Deposilk™ Q1 Polymer

INCI: Polyquaternium-X (Proposed)

Key Advantages

- Superior deposition of active ingredients and silicone in skin care and select wash-off formulations
- Excellent silky, smooth sensory properties
- Rub-off water resistance with flexible barrier properties
- Soluble/dispersible in and supportive of high water, high oil, and high alcohol formulations
- Rheology stability benefits
- Compatible across low and high pH

Solutions for

- Improved formulation performance that can provide tangible label claims and greater efficacy that consumers notice
- Reduced levels of silicone, active ingredients, and sensory agents
- More effective silicone benefits, such as conditioning and emollience, as well as surfactant compatibility
- Improved formulation aesthetics through enhanced feel and fragrance persistence
- Effective high water and high ethanol formulations
- Consistently able to deliver benefits across systems, viscosities, pH levels, and application areas

For more information

Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown, PA 18195-1501

T +1-800-345-3148 (U.S.A.)
T +31 30 285 7100 (Europe)
T +1-610-481-6799 (Global)
cheminfo@airproducts.com
www.airproducts.com/personalcare

Deposilk Q1 polymer empowers formulations through superior deposition of ingredients and an excellent sensory profile. Products will feel silky and smooth while improving deposition of silicones and other ingredients on skin or hair across time, driving greater product efficacy and consumer delight.

Formulators can also benefit from several other properties, including rheology stability benefits; a mild and nonirritating nature; wide compatibility, including with low pH systems; and flexible, natural feeling barrier benefits.

Empower Your Formulations through Superior Deposition

Superior Deposition of Silicone

Deposilk Q1 polymer can provide excellent deposition benefits, proving particularly effective for silicones. Its silicone deposition benefits can be useful for wash-off formulations, where typically much of the oil is washed away. Formulations may also enjoy improved silicone performance, such as for conditioning, emollience and carrier benefits.

As illustrated in **Table 1**, in-vitro silicone retention studies suggest that relative to a no-polymer control and industry standard, polyquaternium-10 ("PQ-10"), Deposilk Q1 polymer can provide greater levels of silicone deposition. Testing was conducted by applying the formulation on in-vitro skin and then immersing it in DI water. Water sample measurements conducted by elemental analysis enabled the calculation of the silicone content retained on the in-vitro skin across time. The study was conducted across three different formulations (see Guide Formulations B003, B004, B005), demonstrating Deposilk Q1 polymer's consistent deposition performance.

Scanning Electron Microscope images (**Figure 1**) of hair tresses coated with a hair conditioning formulation and then washed and dried are also suggestive of the benefit from improved silicone deposition that hair and skin may experience when including Deposilk Q1 polymer. The study used damaged hair to illustrate Deposilk Q1 polymer's silicone deposition benefit. Energy-Dispersive X-ray Spectrometry analysis of the Deposilk Q1 polymer coated hair confirms existence of silicone deposited on the hair shaft.

Superior Deposition of Active Ingredients

Deposilk Q1 polymer also can provide excellent deposition of active ingredients, enabling them to deliver more effective formulations. It can be particularly useful for challenging antiaging actives, as illustrated by studies conducted using niacinamide and erythorbic acid.

Testing was conducted by applying a formulation (**Table 2**) containing 1% Deposilk Q1 polymer (on a 100% solids basis) and 2% niacinamide or 1% erythorbic acid on in-vitro skin and then immersing it in DI water. Water sample measurements enabled the calculation of the actives content retained on the in-vitro skin across time (**Tables 3 & 4**). Niacinamide is an amide of niacin (vitamin B3) and is readily water-soluble, in part leading to the low deposition results for control and polyquaternium-7 ("PQ-7"). Erythorbic acid, also known as isoascorbic acid, is an antioxidant common in antiaging and skin whitening formulations.

Table 2: Actives Deposition Formulation

Phase A		
Deionized Water	q.s. to 100%	
Polymer	Control	None
	Deposilk Q1	1% Active
	PQ-7	1% Active
Active Ingredient	Niacinamide	2% Active
	Erythorbic Acid	1% Active
Phase B		
Octinoxate		1 wt %
Cetearyl Alcohol		5.5 wt %
Ceteareth-25		0.5 wt %

Table 1: Silicone Deposition Over Time

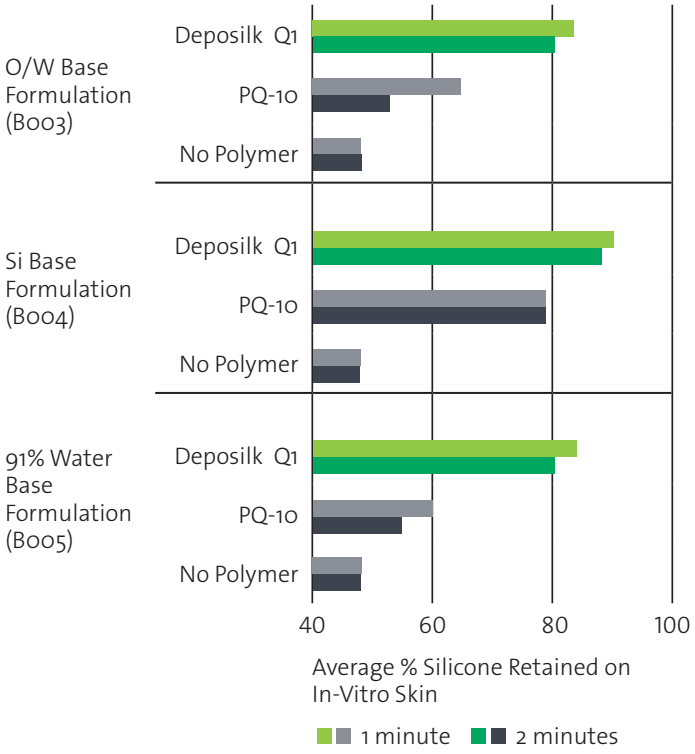
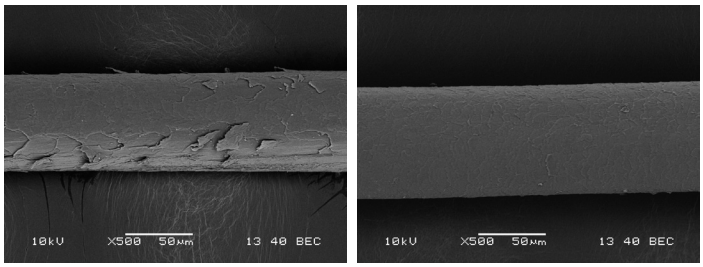


Figure 1: Scanning Electron Microscopic Image

(Hair Tresses Washed and Dried)



Control (No Polymer)

Containing Deposilk Q1 Polymer

Table 3: Percent Niacinamide Deposition Over Time

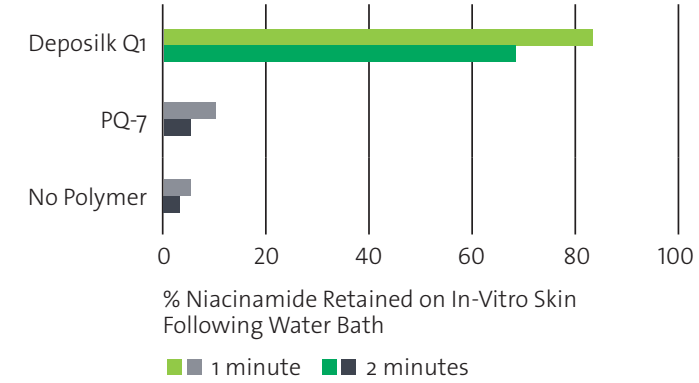
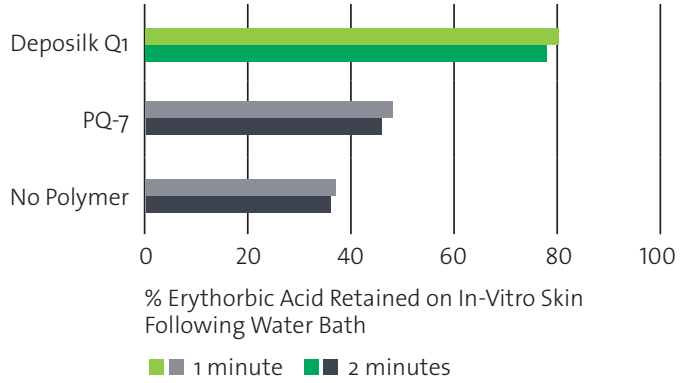


Table 4: Percent Erythorbic Acid Deposition Over Time



Enliven Your Products With Excellent Aesthetic Benefits

Excellent Sensory Properties

Deposilk Q1 polymer can impart formulations with an excellent sensory profile, often described as silky and smooth in feel. At the same time, the material is mild in nature, with Het-Cam and other in-vitro skin irritation tests yielding results indicative of very low irritation potential.

An expert panel evaluated Deposilk Q1 polymer relative to commercially available industry benchmark polyquaternium-7. Results from this panel group (**Table 5**) suggest that Deposilk Q1 polymer provides excellent sensory properties, even comparing favorably with a fully formulated commercial skin care product, used in the study as a control standard.

Rheology Stability Benefits

Deposilk Q1 polymer can provide thickening and viscosity stability benefits across a wide range of formulations. As **Table 6** demonstrates, formulations utilizing Deposilk Q1 polymer were either able to enhance or maintain their viscosity. Particularly of note is Deposilk Q1 polymer's performance in low pH systems, where its presence does not adversely impact viscosity.

Barrier Benefits

Deposilk Q1 polymer provides a flexible barrier that can provide formulations with an added level of water and rub-off resistance. In-vivo, rub-off testing using a mascara formulation suggests that after 30 seconds of washing with gentle rubbing, a formulation containing Deposilk Q1 polymer is able to fare better than the same formulation without Deposilk Q1 polymer (Figure 2). The same formulation on a wool swatch immersed in water for 45 minutes under 300 rpm yields significantly lower loss of color and pigment when using Deposilk Q1 polymer (Table 7).

Compatibility across Wide pH Range and in Surfactant Systems

Wide compatibility is increasingly important as the pace of innovation in the industry continues to drive new and creative product concepts. By providing its benefits across both low and high pH systems as well as in surfactant-based systems, the Deposilk Q1 polymer can provide formulators with a base foundation from which to evolve their product line formulations.

Table 5: Panel Sensory Study Results

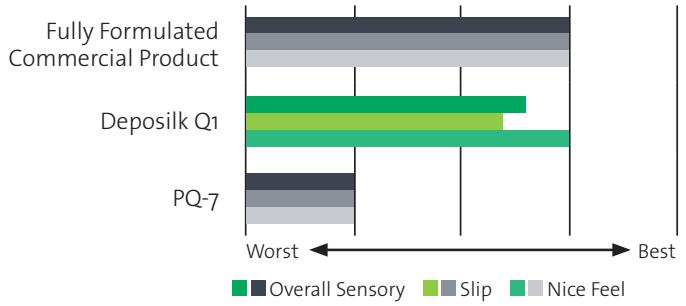


Table 6: Viscosity Across Different Systems (1% Active Polymers)

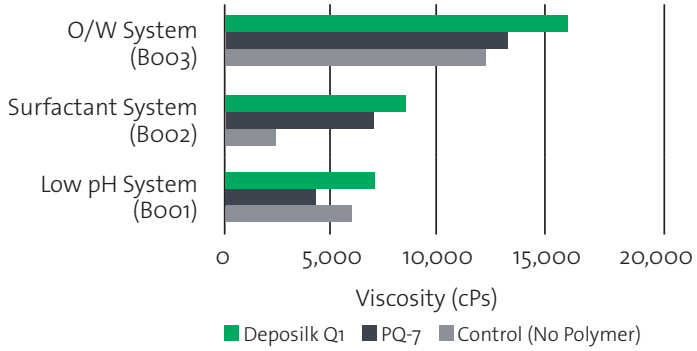


Table 7: Change in Color after 45 Min, 300 rpm Wash-off

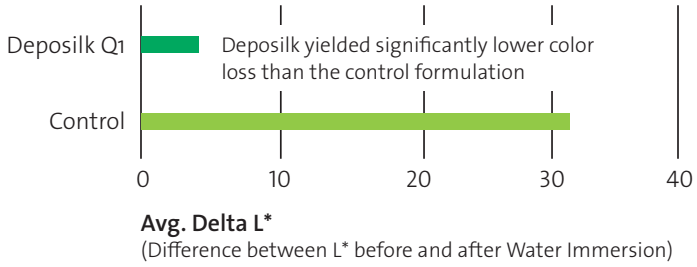
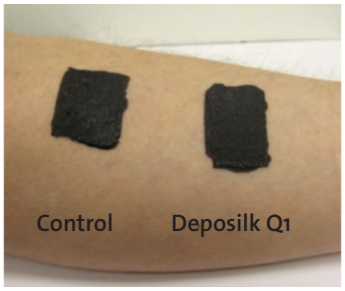


Figure 2: Mascara 30 Second Wash-off with Gentle Rubbing



Before water wash with gentle rubbing

After 30 seconds of warm water wash-off with gentle rubbing

Material Handling and Storage

Deposilk Q1 polymer is freeze-thaw stable and has undergone standard product stability oven testing. The product has a shelf life of 1 year from date of manufacture. It should be stored sealed tightly in its container. Please refer to the Material Safety Data Sheet of this product for more information at www.AirProducts.com/MSDS.

Typical Product Properties

Measure	Typical Bounds
Percent Solids	60%–70%
Bulk Viscosity (Spindle #21 RV)	8,000–22,000 cPs
Residual Cationic Monomer	< 200 ppm
Product Form	Solution, in Butylene Glycol and Water

Tests are batch analyzed. Air Products' test procedures are available upon request and typically under confidentiality.

Formulating Guidance

Low recommended use levels

Deposilk Q1 polymer is typically used at low use levels of 1.0% to 3.0% by active in skin care applications, or as high as 6.0% by active in hair care formulations.

No specific order of addition

No specific order of addition is required for Deposilk Q1 polymer, and it can generally be incorporated at any point in the formulation process.

Material is soluble/dispersible in water, oil, and alcohols

Deposilk Q1 polymer is soluble or readily dispersible in the water phase, oil phase, or alcohol phase of formulations, up to 6% use level.

Material is cationic

Procedural modification may be necessary when incorporating Deposilk Q1 polymer in formulations containing anionic ingredients.

Chemistry

Deposilk Q1 polymer is a high molecular weight polymer whose amphiphilic and cationic properties provide it with an affinity for skin and hair. Its unique, patent pending composition is designed to accentuate its ingredient delivery capabilities while delivering a silky-smooth sensory profile. The polymer is provided as a solution in butylene glycol and water.

Safety and Regulatory Information

Product Safety

Deposilk Q1 polymer has been reviewed compositionally or has undergone standard testing for safety for skin irritation, eye irritation, skin sensitization, mutagenicity, and aquatic toxicity. Results suggest that at anticipated usage levels, this polymer should comply with safety protocols established in most regulatory regimes. Deposilk Q1 polymer has not been tested on animals. Further safety information for this product is available by request.

Regulatory Status

Please refer to the Material Safety Data Sheet of this product for more information at www.AirProducts.com/MSDS.

Source and GMO Status

Deposilk Q1 polymer is manufactured in the United States. It is prepared solely from synthetic materials and does not contain and is not derived from Genetically Modified Organisms or any material of animal origin.

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