MÜNZING
CREATING ADDITIVE VALUE

Technical News
No. 05

EDAPLAN®
490 SERIES

Polymeric Dispersants for Waterbased Applications

Pigment grinding is by far the most costly and time consuming process when manufacturing paints and coatings. To minimize efforts while preparing a fine and consistent pigment particle distribution, the choice of an effective dispersant is very important.
Amongst others a powerful dispersant is characterized by its ability to wet the pigment surface quickly and to adsorb on it permanently.
Therefore the additive creates a kind of protective cover around the particles and prevents them from flocculation. Consequently a perfect stabilization of the dispersed pigments is obtained.

At worst insufficient stabilization may lead to flocculation or shock effects, which result in low color strength or strong rub-out effects in tinted emulsion paints. In full tone applications or in printing inks gloss and transparency might be reduced or visible pigment specks can be caused (Figure 1 and 2).
To obtain a most economically and cost-effective grinding process, the pigment content in the grind should be maximized. Here again the right choice of a dispersant has a strong influence.

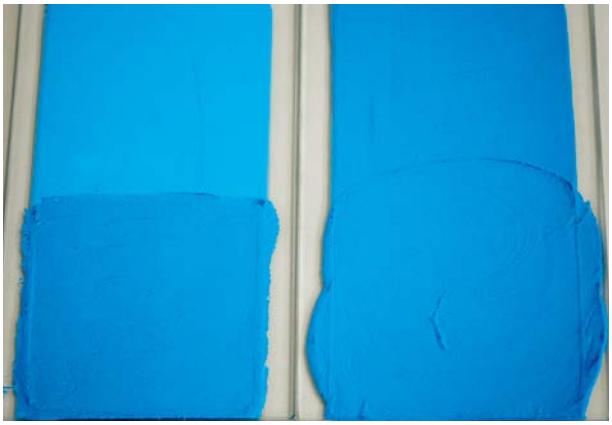

Figure 1 | Strong rub-out of PB15:3 in an emulsion paint — No rub-out

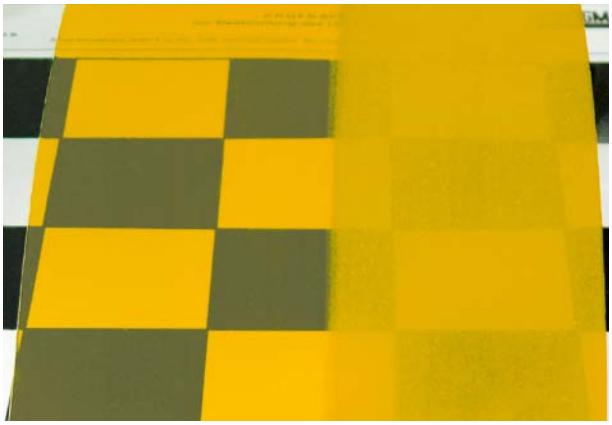

Figure 2 | Excellent transparency of PY 83 in a printing ink — Bad transparency and formation of specks

Product composition

	EDAPLAN® 490	EDAPLAN® 492	EDAPLAN® 494
Polymeric structure	nonionic, high molecular, branched copolymer		anionic, high molecular, branched copolymer
Appearance	brownish-yellowish, clear	amber, clear	brownish-yellowish, clear
Active content	40% solved in water	35% solved in water	50% solved in water
pH	7.5	8.5	8.5
Viscosity	medium viscous		
Suitable for	organic pigments, carbon black, inorganic pigments, Titanium dioxide	carbon black, organic pigments, titanium dioxide, silica/ matting agents	inorganic pigments, titanium dioxide, organic pigments, transparent/nanoscale pigments, carbon black, alternative to dispersing resins in printing inks

Table 1 | Characteristics of EDAPLAN® 490 series

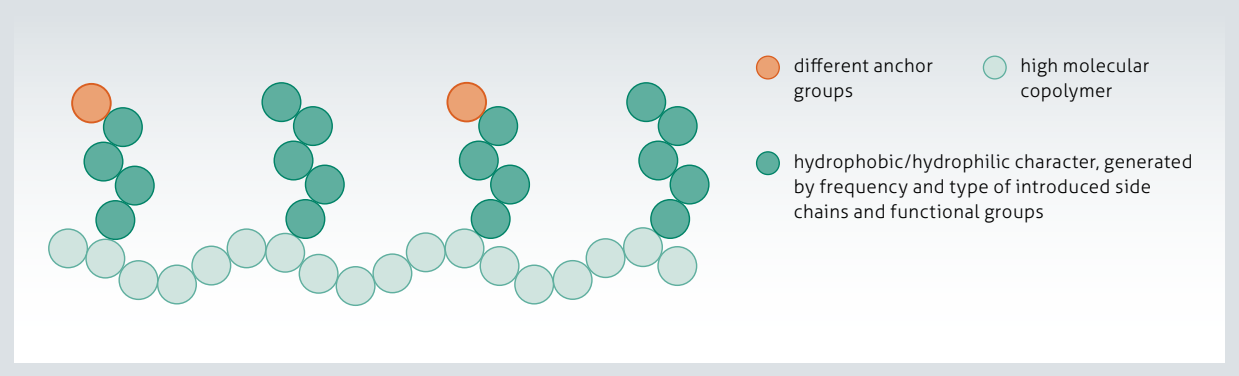

Figure 3 | Chemical structure

Mechanism of Action

During the dispersing process pigment agglomerates are broken and distributed homogenously in the system by applying mechanical shear forces. To avoid re-agglomeration after taking away the shear energy, the dispersant forms a kind of protective cover around each single dispersed pigment particle. Thereby one can differentiate between electrostatic repulsion and steric hindrance. The mechanism of action of the EDAPLAN® 490er series is a combination of both.

For a steric stabilization the polymer needs to contain one or more pigment affine groups, which can durably accumulate on the surface of the dispersed particle and will not be removed by other ingredients of the paint and coating formulation. Also components like binders, wetting agents or solvents have a certain pigment affinity and might compete with the dispersant covering the pigment surface. Another characteristic feature are high molecular structures which are particularly compatible with binders and solvents.

After adsorption on the pigment surface the molecular chains widely extend into the surrounding media and need a certain space in order to be able to move freely. During the approach of pigment particles, the mobility of the polymer chains is reduced which leads to a loss of entropy.

This leads to a repulsion force. Hence steric stabilization is also called entropic repulsion. The hydrophobic parts of the polymer show an extremely strong and lasting interaction with surfaces of organic pigments and carbon blacks.

The mechanism of electrostatic stabilization is characterized by covering the pigment surface with ionically charged additives and building an electric double layer. Due to the charges the mutual repulsion is bigger than the forces of attraction between the pigments.

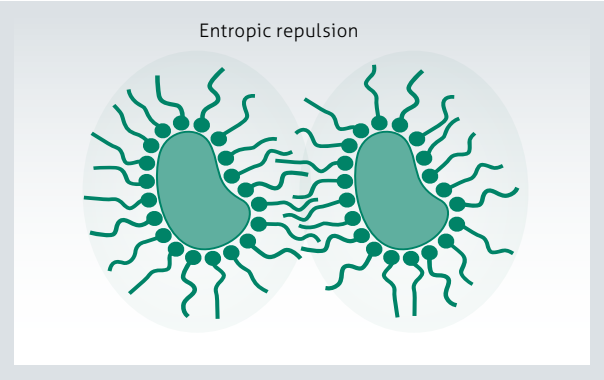

Figure 4 | Steric stabilization

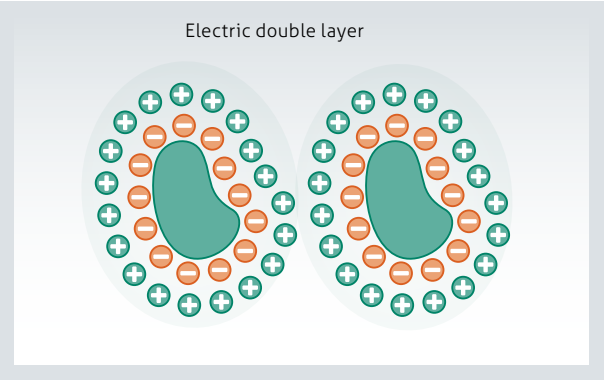

Figure 5 | Electrostatic stabilization

Test Results / Guide Formulations

Efficient stabilization depends on the occupancy rate of the pigment surface with the dispersant. However depending on the producer, pigments vary according to different surface treatments as well as sizes and forms of particles. Consequently the amount of dispersant needs to be determined individually for each pigment.

EDAPLAN® 494 has an outstanding versatility. You could stabilize transparent iron oxides, carbon blacks, different organic pigments as well as opaque iron oxides. (Table 2).

EDAPLAN® 492 is an excellent choice for formulating pigment pastes based on carbon blacks. For some common types the ideal dispersant demand has already been determined (Table 3).

	PR 101 trans.	PY 42 trans.	PBK 7	PB 15:3	PO 36	PR 254	PY 13	PW 6	PR 101	PY 42
Water	36.30	39.55	61.90	38.90	50.50	35.85	43.30	15.30	14.90	18.65
AGITAN 731	0.50	0.50	0.50	1.00	0.50	1.00	0.50	0.50	0.50	0.50
Biocide	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
EDAPLAN® 494	**28.00**	**19.80**	**22.50**	**20.00**	**8.80**	**18.00**	**14.50**	**14.00**	**19.50**	**15.60**
NH_3 (25%)	0.10	0.05	0.00	0.00	0.10	0.08	0.10	0.10	0.00	0.15
Pigment	**35.00**	**30.00**	**15.00**	**40.00**	**40.00**	**45.00**	**41.50**	**70.00**	**65.00**	**65.00**
% active content related to pigment	40%	33%	75%	25%	11%	20%	17.5%	10%	15%	12%

Table 2

	Gasruß XPB 171	Spezial-schwarz 4	Emperor 2000	Farbruß FW 285	Monarch 1400	Printex U	Black Pearls 430
Water	46.00	44.25	69.40	64.95	53.55	50.10	36.60
AGITAN 731	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Biocide	0.10	0.10	0.10	0.10	0.10	0.10	0.10
EDAPLAN® 492	**36.40**	**24.00**	**15.00**	**19.30**	**27.20**	**16.70**	**22.80**
NH_3 (25%)	0.00	1.15	0.00	0.15	0.65	0.10	0.00
Pigment	**17.00**	**30.00**	**15.00**	**15.00**	**18.00**	**32.50**	**40.00**
% active content related to pigment	75%	28%	35%	45%	52%	18%	20%

Table 3

EDAPLAN® 490 and EDAPLAN® 492 show no negative effect on water resistance and adhesion on CED coated sheet by formulating an acrylic clear coat. Film hardness is even improved with addition of EDAPLAN® 492 (Table 4).

	Without dispersant	EDAPLAN® 490	Anionic dispersant	EDAPLAN® 492	Competitor
Binder (44% solid)	100	100	100	100	100
% dispersant solid on binder	0%	5%	5%	5%	5%
Transparency	good	good	good	good	good
Water resistance	**slightly milky**	**slightly milky**	**milky**	**slightly milky**	**milky**
Cross-cut test	Gt 0	Gt 0	Gt 5	Gt 0	Gt 0
König hardness (sec.)	56.7	49	42	64.4	40.6

Table 4

Water resistance

Figure 6 | Milky

Figure 7 | Slightly milky

Summary

Advantages EDAPLAN® 490 Series polymeric dispersants

- Universal use for organic and inorganic pigments
- High color strength development
- Good pigment stabilization -> no rub-out problems
- No foam formation
- Reduction of grind viscosity
- No influence on coating properties like water resistance, film hardness, scrub resistance
- High pigment concentration with low dosage levels
- Broad compatibility with various binders

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