiary amines heads.

The hydrophobic chains have unsaturated character which allows the additive to be liquid at room temperature (easy handling).

In addition, the 'unsaturation' provides drying properties by cross-linking in the presence of oxygen.

The anchoring groups used in **DELTA S® 5225** are similar to those of our high molecular weight dispersion control additives (**DELTA DC® 3000** series) and hence have strong affinity towards pigment surfaces (inorganic, organic and carbon black pigments).

**DELTA S® 5220** has special anchoring groups allowing the additive to drastically reduce the viscosity of inorganic pigments and extenders.

Slurries and highly pigmented iron oxide or titanium dioxide pastes can be prepared by using one single dispersion control additive.

### Colour Acceptance Improvement

It is possible to improve colour acceptance of base paints (solvent and water-based paints) when using both **DELTA S® 5225** or **DELTA S® 5220** as post-additives by preventing the 'de-wetting' of surfactants (surfactant stripping) used for the formulation of universal colorants.

0.5-1.5 parts by weight of either **DELTA S® 5225** or **DELTA S® 5220** into the white base paint (alkyd or emulsion base) can make a world of difference.



# Universal Colorants for Architectural Paints

Production of colorants is essential for tinting of the architectural paints. Ideally these universal tinting pastes should be compatible with water-based as well as solvent-based paints.

With **DELTA S® 5225**, you can from now onward formulate your 16 colorants without any resin and with only one dispersion control additive. Making universal colorants has never been so easy!

Given its unique chemistry and the absence of any carrier, **DELTA S® 5225** will enable customers to:

- Meet the stringent VOC restrictions in place today.
- Comply with the current and anticipated requirements in terms of APEs (Aryl phenylethoxylates) and environmental aspects.

In view of the future environmental legislation and increased health and safety awareness, more and more paint manufacturers in the Middle East market will opt for APE-free products.

Due to many construction projects in the pipeline and the unusual and fast growth in the DIY (Do-It- Yourself) concept, demand for both interior and exterior paints from end-consumers in the Middle East will witness a steady increase in the coming years.

**DELTA S® 5225** will enable paint manufacturers to formulate environmentally friendly colorants, with no APE raw materials and lowered or no VOC content.

The following formulations, developed for in-plant tinting have been tested in our technical service laboratory in various white base paints (water and solvent-based) from different manufacturers in the Middle East. Their compatibility and stability over time are just stunning.

PC 23 Violet	PG 36 Low Green	PBK 7/PY 42 /PR 101 Amber	PY 83 Orange Yellow	PY 42 Yellow Oxide	PR 112 Red	PR 168 Orange Red	PB 15:4 Low Blue
PY 74 Yellow High	PG 7 High Green	PR 122 Magenta	PB 15:3 High Blue	PY 138 Yellow Low	PW 6 White	PBK 7 Black	PR 101 Red Oxide

	PY 74	PB 15:3	PR 112	PG 7	PR 101	PY 42	PW 6	PBK 7
Monoethyleneglycol	18.0	16.0	11.0	16.0	15.3	18.0	15.5	18.0
<b>DELTA S® 5225</b>	6.5	10.0	17.0	10.0	66	7.7	7.3	4.5
Demi-Water	33.8	32.8	38.7	32.8	12.0	17.2	14.1	57.7
NaOH (25% in water)	1.0	1.5	2.6	1.5	1.0	1.1	1.1	1.1
<b>DELTA FC® 1525</b>	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Anti-settling	--	--	--	--	0.3	0.3	0.3	--
Preservative	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pigment	40.0	39.0	30.0	39.0	64.0	55.0	61.0	18.0
Total weight	100.0	100.0	100.0	100.0	99.9	100.0	100.0	100.0
Pigment characteristics	BET=17	BET=57	BET=30	BET=44	OA=26	OA=34	OA=16	DBP=93

Please note that the above formulations were established using specific pigments with determined OA-, BET- and DBP- value (Please refer to Choosing a Dispersion Control Additive).

In case you use pigments with different properties, it is obvious that your formulations would need some adjustments.

Should you require tailored colorant formulations for your own system (s), our Technical Service technicians would be more than pleased to assist.

We can indeed provide you with all the support you need to develop your own tinting system.



# Multi-Functional Additives

**DELTA S® 5700** is an anti-gel agent and viscosity stabilizer for air-drying and stoving coating systems. It delays/prevents thickening, which can occur as a result of oxidation or condensation of the binder.

- It also reduces the reaction of the pigments with the vehicle.
- It is usually added prior to grinding, but already gelled materials can be restored to processing viscosity by the addition of **DELTA S® 5700**.

**DELTA S® 5750** is a diol ester compound that function as a coalescing agent for different types of latexes in water-based paints. **DELTA S® 5750** is characterized by its low water solubility and good hydrolytic stability over wide pH range which enhances its coalescing effect. Further additional benefits are enhancing the scrub resistance, reducing the MFFT, improving color development and has a good hydrolytic stability over wide pH range.

**DELTA S® 5715** is a multifunctional additive for printing inks. It acts as an adhesion promoter and substrate wetting additive for laminating inks. Further, **DELTA S® 5715** improves color strength and stability.

- It can be effectively used with different types of laminating liquid inks improving adhesion on different substrates.

**DELTA S® 5800** is a specially formulated humectant that can replace traditional glycols to help in formulating a low VOC water-based colorants and pigment pastes. It prevents the drying out of water-based pigment pastes, prevents pigment caking and maintains the pigment pastes quality upon storage.

**DELTA S® 5845** is a high molecular polymeric wetting and dispersing agent particularly developed for dispersing organic and carbon black pigments in plasticizers and polyols. It offers an excellent viscosity reduction and color strength. **DELTA S® 5845** is supplied as %50 active in phthalate-free plasticizer.

**DELTA S® 97** provides pH control and stability. It can substitute ammonia and thus reduces odor during production and in the final paint.

- It also reduces the dose of dispersant, wetting agent, anti-foam and coalescent agent and provides excellent wetting properties.



# Replacements for Cobalt Drier Mordry 410/420

MORDRY 410 and MORDRY 420 are highly efficient replacements for cobalt drier in urethane-modified alkyds and alkyds.

They can be efficiently applied in clear and brightly pigmented urethane-modified alkyds and in conventional alkyds, which tend to discolor.

As compared to cobalt octoate, these cobalt replacements can offer superior properties such as:

- The minimization of discoloration of clear urethane-modified alkyds in can.

- The improvement of alkali resistance.
- The increase in yellowing resistance of air-drying alkyd finishes especially those subjected to prolonged heat or alkaline fumes.
- The prevention of 'loss of dry' on aging.
- The relative lower level of toxicity compared to cobalt.

To highlight the performance of one of these special driers, **MORDRY®410** was tested in 2 different urethane-modified alkyds (see table below) in comparison to cobalt octoate, considered to be the benchmark.

Internal reference: Formulation 6/ 2009	Formulation 1	Formulation 2	Formulation 3	Formulation 4
Uralac AR 202 W50 (DSM)	80.00 pbw	80.00 pbw	--	--
U-alkyd 20621 (60%) (Local)	--	--	80.00 pbw	80.00 pbw
White Spirit	18.96 pbw	18.96 pbw	18.46 pbw	18.46 pbw
<b>MORDRY® 410</b>	0.24 pbw	--	0.30 pbw	--
<b>MORDRY® Cobalt 10%</b>	--	0.24 pbw	--	0.30 pbw
<b>MORDRY® Calcium 10%</b>	0.48 pbw	0.48 pbw	0.48 pbw	0.48 pbw
<b>MORDRY® Zirconium 18%</b>	0.80 pbw	0.80 pbw	0.80 pbw	0.80 pbw
Color/Gardner	4 - 5	13 - 14	4 - 5	14
Drying time @25 C (min)	140 min	130 min	150 min	145 min





# 05

## Driers & Catalysts

The chemical hardening of unsaturated liquid binders by means of the reaction with atmospheric oxygen is described as “drying”.

Metal-organic compounds (metal soaps or complex) are used in relatively small concentrations to control drying processes. Such additives are described as driers .

From the chemical standpoint, driers are molecular (homophase) catalysts for free radical oxidative polymerisation, which is a chain process developing in the presence of the atmosphere oxygen.



# Product List

Delta Specialties can offer a broad range of driers to help you control the drying time of your coating films.

## For solvent-based systems, Single Metal Driers

MORDRY® Barium 12.5  
MORDRY® Calcium 4  
MORDRY® Calcium 5  
MORDRY® Calcium 10  
MORDRY® Cerium 10  
MORDRY® Cobalt 6  
MORDRY® Cobalt 10  
MORDRY® Cobalt 12  
MORDRY® Copper 8  
MORDRY® Lead 24  
MORDRY® Lead 32  
MORDRY® Lead 36  
MORDRY® Lithium 2  
MORDRY® Manganese 10  
MORDRY® Potassium 10  
MORDRY® Strontium 10  
MORDRY® Zinc 12  
MORDRY® Zinc 18  
MORDRY® Zirconium 12  
MORDRY® Zirconium 18  
MORDRY® Zirconium 24

## Mixed Driers

MORDRY® 210  
MORDRY® 320  
MORDRY® 390

## For water-reducible systems,

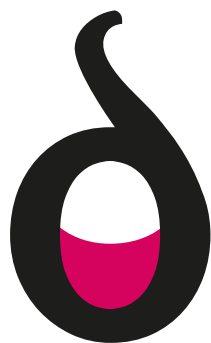
MORDRY® Barium 10 WD  
MORDRY® Calcium 4 WD  
MORDRY® Cobalt 6 WD  
MORDRY® Manganese 6 WD  
MORDRY® Zirconium 12 WD

## Catalysts

MORCURE® 6P  
MORCURE® 8P  
MORCURE® 6P HV  
MORCURE 730  
MORCURE 140  
MORCURE 145







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