Dȳnol™ 604 Surfactant

General Description

Dȳnol 604 surfactant is a low-VOC*, low-foam, nonionic wetting agent ideal for high-performance waterborne applications. This wetting agent has the ability to reduce *both* equilibrium and dynamic surface tension to a degree not found with other surfactants. This excellent balance of properties, generally not possible with fluoro or silicone surfactants, makes it an excellent alternative for difficult-to-wet substrates requiring good flow and leveling under diverse application conditions. Also, compared to many fluoro and silicone surfactants, the use of the acetylenic glycol-based Dȳnol 604 surfactant should reduce/eliminate issues such as increased foaminess, water sensitivity or intercoat adhesion, often associated with nonacetylenic surfactants.

Performance Benefits

Dȳnol 604 surfactant promotes substrate wetting of waterborne systems such as coatings, inks and adhesives by effectively lowering both the equilibrium (static) and dynamic surface tension of aqueous systems. This is demonstrated by the very low surface tension values of a 0.1 wt % solution in water, provided in Table 1. These values represent greatly improved surface tension reducing capabilities compared to those available with traditional surfactants. In a formulated system, Dȳnol 604 surfactant will rapidly migrate to the interface, providing excellent coverage over low-energy or contaminated surfaces. In addition, since the Dȳnol 604 surfactant is based on acetylenic glycol chemistry, it will be low in foam, will have little or no impact on water sensitivity and is ideally suited for very low VOC applications. This combination of performance benefits makes Dȳnol 604 surfactant a suitable alternative where fluoro and silicone surfactants were previously required due to the limited equilibrium surface tension reduction capabilities of traditional organic surfactants. However, compared to fluoro or silicone surfactants, Dȳnol 604 surfactant will not impart excessive foaminess nor is it likely to interfere with recoatability/intercoat adhesion.

Table 1

Typical Physical Properties	
Appearance	Amber liquid
Specific Gravity @ 25 °C	0.974
Flash Point, °C	164
Equilibrium Surface Tension[1], dynes/cm	25.8
Dynamic Surface Tension[2], dynes/cm	28.4
VOC EPA Method 24, %	<1.5
Activity %	100

[1]1 bubble/sec. at 0.1 wt % Sensadyne® 5000 by Chemdyne
[2]6 bubbles/sec. at 0.1 wt % Sensadyne 5000 by Chemdyne

Typical Applications

Metal Coatings

Dȳnol 604 surfactant at 0.2 wt % to 1 wt % is an ideal choice for providing excellent wetting with good flow/leveling and low foam properties on poorly prepared metal surfaces. For example, Dȳnol 604 surfactant at 0.4 wt % provides complete coverage on spray application (e.g., where low dynamic surface tension is important) of a model waterborne urethane black enamel onto an oil-contaminated metal surface. The specified fluorosurfactant, evaluated at the recommended 0.1 wt % to as high as 0.4 wt %, still provides inferior coverage. This excellent combination of equilibrium and dynamic surface tension provides performance not available with the competitive technologies (illustrated in Table 2). This balance of additive properties provides the formulator of metal coatings the confidence that the coatings will perform well under a variety of application speed and surface preparation conditions.

*Volatile Organic Compounds

Wood Coatings

Dȳnol 604 surfactant can be used in waterborne wood coating applications to provide wetting and penetration of the wood substrate for complete coverage, provide flow and leveling and assist in the release of trapped air bubbles/microfoam. For example, the use of Dȳnol 604 surfactant at 0.5–1 wt % in a model waterborne acrylic wood, spray-applied topcoat provides superior flow and gloss compared to silicone and fluorosurfactants. In addition, using Dȳnol 604 surfactant in a model Do-It-Yourself waterborne acrylic wood sealer provides greatly improved water penetration/blush resistance compared to alternative, generally foamy silicone or fluorosurfactant additives. This illustrates the excellent water resistance properties of Dȳnol 604 surfactant.

Printing Inks

Dȳnol 604 surfactant can provide outstanding substrate wetting and flow and leveling in water-based inks for both flexographic and gravure applications on plastic film, cellulosic, foil and a variety of other surfaces. With improved substrate wetting, low water sensitivity, low foam and the low VOC provided by Dȳnol 604 surfactant, ink formulators should be able to further optimize water-based ink performance while minimizing/eliminating the need for solvent additions.

Other Applications

Dȳnol 604 surfactant provides wetting performance generally not possible with traditional surfactants. Also, with its balance of properties, Dȳnol 604 surfactant is suitable for applications such as concrete sealers, floor polishes, leather coatings, metal/plastic primer and topcoats, architectural paints, pressure-sensitive adhesives and other waterborne applications requiring low VOCs, outstanding surface wetting, low foam and low water sensitivity characteristics. It can also be utilized as a pigment grind aid in combination with suitable pigment dispersing agents.

Table 2

Performance of 0.1 wt % Surfactants in Water

	Dȳnol 604	Fluorocarbon	Silicone
Surface Tension, dynes/cm			
Equilibrium	**25.8**	21.2	20.5
Dynamic	**28.4**	72.4	63.6
Ross-Miles Foam			
Initial to final cm of foam	2.5 to 0	6 to 5	9 to 9
Time to break	30 sec	>5 min	>5 min
VOCs, %	<1.5	80[1]	50[1]

[1]As high as these percentages, depending on product

Formulating With Dȳnol 604 Surfactant

Dȳnol 604 surfactant, is a low water soluble, 100% active, liquid additive without a solvent carrier. Hence, it has very low VOCs. It has been found effective at 0.1 wt % in clear formulations, but may require as high as 1 wt % for highly resinated/pigmented systems. Dȳnol 604 surfactant should be added directly, with good mixing, after the polymer emulsion and pigment introduction. Allow 24 hours equilibration for optimum performance.

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