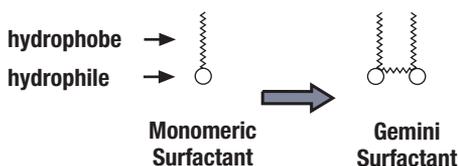


## **EnviroGem® AD01 Surfactant** **Defoaming Wetting Agent**

### **Description**

EnviroGem AD01 surfactant is a 100% active, liquid, defoaming wetting agent based on Gemini surfactant technology. Because they contain two hydrophiles and at least two hydrophobes within a single molecule, Gemini surfactants are more surface-active than their single hydrophile/single hydrophobe analogs, as shown by the diagram below.



### **Advantages**

- 100% active liquid
- No hazardous air pollutants (HAPs)<sup>1</sup>
- No alkylphenol ethoxylates (APE-free)
- Low VOCs
- Fast knock-down defoaming and outstanding foam control
- Excellent dynamic wetting
- Low-odor, nonionic surfactant
- Non-micellar, no cloud point
- Chemical stability from pH 3 to 13
- Wide compounding latitude

<sup>1</sup> Hazardous air pollutants are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. The 1990 Clean Air Act Amendments direct the US EPA to set standards for all major sources of air toxics.

### **Formulation Guidance**

Typical use levels of EnviroGem AD01 surfactant range from about 0.1 to 2 wt.% in many formulations. For specific use and formulation guidance, please contact us at one of the offices listed on the back of this brochure.

### **Applications**

EnviroGem AD01 surfactant is recommended for use in waterborne, radiation-cured (UV/EB), and other systems in which a solvent-free wetting agent and/or defoamer is desired.

- Coatings
  - Automotive OEM and refinish
  - OEM, DIY and UV wood
  - Industrial maintenance
  - Metal and paper
- Graphic arts
  - Printing inks
  - Overprint varnishes
  - Fountain solutions
- Adhesives
- Dye and pigment synthesis
- Pigment grinding
- Oil and gas processing
- Cleaning products
- Semiconductor cleaning and processing
- Metalworking fluids
- Cements, mortars and grouts
- Agricultural adjuvants



EnviroGem AD01 (left) is a clear, colorless liquid, while Surfynol® 104 surfactant is a white, waxy solid.

### Typical Chemical, Physical and Performance Properties<sup>2</sup>

Appearance	Clear Liquid
Color	Colorless to pale yellow
Odor	Slight to none
Viscosity <sup>3</sup> at 25 °C	2000 cP
Density at 20 °C	0.90 kg/L (7.5 lb/gal)
Boiling Point	260 °C (500 °F)
pH (1 wt.% aqueous solution)	7
HLB <sup>4</sup>	4
Vapor Pressure at 20 °C	0.0011 kPa (0.0080 torr)
VOCs <sup>5</sup>	6.2 wt. %
Solubility in Water	0.06 wt. %
Equilibrium Surface Tension <sup>6</sup> at 0.1 wt.%, 25 °C	35.2 mN/m
Dynamic Surface Tension <sup>7</sup> at 0.1 wt.%, 6 b/s, 25 °C	36.4 mN/m
Initial Ross-Miles Foam Height at 0.1 wt.%, 25 °C	0 mm
Draves Wetting Time <sup>8</sup> (sec)	44 sec at 0.10 wt. % 9 sec at 0.15 wt. %

<sup>2</sup> These are typical properties only and do not constitute product specifications.

<sup>3</sup> Brookfield HADVII+C/P cone/plate viscometer, HA#CP41 at 10 rpm.

<sup>4</sup> HLB determined using the Water-Solubility Method, "The HLB System," ICI Americas, Inc., 1992.

<sup>5</sup> Volatile organic compounds (VOCs) were determined using EPA Reference Method 24 and ASTM D 2369.

<sup>6</sup> Measured using the Wilhelmy plate method, mN/m = dyne/cm.

<sup>7</sup> Measured using the maximum bubble pressure method.

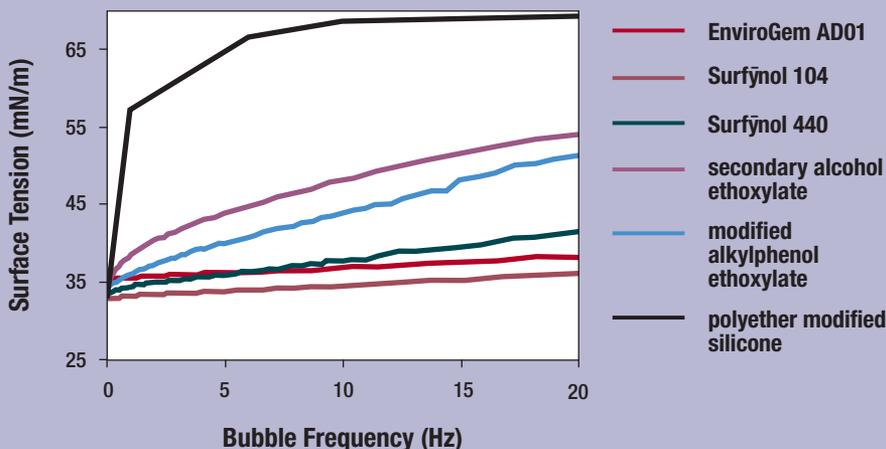
<sup>8</sup> ASTM D 2281, 25 °C, using a cotton skein.

### EnviroGem AD01 Surfactant Provides Excellent Wetting in High-Speed Applications

The ability of a surfactant to reduce the surface tension of water is important because it enables the wetting of low-surface-energy substrates. In many processes, interfaces are rapidly generated and surfactants must quickly migrate to those interfaces in order to prevent film retraction and other surface defects. EnviroGem AD01 surfactant lowers surface tension at high surface creation rates (represented by high bubble frequency using the maximum bubble pressure technique) and surpasses the performance of conventional surfactants under dynamic conditions.

Figure 1

Comparison of the Dynamic Surface Tension of Various Surfactants (at concentrations of 0.1 wt.% in water)

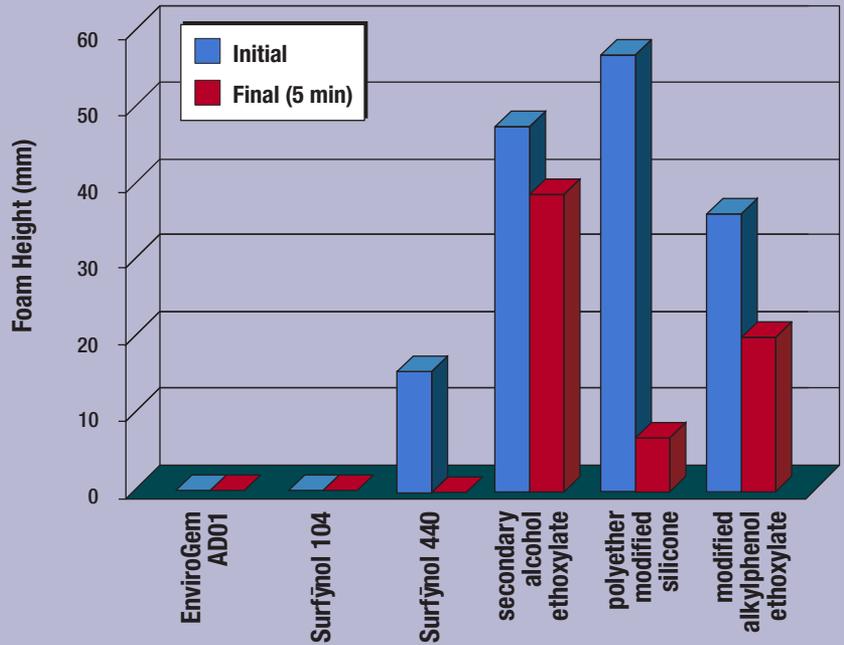


## Outstanding Foam Control in Aqueous Systems

Many commodity surfactants, such as sulfosuccinates, alkylphenol ethoxylates, alcohol ethoxylates, and certain silicone-based surfactants, promote and stabilize excessive foam. Air can also become entrained in a formulation because of applied shear. This entrained air (microfoam) can impede grinding efficiency and make packaging to net weight difficult. Additionally, entrained air often causes undesirable surface defects and adversely affects adhesion, water sensitivity and corrosion, thereby negatively impacting the aesthetics and/or performance of the finished product. EnviroGem AD01 surfactant demonstrates excellent knock-down foam control and antifoaming properties compared to most commodity surfactants. The unique defoaming capabilities of EnviroGem AD01 surfactant can significantly reduce or eliminate the need for additional defoamers in a formulation.

Figure 2

Comparison of Ross-Miles Foam Heights for Various Surfactants (ASTM D 1173, 25 °C, 0.1 wt.% aqueous solution)



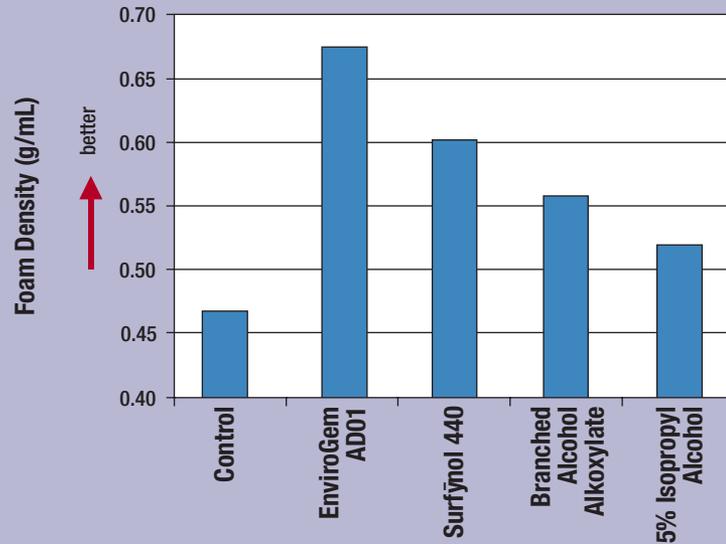
## Application Benefits

### Printing Inks

The multifunctional benefits of exceptional defoaming and wetting that EnviroGem AD01 surfactant provides in waterborne surface printing or laminating inks greatly improve printability and coverage on film substrates such as oriented polypropylene or high-slip polyethylene. EnviroGem AD01 surfactant controls foam in waterborne ink systems, eliminating or significantly reducing the need for defect-causing defoamers. It can be incorporated into the grind or letdown, depending on the surfactant function required.

**Figure 3**

**Comparison of Foam Density Data for Packaging Inks**  
(using surfactant concentrations of 1.0 wt.% in a Joncryl 624-based formulation<sup>9</sup>)



<sup>9</sup> Joncryl 624 is an acrylic emulsion available from Johnson Polymer, Inc.

**Figure 4**

**Wetting of Polyethylene Film With Packaging Inks**  
(using surfactant concentrations of 1.0 wt.% in a Joncryl 624-based formulation<sup>9</sup>)



<sup>9</sup> Joncryl 624 is an acrylic emulsion available from Johnson Polymer, Inc.

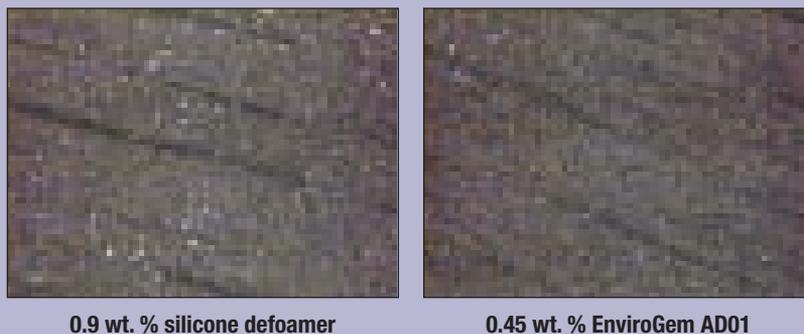
## OEM Wood Coatings

The use of EnviroGem AD01 surfactant in waterborne wood coatings gives formulators a solvent-free solution to typical problems encountered during spray, dip, roll or curtain coating processes. Foam creation or curtain break can cause defects in the coating, and residual oil and sap on the wood can lead to poor wetting of the substrate. In waterborne DIY (“Do-It-Yourself”) formulations, EnviroGem AD01 surfactant can provide benefits such as color uniformity, consistent wetting, and improved flow and leveling on various types of wood. EnviroGem AD01 can reduce or eliminate problems such as poor wetting and adhesion, microfoam, gloss loss, and flow and leveling issues.

As can be seen in Figure 5, using EnviroGem AD01 at just half of the use level of a commonly used silicone defoamer in a waterborne UV-curable wood lacquer results in a superior coating.

Figure 5

**Comparison of Waterborne UV-Curable Wood Lacquers Coated on White Oak Panels (EnviroGem AD01 used at 0.45 wt.% in a NeoRad R-440<sup>10</sup> polyurethane dispersion-based formulation; modified polydimethylsiloxane used at 0.90 wt.% in the same formulation)**



<sup>10</sup> NeoRad R-440 is a waterborne UV/EB curable aliphatic urethane dispersion available from NeoResins.

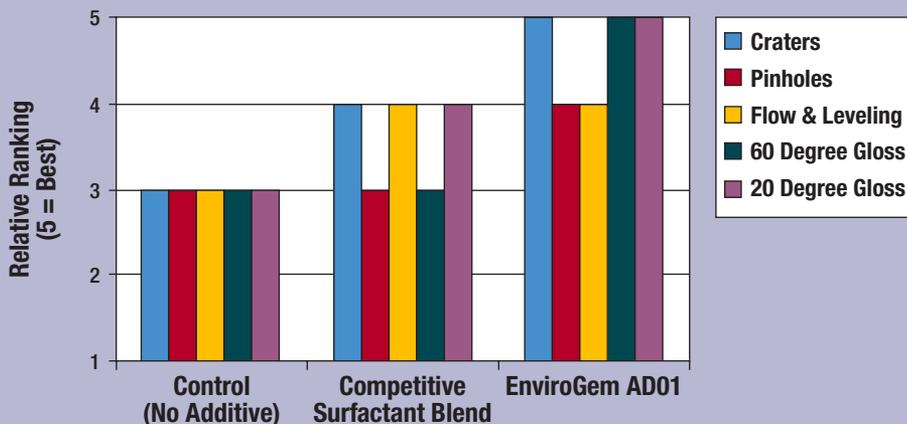
## Automotive OEM Coatings

EnviroGem AD01 surfactant allows the formulator to produce defect-free waterborne automotive coatings for an industry in which only a perfect coating will suffice. Not only does EnviroGem AD01 surfactant provide outstanding dynamic surface tension reduction and wetting, but it is also able to control the foam that leads to surface defects. Improved flake orientation, increased compatibility, higher gloss and impact resistance, better adhesion and water resistance, and elimination of solvent popping and pinholes are some of the many benefits that EnviroGem AD01 surfactant provides.

Figure 6 shows that the use of EnviroGem AD01 surfactant in a waterborne automotive primer results in a dried paint film that has fewer defects compared to primer that contains competitive surfactants.

Figure 6

**Comparison of Surface Defects and Appearance of Waterborne Automotive Primers (surfactant used at 0.5 wt.% in a Bayhydrol D 270 and Bayhydrol FT 145-based waterborne primer,<sup>11</sup> 1 = poor, 5 = outstanding)**



<sup>11</sup> Bayhydrol D 270 is a saturated polyester resin, and Bayhydrol FT 145 is a fatty acid-modified polyester polyurethane resin; both are available from Bayer.

## Industrial Maintenance Coatings

The incorporation of EnviroGem AD01 surfactant into the letdown or grind stage of spray-applied waterborne industrial maintenance coatings aids in the reduction of internal and external microfoam, resulting in improved gloss, enhanced flow and leveling, reduction in pinholes and craters, and excellent film durability.

### Comparison of Performance Data for Industrial Maintenance Paints

(surfactant used at 1.0 wt.% in a Maincote HG-54-based formulation<sup>12</sup>)

	Surface Tension of Dilute Emulsion-Surfactant Mixture @ 10 bubbles/sec (mN/m)	Foam Density of the Paint (g/mL) <sup>13</sup>	60° Gloss Value for Dried Paint <sup>13,14</sup>
Control (no surfactant)	54	0.83	47
<b>EnviroGem AD01</b>	<b>36</b>	<b>0.86</b>	<b>55</b>
Surfynol 104	35	0.92	51
Modified Alkylphenol Ethoxylate	44	0.75	48
Branched Alcohol Alkoxylate	38	0.80	50
Polyether Modified Silicone	53	0.84	53

<sup>12</sup> Maincote HG-54 is available from Rohm and Haas Co.

<sup>13</sup> Higher values represent better performance in these tests.

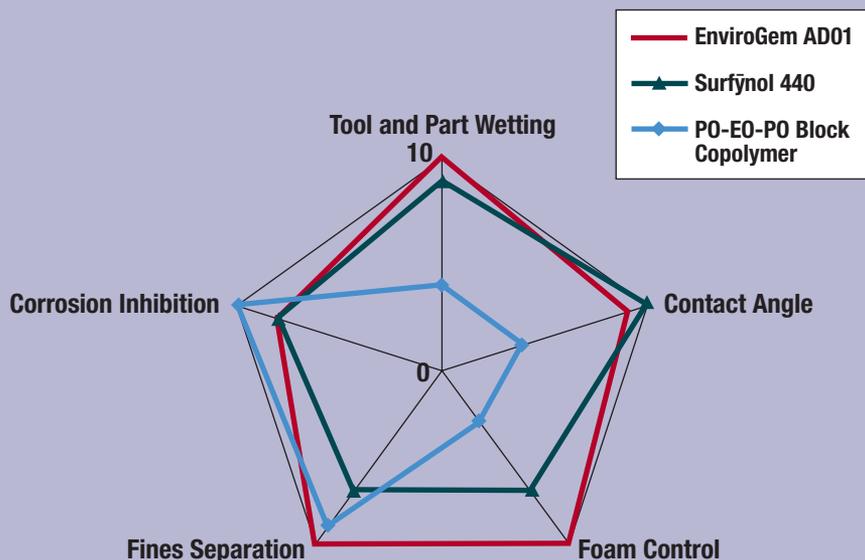
<sup>14</sup> Paint applied to oil-contaminated metal panels.

## Metalworking Fluids

EnviroGem AD01 surfactant provides a high degree of formulating latitude and significant performance benefits in water-based metalworking fluids. Advantages of good wetting, excellent foam control, improved heat transfer, enhanced fines removal, hard water stability, and corrosion inhibition can be realized when EnviroGem AD01 surfactant is used in typical synthetic metalworking fluid formulations. Figure 7 shows the relative performance of surfactant-containing metalworking fluids. This graph plots poor performance near zero at the center of the pentagon and outstanding performance near ten on the perimeter of the pentagon. Clearly, EnviroGem AD01 surfactant provides excellent overall performance relative to Surfynol 440 and a competitive product.

Figure 7

**Comparison of Synthetic Metalworking Fluid Formulation Performance**  
(surfactant used at 1.0 wt.% in a waterborne formulation, 0 or center = poor, 10 or outside corners = outstanding)





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