



Dispersion of Ultramarine Pigments

Why Disperse?

It is often assumed by new end users that Ultramarine can gently be stirred into a resin to impart a uniform colour.

More experienced users will know that this is not the case. While dyes dissolve in compatible systems, pigments exist as particles suspended within a resin. Optimum colour is obtained from a system in which the pigment is present as primary particles rather than larger agglomerates. Ultramarine pigments range in primary particle size from 1 to 5 microns.

It would be exceedingly difficult to handle a dry powder comprising of such fine particles but as supplied the pigment is in the form of larger soft agglomerates. These agglomerates must be broken down into the resin in a process called dispersion.

The colouristic properties of a particular Ultramarine grade are dependent on its primary particle size. Care should be taken to avoid changing the primary particle size during the dispersion process. Fortunately Ultramarine pigments disperse very easily and relatively low shear forces are all that is required.

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Principles of Dispersion

Dispersion of pigments involves the application of shear forces to the agglomerates so that they break down into primary particles. If a small amount of Ultramarine, say 10%, is added to water and stirred briskly, the agglomerates will simply be carried within the flow and hardly change their nature.

But increase the pigment content to 50% and the system changes. Because of the increased viscosity, the layers of liquid closer to the edge of the container experience drag which slows their movement compared to layers closer to the centre. The layers move at different speeds relative to each other introducing shear forces which act on the pigment agglomerates, dividing them into primary particles. Clearly the viscosity of the system is a very important factor in the process, too little viscosity gives no shear while too much results in insufficient flow (see figure 1). Because dispersion depends so heavily on viscosity it is common for pigments to be pre-dispersed in special formulations under optimum conditions. The pre-dispersed pigments are then used to prepare finished products.

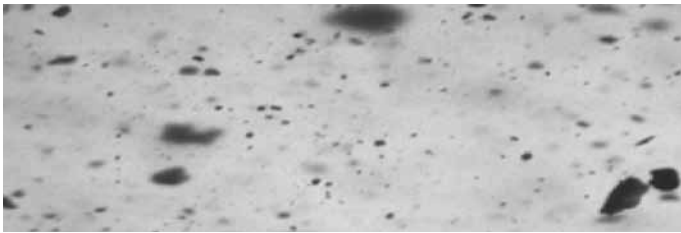


Figure 1:- Photomicrographs of Ultramarine pigment at 1% addition to polypropylene.

Applying inadequate shear force to break down agglomerates gives unacceptable dispersion (above). Increasing the shear force results in acceptable dispersion of the same pigment (below).



As supplied, an Ultramarine pigment particle is surrounded by air. In order to disperse the pigment this air must be replaced by the medium required, whether it be molten plastic, water or resin. This process is generally called "wetting" and various additives (dispersants) are available to improve the compatibility of the Ultramarine with the medium into which it is being dispersed. Selection of the correct additive can greatly improve the ease of dispersion but depends on the particular pigment / medium combination. Recommendations can be obtained from Holliday Pigments or additive suppliers. Ultramarine pigments are hydrophilic, i.e. most compatible with aqueous systems. Ultramarines also disperse quite easily in the majority of oleophilic resins, however Holliday Pigments SA produces a range of Ultramarines with an oleophilic surface coating if required.

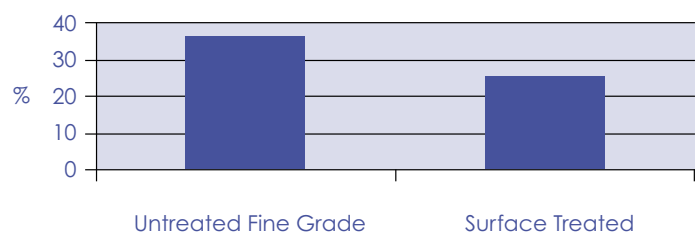


Figure 2:- Oil absorption %.

Stability

Once dispersed, in liquid systems it may be necessary to stabilise the primary particles. After the process of dispersion, the particles tend to be energised and may well be attracted to one another in liquid systems, a process called "flocculation".

This reverses the act of dispersion as the primary particles form into large flocculates. Correct selection of dispersant will avoid this problem. If long term shelf life is required then it is important to consider settlement. Once again correct dispersant selection helps, but it may be necessary to introduce an additive which increases viscosity or creates a gel structure, in which the system is not mobile at rest but breaks down to a pourable liquid on shaking. Any aqueous system containing Ultramarine will require a suitable biological preservative.



Dry Systems

The comments so far relate mainly to the dispersion of Ultramarine pigments into liquids. However there are a number of occasions when it is necessary to combine Ultramarine with other powders. This is normally easy to achieve using the simplest of mixers.

If the Ultramarine is being combined with a powder of low density, it is possible that the pigment agglomerates will not be broken down and specks of undispersed Ultramarine will remain. In this case a powder blender with more shear is necessary. It is often more efficient to make up a concentrate of Ultramarine with the diluent powder in a high shear mixer, before returning it to a simpler mixer for final dilution.

Ultramarine Grades

Ultramarine is one of the most easily dispersed pigments and in most applications, standard grades are perfectly satisfactory. However Holliday Pigments offers a number of special grades designed to help in specific applications.

- **Prestige – Easy dispersing pigments for plastics**
Holliday Pigments' Prestige grades are pre-wetted with a low melt temperature resin, which also eliminates dust. By removing the need to first wet the pigment before dispersion can begin, Prestige grades make the process much quicker and easier.
- **Premier FRX – Extra fine particle size**
Standard Ultramarine grades disperse well enough for most applications. However some applications, such as fibres, are particularly sensitive to even the smallest number of oversized particles. For these applications Holliday Pigments manufactures Premier FRX, which is specially processed to remove any such oversized particles
- **Oleophilic Grades – Increased compatibility**
For increased compatibility with oleophilic resins Holliday Pigments offers a range of Ultramarines with an oleophilic surface coating. The coating also provides a lubricating effect during dry blending.



About Holliday Pigments

Holliday Pigments is a world leading supplier of Ultramarine pigments, which are used in a variety of applications including plastics, coatings, cosmetics, artists' colours and printing inks. Exporting to over 80 countries, Holliday Pigments has dedicated customer and technical service teams at its factory in France and its commercial office in Singapore.

Holliday Pigments has a proud 125-year history in the manufacture of technical quality Ultramarine and is the only Ultramarine manufacturer in the world to have invested in Flue Gas Desulphurisation technology, reducing sulphur dioxide emissions inherent in the manufacturing process by more than 99.5%.

In August 2008, Holliday Pigments joined Rockwood Holdings Inc., becoming an important addition to the Color Pigments and Services Division.

Rockwood's Color Pigments & Services Division is one of the largest worldwide suppliers of colored pigments for construction, coatings, plastics and specialty applications. The Division's manufacturing sites and customer service centers are located in the United States, United Kingdom, France, Italy, Germany, Australia and China with additional sales offices located in Singapore and Hong Kong. For more information on Rockwood, please visit www.rockwoodpigments.com.

The Rockwood Color Pigments & Services Division is a business unit of Rockwood Holdings Inc., Princeton, N.J., U.S.A. Rockwood Holdings, Inc. is a leading global specialty chemicals and advanced materials company. Rockwood has a worldwide employee base of more than 9,500 people and annual net sales of approximately \$3 billion. The company focuses on global niche segments of the specialty chemicals, pigments and additives and advanced materials markets. For more information on Rockwood, please visit www.rockwood.com.

Further information on all Holliday Pigments' products is available from:

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