Scientific article
UDC 667.621.264
DOI: 10.52957/27821900_2022_04_68

IMPROVING THE DISPERSIBILITY OF WATER-DISPERSION PRIMERS

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Keywords:
dispersants, water-dispersion primer, conditional viscosity, degree of grinding of the primer

Abstract. *The paper considers the effect of different dispersants on the dispersion time of pigments and fillers in water-dispersion primers. The study shows that a non-ionic dispersant, which is a polymer with pigment-affinity groups, makes it possible to disperse pigments and fillers in aqueous medium to the required particle size of ~30 μm (wedge) in minimum time.*

For citation:
Vasyalina, A.A., Ozhiganov, V.V., Bakunin, D.O. & Ilyin, A.A. (2022) Improving the dispersibility of water-dispersion primers, *From Chemistry Towards Technology Step-By-Step,* 3(4), pp. 68-70 [online]. Available at: http://chemintech.ru/index.php/tor/2022-3-4

Nowadays, environmental requirements concerning the production and use of coatings and paints (paints and varnishes) have increased in all industrialised countries [1, 2]. A special part among environmentally friendly coatings are water-dispersion enamels and primers intended for coating metal surfaces [3, 4].

When developing new anti-corrosive water-dispersion coatings special attention should be paid to the correct selection of functional additives - dispersants, pigments, and fillers. Dispersants can influence not only the dispersion time of pigments and fillers under a binder medium to a certain particle size, but also the properties of the formed coatings, including corrosion protection properties.

Nowadays the Disperbyk 190 (BYK, Germany) is used for dispersing pigments and fillers for water-dispersion primers.

However, we should note, that the company BYK has not supplied a single kilogram of its products to Russia since the 31 March 2022 [5].

The search for new functional additives available on the market to reduce the time of the energy-intensive dispersion stage of water-dispersion primers is an urgent task.

The purpose of this study is to investigate the effect of different dispersants used in the production of aqueous dispersion primers on the dispersion time of pigments and fillers to the desired particle size.

The base of the developed corrosion protection primer was an aqueous acrylic-styrene dispersion filled with yellow iron oxide pigment, talcum and zinc phosphate in a ratio of 1.0:0.65:0.9, respectively. The fill level was 13–15 % vol.

We performed the predispersion of the pigment paste mentioned above in an aqueous medium on a Dispermat LC-110 Disolver (VMA-Getzmann) under the milling machine at a circular speed of ~3 m/s for 10 min.

We conduct the dispersion of pigments by Dispermat LC-110 immersion bead mill at a rotor speed of 2000 rpm to the required degree of grinding ~30 μm (by wedge) [6].

Also we determined the apparent viscosity of mixtures of pigment pastes with various dispersants at a temperature of (23.0±0.2) °C by Bruckfield viscometer (type A, spindle - disk No. 3) at 20 rpm according to GOST 25271-93.

At the stage of pigments and fillers dispersion we used the following dispersants in aqueous medium:

- dispersant No. 1, Disperbyk 190, which is a solution of a high molecular weight block copolymer with pigment-affinity groups. This dispersant provides deflocculation of the pigments through steric stabilisation;
- dispersant No. 2, which is an ammonium salt of polycarboxylic acid, provides deflocculation of pigments by stabilisation through electrostatic repulsion;
- dispersant No. 3, which is a modified acrylic copolymer in aqueous solution, provides deflocculation of pigments by stabilisation through electrostatic repulsion and steric factors;
- dispersant No. 4, which is a synthetic non-ionic polymer with pigment-affinity groups, recommended for stabilisation of fillers, organic, inorganic pigments and carbon black in aqueous systems, provides deflocculation of pigments through steric stabilisation.

In order to determine the optimum quantity of introduced functional additives in the mixing of pigment paste (suspension of pigments and fillers in water) we study the effect of the apparent viscosity of the dispersant content (Fig. 1).

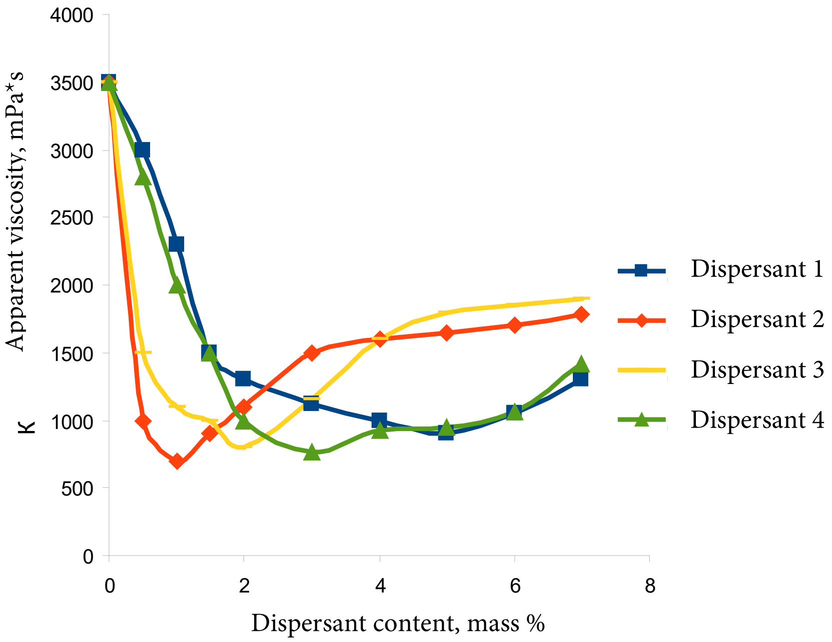

Fig. 1. Dependence of apparent viscosity of pigment paste batch on dispersant content

The minimum achievable apparent viscosity of the compositions corresponded to the amount of additives was added. The ratios were: for dispersant No. 1: 5.0 mass %; for dispersant No. 2: 1.0 mass %; for dispersant No. 3:2.0 mass %; for dispersant No. 4:3.0 mass %.

Fig. 2 shows the dependencies of the degree of grinding of the composition pigment pastes dispersed on the immersion bead mill with different dispersants on the dispersion time. The required 30 μm grinding degree of water-dispersion primer is achieving with different functional additives at different times (Table 1).

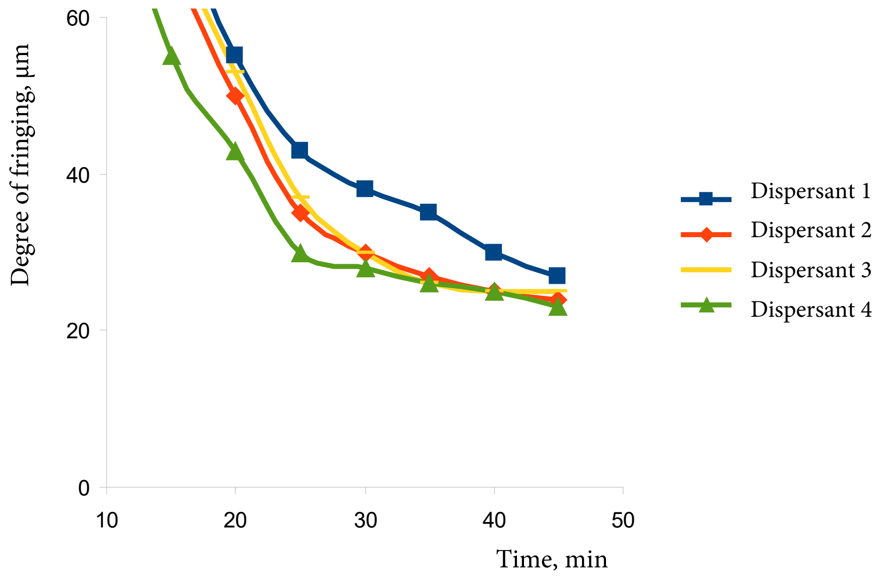

Fig. 2. Dependence of the degree of grinding of pigment pastes with various dispersants on the dispersion time

Table 1. Time to reach a grinding degree of 30 μm when dispersing pigment pastes with different dispersants

	Dispersant No. 1	Dispersant No. 2	Dispersant No. 3	Dispersant No. 4
Time, min.	40	30	30	24

Therefore, dispersant No. 4, which is a synthetic polymer with pigment-affinity groups, can significantly reduce time-consuming dispersion of pigment and filler suspension in aqueous medium compared to dispersant No. 1 (Disperbyk 190).

Thus, to obtain a water-dispersion acrylic styrene primer it is necessary to use dispersant No. 4, which is a synthetic polymer with pigment-affinity groups.

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Received 09.10.2022
Approved 26.10.2022
Accepted 09.12.2022