



## SILVADUR™ 930 FLEX Antimicrobial

EPA-Registered biocide  
EPA Reg. No. 464-785

### General

SILVADUR™ 930 FLEX Antimicrobial uses a patented, polymer-based delivery system to transport and secure silver ions to textile goods efficiently. This novel system binds silver to avoid discoloration and early exhaustion. When incorporated into textiles and fibers during the manufacturing process, SILVADUR™ 930 FLEX can control microbial derived odor and absorb select odors to provide durable freshness protection.

SILVADUR™ 930 FLEX is supplied as a liquid, making it easy to dispense and mix, and is compatible with a wide range of textile chemicals, including latex resins (such as acrylic, PVA, SBR, EVA), and finishing agents (such as anti-wrinkle resins, wicking, fluorocarbons and softeners).

### Physical Properties

The following are typical properties of SILVADUR™ 930 FLEX Antimicrobial (**not product specifications**).

Appearance, visual:.....Pale brown liquid  
Ionic character:.....Slightly anionic  
pH:.....9.0 - 11.5  
Viscosity<sup>1</sup>: .....1-5 mPa.s at 25°C (77°F)  
Silver concentration via titration, wt. %:.....0.098  
Flash point, °C, Closed Cup:.....> 93

<sup>1</sup>Viscometer Brookfield Model DV-II + LV spindle 1, speed 30 rpm

### Special Features and Benefits

- Holistic odor control: functions to prevent microbe-derived odor while adsorbing select, common human odors to maintain textile freshness
- Smart control: binds silver sufficiently to enable 50 home launderings, longer-term efficacy, and improved cost-to-treat
- Broad spectrum activity: controls numerous odor-causing microorganisms which can accumulate in textiles and fibers from skin contact and laundering
- Improved fabric color stability down to pH 4.5
- Thermally stable: tolerance up to 180°C during drying over the course of minutes
- Applicable to natural and synthetic fibers via spray, pad, and exhaustion
- Compatible with a broad range of woven and non-woven additives, including fluorocarbon chemicals, softeners, antiwrinkle resins, etc.
- Maintains aesthetics of the fabric
- Dermatologically tested; treated articles have outstanding skin tolerance

## Antimicrobial Activity & Performance

SILVADUR™ 930 FLEX Antimicrobial has been tested against a variety of microorganisms and has been shown to be effective in controlling the growth of a variety of Gram negative and Gram positive bacteria and fungi.

### Efficacy of 3% SILVADUR™ 930 FLEX on Standard Textiles

Antimicrobial Textiles	ISO 20743* Log Reduction	
	Untreated	Treated
100% Cotton	+2.0	>3.0
100% Nylon	+1.2	>3.0
100% Polyester	+1.5	>3.0
50/50 PES/Cotton	+1.4	>3.0

\**Escherichia coli* with 1:500 nutrient broth in inoculum. Results are log reduction of *E. coli* compared to the untreated controls at time = 0. Positive values indicate microbial growth.

### Efficacy on Polyester Cotton Blend (60/40) Laundered 50 times

SILVADUR™ Antimicrobial 930 FLEX (%)	AATCC Method 100 Percent Microbial Reduction		Performance
	<i>Staphylococcus aureus</i>	<i>Klebsiella pneumoniae</i>	
0	0	0	Microbial Growth
3	>99.9%	>99.9%	Excellent Control

\*Washed using AATCC 61-2A

### SILVADUR™ 930 FLEX Color Contribution on 100% White Cotton

SILVADUR™ 930 FLEX Antimicrobial (%)	L*	a*	b*	ΔE*	ISO Grey Scale (D65/10)
Untreated	95.4	-0.5	3.0	-	-
0 (bath pH 4)	95.5	-0.5	2.7	0.3	4.8
3.0 (bath pH 4)	95.0	-0.6	2.9	0.5	4.7
5.0 (bath pH 9)	95.3	-0.4	2.5	0.5	4.7
5.0 (bath pH 6)	94.9	-0.5	3.5	0.7	4.6
5.0 (bath pH 5)	96.6	-0.9	2.8	1.3	4.3
5.0 (bath pH 4)	94.1	-0.5	3.7	1.5	4.1

- 1) JIS L0802 Standard white cotton was used for all experiments and control samples for relative color change evaluation
- 2) Fabrics were subjected to recycled humidity (30% 6 hours, 85% 6 hours) and light exposure until no additional color change was observed (approximately 3 weeks on average)
- 3) Bath pH was adjusted with acetic acid



### Fabric pH at Various SILVADUR™ 930 FLEX Treatment Levels

Treatment	Target Silver Level (o.w.f)	Treatment Bath pH	Final Fabric pH
Untreated: No Finish	0 ppm	7.67	5.93
Untreated + Finish*	0 ppm	5.90	6.38
Finish + 0.5% SILVADUR™ 930 FLEX	5 ppm	6.92	6.25
Finish + 1.5% SILVADUR™ 930 FLEX	15 ppm	7.04	6.20
Finish + 3.0% SILVADUR™ 930 FLEX	30 ppm	8.23	6.20

### SILVADUR™ 930 FLEX Microbial-derived Odor (Isovaleric Acid) Control in Polyester Inoculated with Staphylococcus Aureus

Treatment	Isovaleric Acid (ppm)
Untreated	8.3
SILVADUR™ Treated	0.5

### SILVADUR™ 930 FLEX Odor Absorption in Cotton

Treatment	# odor bodies captured*	Total Odor % reduction
Silvadur Flex	4	38.82%

\*Odor bodies captured represent odorants with >50% reduction with treatment by HS-GC-MS; a total of 9 human odor bodies were evaluated.

## Application Guidelines

SILVADUR™ 930 FLEX Antimicrobial may be applied to fabrics and knitted goods of all fibers by padding, exhaustion, printing, and spray application. It is highly recommended that SILVADUR™ 930 FLEX be applied prior to any sacrificial, non-durable, treatment during chemical finishing (e.g., before repellents, moisture wicking additives, softeners, etc.). Complete rinsing and neutralization of fabric prior to the addition of SILVADUR™ is required in order to achieve the highest durable antimicrobial finish. SILVADUR™ 930 FLEX has broad compatibility with many textile finishing chemicals including repellents, moisture wicking additives, softeners, optical brighteners, and dyes. **Pre-trials are recommended to ensure bath compatibility and to ensure that the degree of whiteness or wash durability of the fabric is not altered.** Avoid releasing SILVADUR™ 930 FLEX into wastewater. Avoid the following chemistries or ensure fabric is sufficiently rinsed prior to SILVADUR™ addition in order to achieve desired whiteness, durability, and antimicrobial performance:\*

- Sulfur dyes
- Reducing agents: sodium hydrosulfide, sodium hydrosulphite, sodium thiosulphate, glucose, citric acid, etc.
- Addition of excess salts to treatment bath or fabric to drive exhaustion (e.g., MgCl<sub>2</sub>)
- Enzymes or natural proteins
- Some strongly cationic finishing chemicals

\*These statements concerning the compatibility and use of our product reflect the current state of our knowledge. **Specific performance parameters for finished material should, in each case, be assessed by the user before commercial application.**



**Exhaust Application:** Apply SILVADUR™ 930 FLEX at levels between 1.5% and 5% based on the weight of the goods and durability requirements. This dose will provide silver loading levels between 15 and 50 ppm.

1. Completely rinse and neutralize fabric.
2. In a separate dilution vessel, add 80% water based on required volume of the exhaust machine.
3. Add SILVADUR™ 930 FLEX gradually to the water with constant stirring at room temperature at a concentration appropriate for obtaining proper final concentration based on the weight of fabric.
4. Add additional water with continued agitation up to 100% of bath volume.
5. Add this diluted solution of SILVADUR™ 930 FLEX to the main exhaust machine.
6. Gradually add dilute acid to achieve pH between 4.5 and 6.5 with optimal pH of 5.0 in exhaust bath. Preferably use buffer to control the pH (Notes 1-3). Avoid citric acid as it may cause discoloration on white fabrics.
7. Raise exhaust bath temperature to no higher than 80°C and continue exhaustion for 20 minutes with recommended liquor to goods ratio of 10:1. Effective exhaustion has been observed at temperatures lower than 80°C.
8. Dry fabrics below 180°C. No specific cure temperature is required.

**Note 1:** pH adjusted solutions should not be stored for later use.

**Note 2:** A suspension containing 90% water and 10% Buffer A has been shown to be an effective buffer. Buffer A contains 79% of 0.1M sodium acetate and 21% of 0.1M acetic acid.

**Note 3:** Immediately wash pH probes after use to prevent build-up of excess residual polymer.

**Pad Application:** Apply SILVADUR™ 930 FLEX at levels between 1.5% and 5% based on the weight of the goods and durability requirements. This will provide silver loading levels between 15 and 50 ppm.

1. Completely rinse fabric.
2. In a separate dilution vessel, add 90% water based on required volume of the padding machine.(Note 1)
3. Add SILVADUR™ 930 FLEX gradually to room temperature water with constant stirring at a concentration appropriate for obtaining proper final concentration based on the wet weight pick-up of fabric.
4. Add additional water with continued agitation up to 100% of bath volume. (Note 2 & 3)
5. Add this diluted solution of SILVADUR™ 930 FLEX to the main padding bath.
6. Pad apply using standard temperature and pressure in order to obtain desired SILVADUR™ 930 FLEX treatment based on the weight of the goods.
7. Dry fabrics below 180°C. No specific cure temperature is required.

**Note 1:** City Tap water is preferred; high hardness water, including underground water is not recommended. We recommend conducting a small-scale trial before full-scale production if uncertain on impact of water quality.

**Note 2:** If bath solution pH must be acidic, lower diluted application solution pH using a weak acid; avoid citric acid. Do NOT lower the pH of the bath solution below pH 4.5, and preferably maintain pH between 5.0 and 8.5 for color sensitive fabric (e.g., white fabric).

**Note 3:** Final Fabric pH will remain at/below 7.0 even if SILVADUR™ 930 FLEX treatment bath is above 7.0 due to ammonia evaporation during drying.



## **Storage, Handling & Disposal**

Use SILVADUR™ 930 FLEX in a well ventilated area, free of sparks and open flames. Standard city water may be used, provided it is free of high concentrations of metal ions and chloride; water treatment is always recommended when available. For full application instructions, contact Dow personnel prior to use to facilitate proper and efficient application of the SILVADUR™ 930 FLEX product. Please refer to the Safety Data Sheet (SDS) for this product for precise instructions. The processing and use of industrial chemicals requires adequate technical and professional knowledge. In general, avoid eye and skin contact, and wear correct personal protective equipment. Avoid prolonged inhalation of SILVADUR™ 930 FLEX Antimicrobial vapors. Store SILVADUR™ 930 FLEX in a well ventilated area. It should be stored at ambient conditions in the original container, tightly sealed. Protect from frost and heat.

## **Product Stewardship**

When considering the use of any Dow product in a particular application, review the latest Safety Data Sheet (SDS) and country-specific product label to ensure the intended use is within the scope of approved uses. Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products – from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

## **Customer Notice**

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For further information visit our website:  
[www.dowmicrobialcontrol.com](http://www.dowmicrobialcontrol.com)  
or call:

Central and Eastern Europe:

Turkey +90-216-571-16-00

Russia +7-495-663-78-20

Poland +48-22-543-18-00

Western Europe:

+800-3-694-6367 (toll-free)

+31-115-67-26-26 (phone)

+31-115-67-28-28 (fax)

North America:

+1-800-447-4369 (toll-free)

+1-989-832-1560 (phone)

+1-989-832-1465 (fax)

Middle East and Africa:

UAE +971-4-332-88-66

South Africa +800-99-5078 (toll-free)

Greater China:

Shanghai +86-21-3851-1000

Beijing +86-10-8527-9199

Guangzhou +86-20-3813-0600

Taiwan +886-227-718-000

Southeast Asia:

Philippines +63-2-867-3293

Indonesia +62-21-2995-6273

Singapore +65-6830-4575

+65-6796-6217

Thailand +66-2365-7371

Vietnam +84-8-3822-5808

Malaysia +603-7965-5200

Australia and New Zealand:

+613-9226-3500 (phone)

+61-3-9226-3562 (fax)

Japan and Korea:

Japan +81-3-5460-2261

Korea +82-2-3490-4348

Indian Subcontinent:

+91-22-6793-4953 (phone)

+91-22-6793-4924 (fax)

Latin America:

+55-11-5188-9555 (phone)

+55-11-5188-9400 (fax)

Other Global Areas:

+1-989-832-1560 (phone)

+1-989-832-1465 (fax)

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