

Acrylic Paints Formulation

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Abstract

Paints are used to protect and prolong the life of natural and synthetic materials as it acts as a barrier against environmental conditions. Paints contain extenders, solvents, pigments, binders, and some additives. The objective is to improve some physical properties of the current matt paint formulation. The contents of acrylic white matt emulsion paint are known to be 25% Pigments, 12% Extender pigments, 5% Additives, 44% Solvents, and 14% Binders. [2].

Binders are matrices and are used to hold the pigment in place. Extenders have larger pigment particles to improve adhesion and to strengthen the film and save the binder. Pigments are used to give color and opacity to the paint. Solvent can be either organic solvent or water and is used a thinner and to dissolve paint components and make it uniform. Additives are commonly used to improve properties of the paint.

Keywords: formulation; paints; matt; gloss

Introduction

The company is looking to improve the properties of the current acrylic matt paint formulation as the current formulation shows a low scrub resistance test compared to the reference. The current paint scrub-resistance test shows the paint operates 60% effectiveness compared to the reference.

The current formulation consisted of 47% Vinyl acetate, 0.1258% Potassium Persulfate, 0.0234% Tertiary butyl hydrogen peroxide, 0.06% Hydrogen peroxide, 0.05% Sodium formaldehyde sulfoxylate, 1.0% Di butyl phthalate, 0.1% Formaline, 0.05% biocide, 0.1% Silquest A-171 and 0.06% defoamer , 0.4% Natrosol 250- HHBR, 44.39% water, 0.14% Sodium Bicarbonate, 2.0% Polyoxyethylene 25 octyl phenol, 2.0% Octyl

phenol polyglycol ether sulfate sodium salt, 0.5%, Provichem, and 2.0% Buyl acrylate, [1]. The objective is to find chemical compounds that would potentially lower the scrub resistance and find additives and chemical compounds that would potentially increase the quality and increase the scrub resistance test for the acrylic matt paint. Chemical names, molecular formulas and molecular weights of all chemical compounds used in making the current acrylic paint formulation are listed in table 1.[3]

An acrylic white matt emulsion paint is known to consist of 25% Pigments, 44% Solvents, 12% Extender pigments, 5% Additives, and 14% Binders, Figure 1 [2]

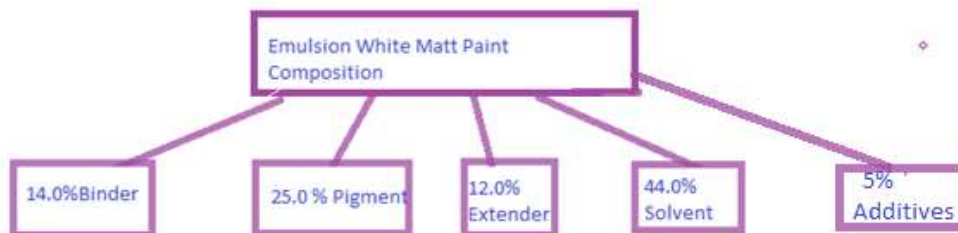


Figure 1: Chemical Composition for a matt white Paint

Overview

Table 1, lists the chemicals, amounts in percentage, and the role of chemical compounds used in the current acrylic paint formulation.

Chemical Name	Percent (%) used in the current formulation	Molecular Formula	Role of Each Chemical Compound in Current Formulation
Water	44.09	H ₂ O	Solvent
Natrosol 250- HHBR	0.4	C ₃₆ H ₇₀ O ₁₉	Nonionic water thickener
Sodium Bicarbonate	0.14	NaHCO ₃	Pigment
Polyoxyethylene (25) octyl phenyl ether	2.0	(C ₂ -H ₄ -O) mult-C ₁₄ H ₂₂ -O	Surfactant and buffer
Octyl phenol polyglycol ether sulfate sodium salt	2.0	Octyl phenol polyglycol ether sulfate sodium salt	Surfactant and buffer
Provichem (<i>Sodium vinylsulfonate</i>)	0.5	C ₂ H ₃ NaO ₃ S	Surfactant
Butyl acrylate	2.0	C ₇ H ₁₂ O ₂	Monomer in homo or copolymerization (Binder)
Vinyl acetate	47.0	C ₄ H ₆ O ₂	Monomer in homo or copolymerization (Binder)
Potassium Persulfate	0.1258		Initiator
Tertiary butyl hydrogen peroxide	0.0234	C ₄ H ₁₀ O ₂	Oxidizing catalyst
Hydrogen peroxide	0.06	H ₂ O ₂	Initiator
Sodium formaldehyde sulfoxylate	0.05	CH ₇ NaO ₅ S	Reducing agent.
Di butyl phthalate	1.0	C ₁₆ H ₂₂ O ₄	Secondary plasticizer
Formaline	0.1	CH ₂ O	Preservative
Biocide	0.05	Biocide	Biocide
Silquest A-171 (Vinyltrimethoxysilane)	0.1	C ₅ H ₁₂ O ₃ Si	Crosslinking polymer
Defoamer	0.06	Defoamer	Defoamer
Total Percentage	100	N/A	N/A

Table 1: Chemical name, molecular formula, chemical formula and the role of chemical compounds used in the current acrylic paint formulation.

Detailed Analysis

The current acrylic paint formulation consisted of mainly of 44.39% water as solvent, 49% pre-emulsion monomers (vinyl acetate and butyl acrylate) and 6.61% additives (Natrosol 250-HHBR, Sodium Bicarbonate, Polyoxyethylene 25 octyl phenol, Octyl phenol polyglycol ether sulfate sodium salt, Provichem, 2.0% Butyl acrylate, Potassium Persulfate, Tertiary butyl hydrogen peroxide, Hydrogen peroxide, Sodium formaldehyde sulfoxylate, Di butyl phthalate, Formaline, biocide, Silquest A-171 and defoamer).

Conclusion

The current formulation consists of pigments 0.14% in the form of Sodium Bicarbonate, compared to literature amount 25%, extender pigments weren't used in the current formulation compared to literature amount 12%, surfactants 4.5% compared to literature amount 0-1%, and binders 49% compared to literature amount 14%. The current paint scrub-resistance test shows the paint operates 60% effectiveness compared to reference due to missing 40% of main ingredients that makes a good acrylic paint. It has been found that main chemical compounds are missing from the current formulation: pigments, extenders, and another type of pre-emulsion monomer. It also has been found that copious amounts surfactants 4.5% (2.0% Octyl phenol polyglycol ether sulfate sodium salt, 2.0% Octyl phenol Polyglycol Ether Sulphate Sodium Salt, and 0.5% Provichem) have been causing a low scrub resistance test of

current formulation compared to reference. It's recommended to avoid using copious amounts of surfactants and it's also recommended to use pigments and extenders in order to form a firm protective layer and prevent the dissolution of paint film from the surface and to improve the scrub resistance test of the acrylic paint.

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