



SILVADUR™ 930 Antimicrobial

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

General

SILVADUR™ 930 Antimicrobial is a polymer-based antimicrobial that uses a patented delivery system to transport and secure the silver ions to a treated article. This novel system controls the release of the silver to avoid discoloration and early exhaustion typical of other silver products. When incorporated into textiles and fibers during the manufacturing process, SILVADUR™ 930 can inhibit the growth of microbes to offer protection, durability and freshness.

SILVADUR™ 930 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 Antimicrobial (**not product specifications**).

Appearance, visual:.....	Pale amber liquid
Ionic character:.....	Slightly anionic
pH:	9.5 -10.5
Viscosity ¹ :.....	1-5 mPa.s at 25°C (77°F)
Silver concentration via titration, wt. %:.....	0.098
Flash point, °C, Closed Cup:.....	>93

¹Viscometer Brookfield Model DV-II + LV spindle 1, speed 30 rpm

Special Features and Benefits

- Smart control: controlled release of silver for improved durability, longer-term efficacy and improved cost-to-treat
- Novel liquid formulation: a clear and non-tacky solution that is easy to dilute, dose, formulate and apply
- Broad spectrum activity: controls various odor-causing microorganisms which can accumulate in textiles and fibers from skin contact and wash cycles
- Color stability: improved product quality and appearance vs. other silver products
- Thermal stability: tolerance up to 190°C during drying
- Easy to coat natural and synthetic fibers
- 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; ready treated articles have outstanding skin tolerance
- Can be applied by spray, pad, and exhaustion processes

Antimicrobial Activity & Performance

SILVADUR™ 930 Antimicrobial has been tested against a variety of microorganisms and has been shown to be effective in controlling the growth of the following microorganisms on textiles and fibers.

Abridged list of Microorganisms for Which SILVADUR™ 930 is Active Against

Bacteria	Yeasts/Molds
Escherichia coli	Aspergillus niger
Klebsiella pneumonia	Trycophytonmentagrophytes
Pseudomonas aeruginosa	
Staphylococcs aureus	
Corneybacterium ammoniagenes	

Efficacy of 3% SILVADUR™ on Standard Textiles

Antimicrobial Textiles	ISO20743* Log Reduction CFU	
	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. Positive values indicate microbial growth.

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

SILVADUR™ Antimicrobial 930 (%)	AATCC Method 100 Log Reduction (CFU/mL)		Performance
	Staphylococcus aureus	Klebsiella pneumoniae	
0	0	0	Microbial Growth
3	>99.9%	>99.9%	Excellent Control

*Washed using AATCC 61-2A

SILVADUR™ 930 Color Contribution on 100% White Cotton

SILVADUR™ 930 Antimicrobial (%)	L*	a*	b*	ΔE*	ISO Grey Scale (D65/10)	ΔE CMC (I :c=2:1)
0 (untreated*)	95.87	-0.62	1.3			
0 (Tap water treated)	95.65	-0.48	0.94	0.45	4.5	0.54
1.0 (Bath pH=9.2)	95.36	-0.51	1.47	0.55	4.5	0.33
2.0 (Bath pH=9.4)	95.32	-0.51	1.68	0.67	4.5	0.57
3.0 (Bath pH=9.5)	94.47	-0.45	2	1.57	4	1.1
4.0 (Bath pH=9.6)	95.36	-0.75	2.54	1.35	4	1.72
5.0 (Bath pH=9.7)	92.15	-0.01	3.75	4.49	2.5	3.7
3.0 (Bath pH=9.58)	95.14	-0.51	1.98	0.99	4.5	0.97
3.0 (Bath pH=6.99)	95.31	-0.48	2.07	0.96	4.5	1.08
3.0 (Bath pH=6.0)	94.51	-0.25	3.1	2.28	3.5	2.56
3.0 (Bath pH=5.0)	92.77	0.4	4.27	4.41	2.5	4.45

- 1) *JIS L0802 Standard white cotton was used for all experiments, and as control samples for relative color change evaluation
- 2) Fabric are subjected to recycled humidity (30% 6hours, 85% 6hours) and light exposure till no more color change was observed (normally 3weeks)

3) Bath pH was adjusted with acetic acid

Fabric pH at Different SILVADUR™ 930 Treatment Levels

Treatment	Target Silver level (o.w.f)	Treatment Bath pH	Final Fabric pH
Untreated: No Finish	0ppm	7.67	5.93
Untreated + Finish*	0ppm	5.9	6.38
Finish + 0.5% SILVADUR 930	5ppm	6.92	6.25
Finish + 1.5% SILVADUR 930	15ppm	7.04	6.20
Finish + 3.0% SILVADUR 930	30ppm	8.23	6.20

Application Guidelines

SILVADUR™ 930 Antimicrobial may be applied to fabrics and knitted goods of all fibers by padding, exhaustion, printing, and spray application. SILVADUR™ 930 can be exhaust and pad applied using most industry standard equipment. It is highly recommended that SILVADUR™ 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.

Compatibility: SILVADUR™ 930 has good compatibility with a broad range of textile finishing chemicals including repellents, moisture wicking additives, softeners, optical brighteners, and dyes when it must be added in the same bath. **Pre-trials are recommended to ensure bath compatibility and that the degree of whiteness or wash durability of the fabric is not altered.**

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. MgCl₂)
- 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 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 and neutralize fabric.
2. In a separate dilution vessel, add 80% water based on required volume of the exhaust machine.
3. Add SILVADUR™ 930 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 to the main exhaust machine.
6. Gradually add dilute acid to achieve pH between 5.5 and 6.5 in exhaust bath. Preferably use buffer to control the pH (Notes 1-3). Do not use citric acid as it may cause discoloration.
7. Raise exhaust bath temperature to 80°C and continue exhaustion for 30 minutes with recommended liquor to goods ratio of 5:1 (Note 4).
8. Dry fabrics below 180°C, preferably at 140 °C for 90 sec.

Note 1: It is critical that the pH of the dilute SILVADUR 930 solutions must be between 5.5-6.5 in order to maintain proper exhaust efficiency. **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.

Note 4: Higher exhaustion temperature, longer dwell times, and liquor to goods ratios lower than 10:1 will increase efficiency.

Pad Application: Apply SILVADUR 930 at levels between 1% and 5% based on the weight of the goods. This will provide silver loading levels between 10 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 gradually to the water with constant stirring at room temperature 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 to the main padding bath.
6. Pad apply using standard temperature and pressure in order to obtain desired SILVADUR 930 treatment based on the weight of the goods.
7. Dry fabrics below 180 °C, preferably at 140 °C for 90 sec.

Note 1:City Tap water is preferred; high hardness water, including underground water is not recommended. Please execute 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; Do not use Citric acid . Do NOT lower the pH of the bath solution below pH 5.5, and preferably maintain pH between 6.0 and 9 for color sensitive fabric (e.g. white fabric).

Note 3: Final Fabric pH will be maintained below 7.0 in the event that SILVADUR 930 treatment bath is above 7.0 as ammonia will evaporate out during drying process.

Storage, Handling & Disposal

Use SILVADUR™ 930 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. For full application instructions, contact Dow personnel prior to use to facilitate proper and efficient application of the SILVADUR™ 930 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 Antimicrobial vapors.

Store and use the SILVADUR™ 930 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

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including Safety Data Sheets (SDS), should be consulted prior to use of Dow products. Current Safety Data Sheets are available from Dow.

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