The Design Of Safer Chemicals

Engelhard Rightfit^{TM} Organic Pigments: Environmental Impact, Performance, and Value

Introduction

Pigment are the group of compounds that are intensely coloured and are used to colour other materials. There are a large number of colour pigments, both organic and inorganic, that allow paint users to create films of almost all the colours in the visible spectrum. Colour pigments act by absorbing certain wavelengths of visible light and transmitting or scattering the other wavelengths.

Classification of pigments

Based upon their composition they can be broadly classified as:

a) Inorganic pigments
b) Organic pigments

Inorganic pigments:

Compounds obtained from inorganic metallic compounds and salts such as chromates, metallic oxides, sulphates etc. are used in inorganic pigments. Naturally occurring inorganic colored pigments, prepared from minerals or their combustion products, have been used since prehistoric times. Minerals and rocks containing iron oxides provide yellow, orange, red, brown, and black pigments. Lead, mercury, arsenic, and copper oxides, sulfides, and carbonates produce red, blue, and green colors; examples include cinnabar (HgS), malachite ($2\ CuCO3 \bullet Cu(OH)2$) , lapis lazuli (natural ultramarine), and carbon black. Inorganic pigments often contain one or more of the transition metals, which usually contain partially filled d orbitals, can exist in different oxidation states, and are incorporated in sites with different geometrical arrangements of anions or ligands; in some cases the spectral absorptions are adequately explained by crystal field d-d transitions Compared to organic pigments, inorganic pigments are easier to disperse and therefore used for various applications. These pigment are stable to heat and light.

Organic pigments

Organic pigments are generally derived from plants. Organic pigments are usually brighter, stronger, and more transparent than inorganic pigments but are not as light resistant. They may be partially soluble in many thermoplastics, with a much greater tendency to migrate. the colour is due to light energy absorbed by the delocalised electrons of s conjugated system in the

molecule. Furthermore, the presence of chromophore enhnces the colour of the molecule. Organic pigments outclass inorganic pigments in regard to toxicity as the majority of organic pigments have either no or very low toxicity. The major classes of organic pigments which are in use in automotive coatings include perylene, benzimidazolone, isoindoline, isoindolinone, quinacridone, diketopyrrolopyrrole, dioxazine and phthalocyanine pigments.

Need for the development of non-toxic pigments

Most of the pigments are used for industrial applications such as coloring paint, ink, plastic, fabric, cosmetics, food, and other materials. Traditionally heavy metal based pigments have been used for coloration in various industrial applications. Red, orange, and yellow color is basically obtained from pigments based on heavy metals such as lead, chromium(VI), cadmium. Heavy metals, are the hazardous pollutants which are deleterious to human health and environment. These contaminants can bioaccumulate into food chains thereby, causing several potential ill effects on humans and animals. Therefore there is an urgent need of some alternatives of these toxic and harmful pollutants which can be used as pigments.

Recently, the heavy metals have been replaced by the use of rganic pigments . however, these organic pigments also suffers from various disadvantages like.

a) Generally, synthesis of organic pigments involves high costs.
b) Use of large amount of organic solvents
c) Synthesis involves the use of large concentration of polyphosphoric acid which lead to the elimination of phosphates as harmful by- products.
d) Many of the pigment are based on toxic polychlorinated organic compounds such as dichlorobenzidine, polychlorinated phenyls etc.

Rightfit Pigment

Engelhard has developed a wide range of environmentally friendly Rightfit^{TM} azo pigments contain calcium, strontium, or barium; as compared to the conventional heavy-metal-based pigments which contain lead, hexavalent chromium, or cadmium. These pigments eliminate the risk to human health and the environment from exposure to heavy metals. They are expected to have very low potential toxicity they have been approved both by the U.S. Food and Drug Administration (FDA) and the Canadian Health Protection Branch (HPB) for indirect food contact applications. They also possess good dispersibility, improved dimensional stability, improved heat stability, and improved color strength. Their higher color strength achieves the

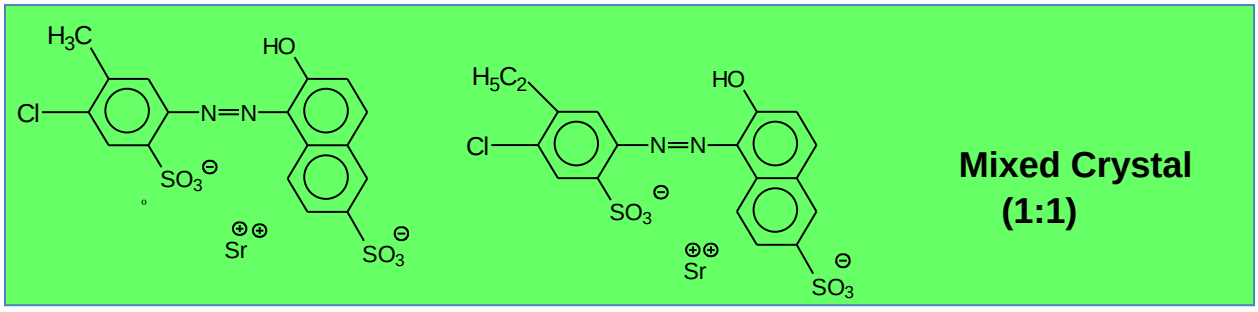
same color values using less pigment. Rightfit^{TM} pigments also cover a wide color range from purple to green-shade yellow color. Being closely related chemically, these pigments are mutually compatible, so two or more can combine to achieve any desired intermediate color shade.

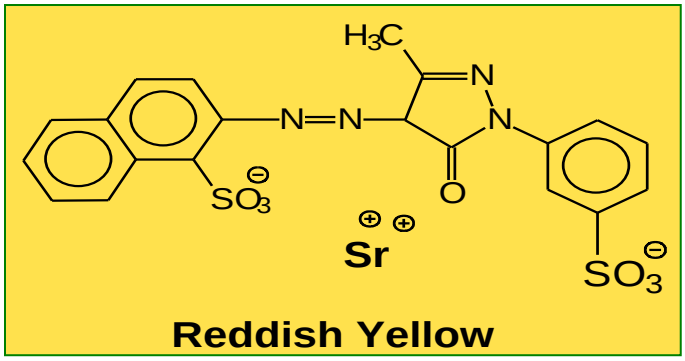
Synthesis of Rightfit pigment:

Theses pigments can be manufactured in a one pot reaction under aqueous medium which eliminates the exposure to the polychlorinated intermediates and organic solvents associated with the manufacture of traditional high-performance pigments. The reagents are added sequentialy without the need of isolation of intermediates.

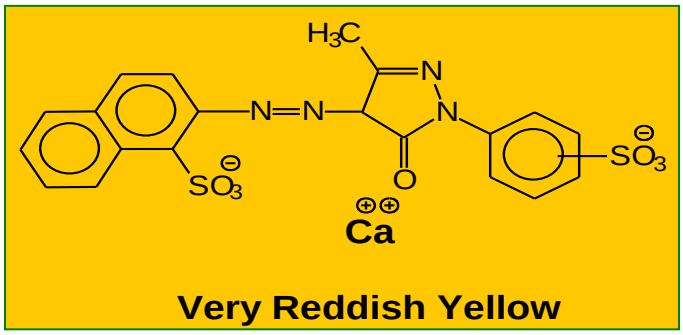
Advantages of Rightfit pigment:

Rightfit^{TM} pigments are ecofriendly, high stability with improved colour, good performance characteristics, low potential toxicity and very low migration, value-added color to packaging used in the food, beverage, petroleum product, detergent, and other household durable goods markets, cost effective.

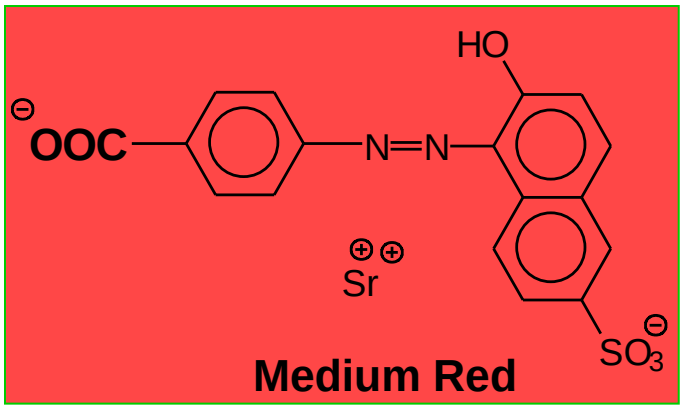




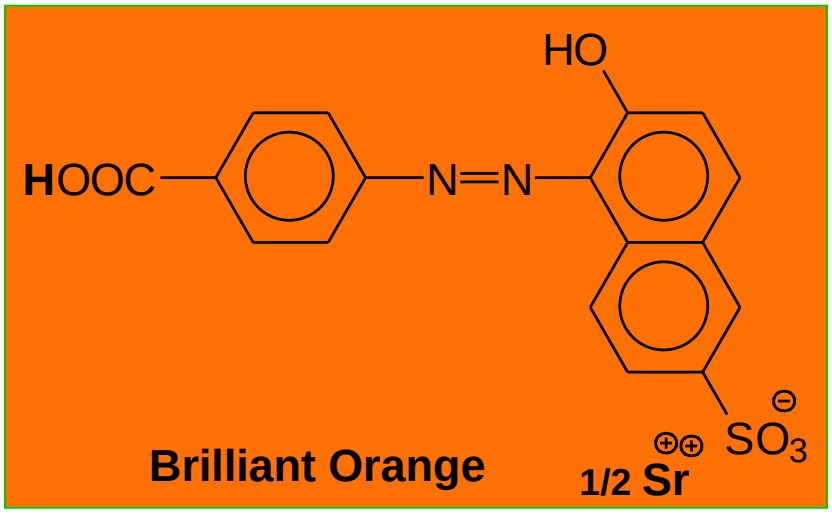
Reddish Yellow



Very Reddish Yellow



Medium Red



Brilliant Orange