



Introducing the Technology



Silver Ion Antimicrobial

Funk Fighter, A product of Tri-Titans International Inc. Powered by



Microbial Control

TRI-TITANS[®] ANTIMICROBIAL ATHLETIC WEAR



A Fundamentally New Approach to Delivering the Benefits of Ag⁺

- Proprietary polymer that complexes Silver Ion (Ag⁺)
- Forms an extensive polymeric network on the fabric
- Uses “smart control” mechanism to release Ag⁺
- Provides a durable, heat and light stable silver antibacterial finish

The latest innovation in antimicrobial technologies...

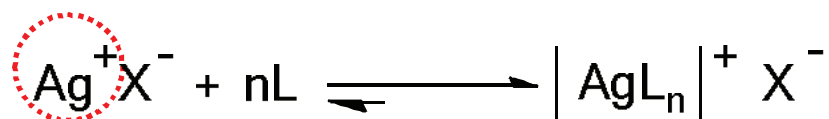


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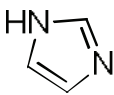
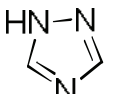
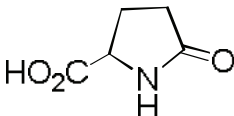
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Minimum inhibitory concentration (MIC) for Ag⁺ complexes

Complex	Ligand	Staph. <i>aureus</i>	<i>P. aeruginosa</i>	<i>A. niger</i>
⁽¹⁾ AgNO ₃	--	>1600	6	>1600
⁽¹⁾ [Ag(imid) ₂]NO ₃		15.7	7.9	15.7
⁽²⁾ [Ag(1,2,4)- triazole]		125	7.9	1000
⁽³⁾ Ag(H ₂ pyrrld)		31.3	15.7	15.7

(1) Nomiya, K. et. al. J. Inorg. Biochem. 1997, 68, 39-44

(2) Nomiya, K. et. al. J. Chem. Soc. Dalton Trans. 1998, 1653-1659

(3) Nomiya, K. et. al. J. Chem. Soc. Dalton Trans. 2000, 4369-4373



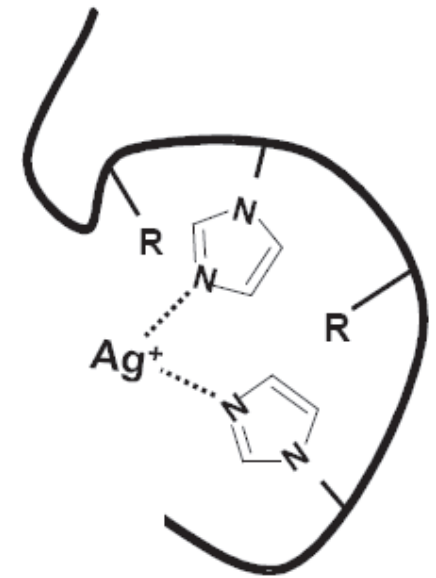
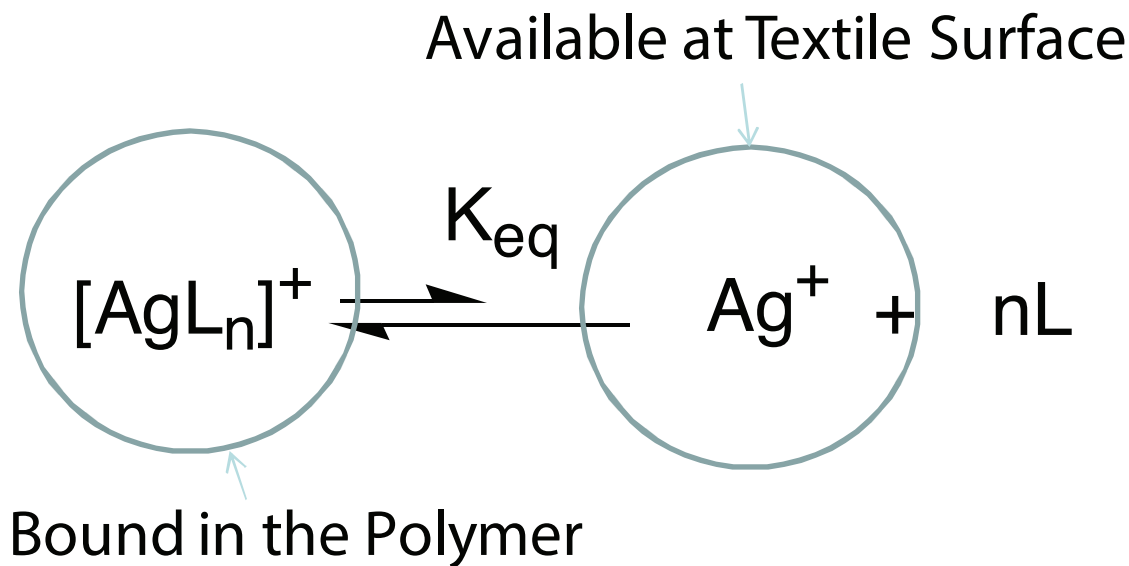
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Polymer Technologies: Polymer-Silver Complex



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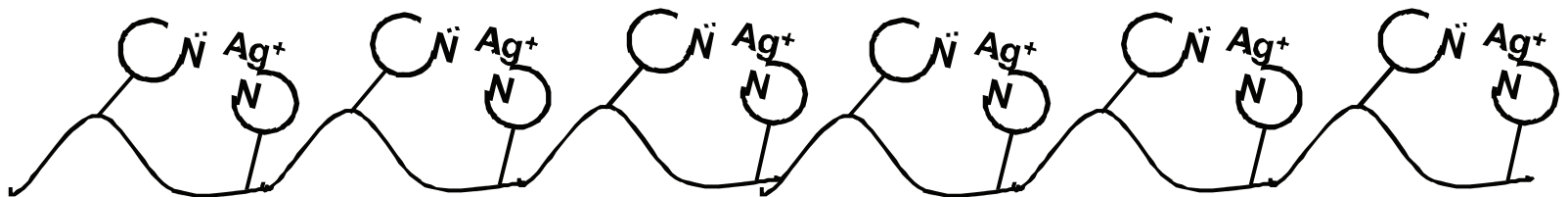
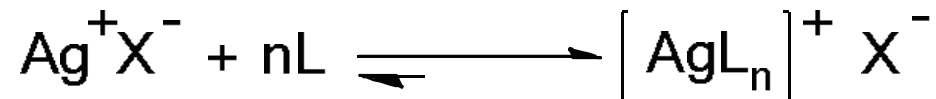
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Polymer Technologies:

Creates a surface that only releases active silver ions based on a specific equilibrium constant



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COMMON, RECOGNIZED AND ACCEPTED



*Antimicrobial Silver technologies currently
in the marketplace*



Particle

versus

Polymer



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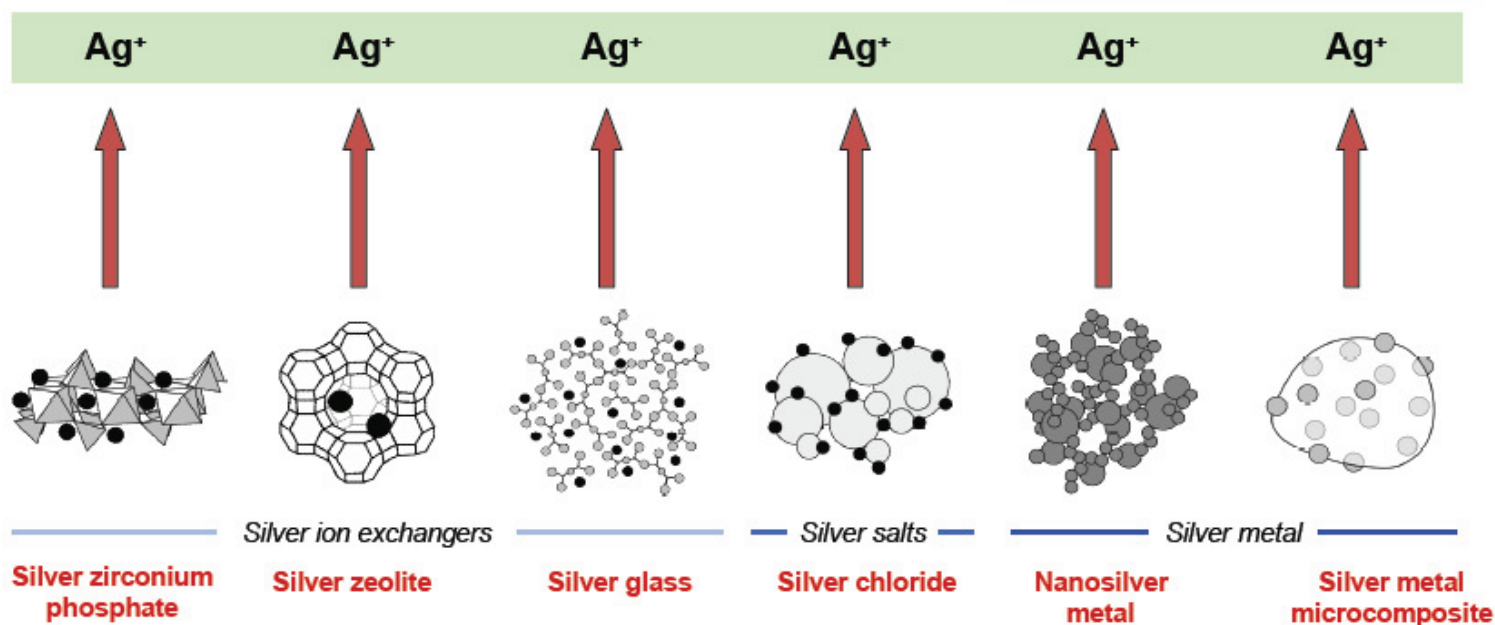


Microbial Control

COMMON, RECOGNIZED AND ACCEPTED



Particle Based Silver technologies currently in the marketplace



Silver nanotechnology Working Group: Presentation Dr. Murray Height

Wijnhoven, SWP. et al. "Nano-silver - a review of available data and knowledge gaps in human and environmental risk assessment", *Nanotoxicology*, 3:2 (2009) p109 — 138.



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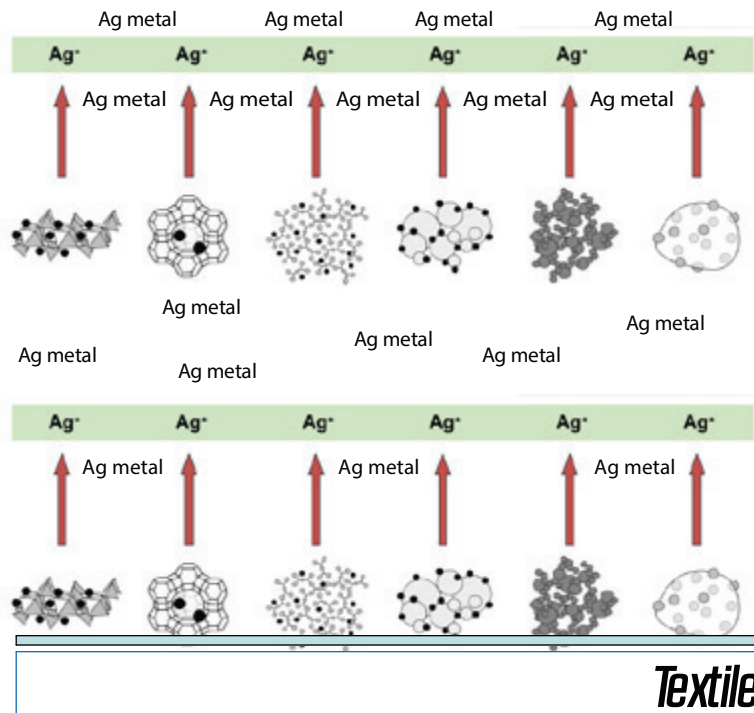


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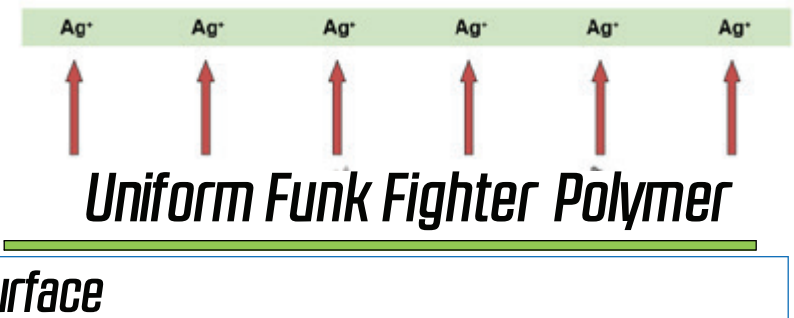
SILVER IONS AND SILVER METALS



Particles released Metals and Silver ions released



No Polymer released Only Silver ions released



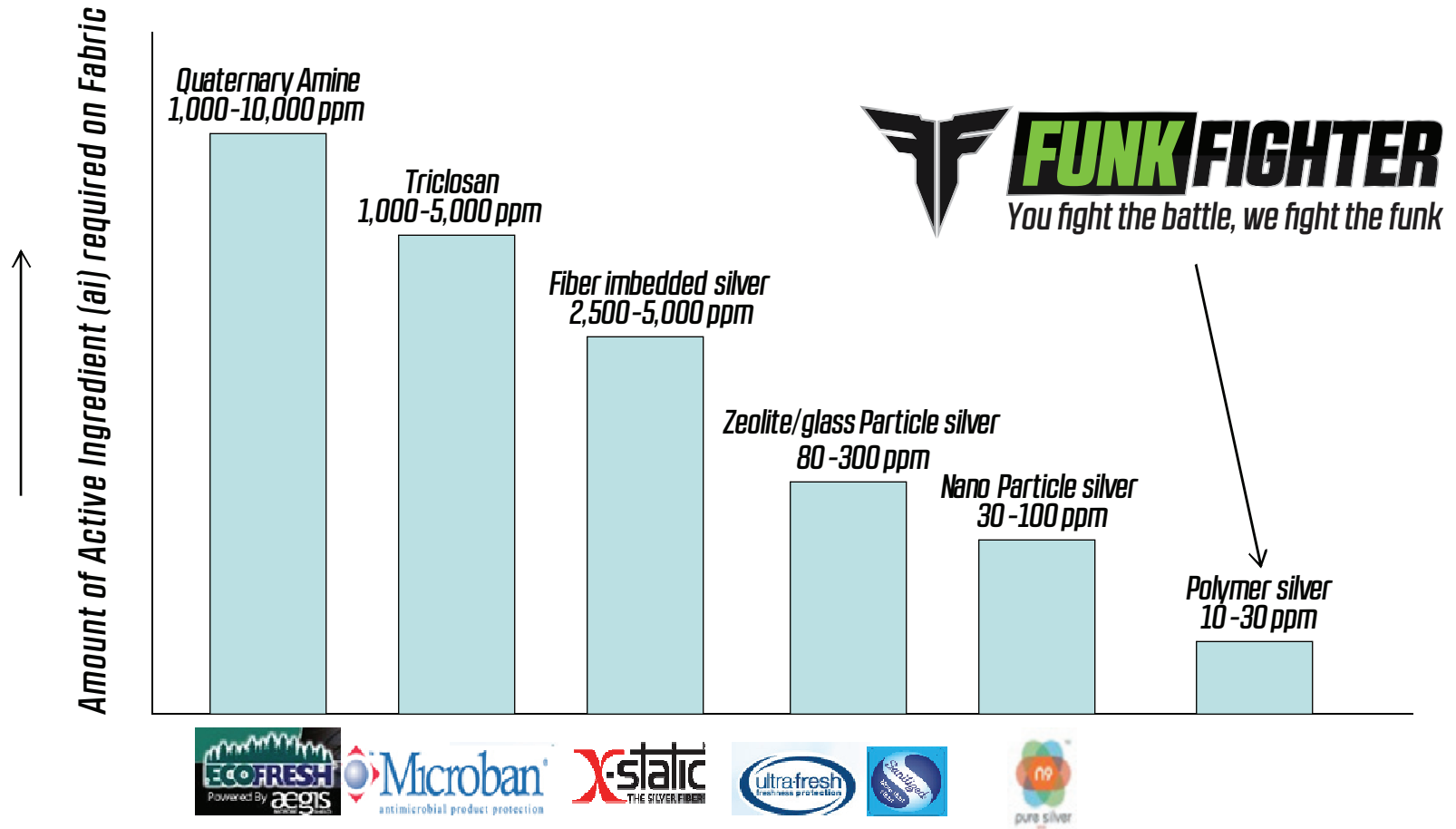
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ANTIMICROBIAL USE LEVELS



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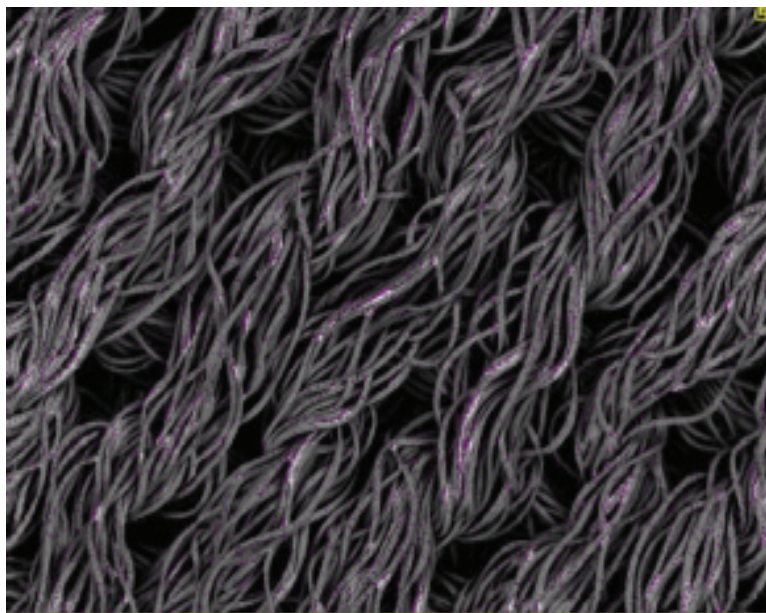
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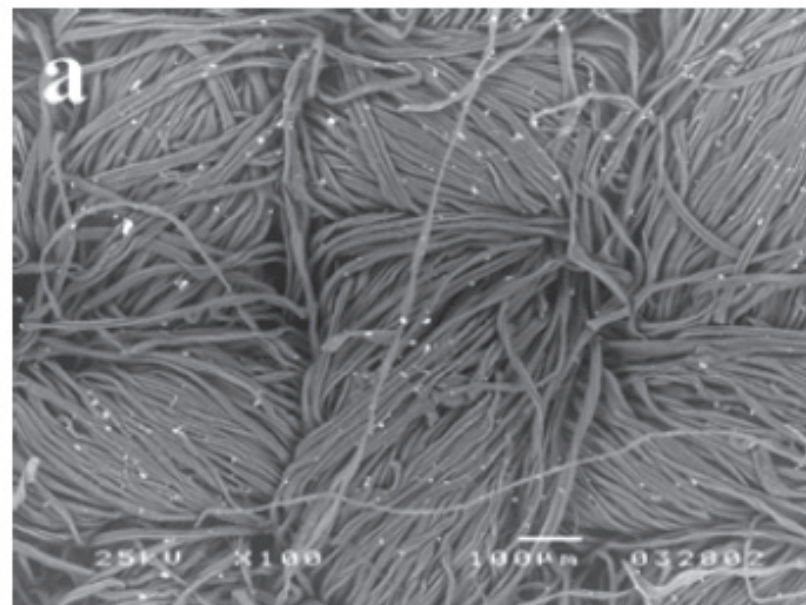


FUNK FIGHTER technology forms a polymeric coating on the fabric, allowing for smarter release of active silver ions

Funk Fighter applications create a smooth uniform polymer across the surface (purple)



Typical silver applications on fibers include beads, nano particles, or tubes



Matyas-Zgondek E., Baccarelli A., Rybicki E., Szynkowska M.I., Kolodziejczyk M. ; Antibacterial Properties of Silver-Finished Textiles. FIBRES & TEXTILES in Eastern Europe January / December / A 2008, Vol. 16, No. 5 (70) pp. 101-107.



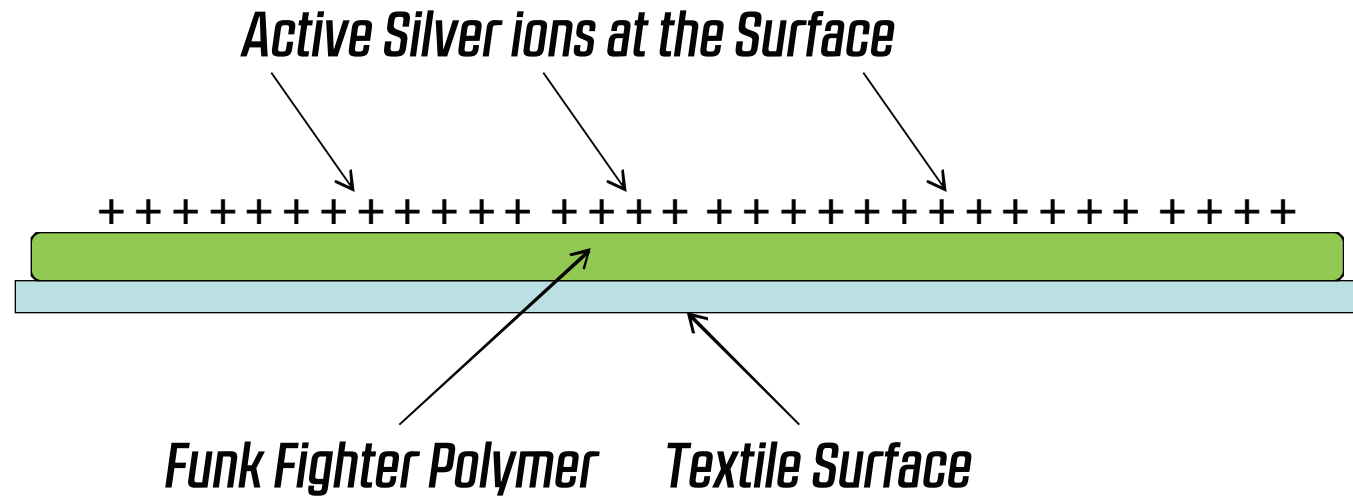
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FUNK FIGHTER INTELLIGENT CONTROL



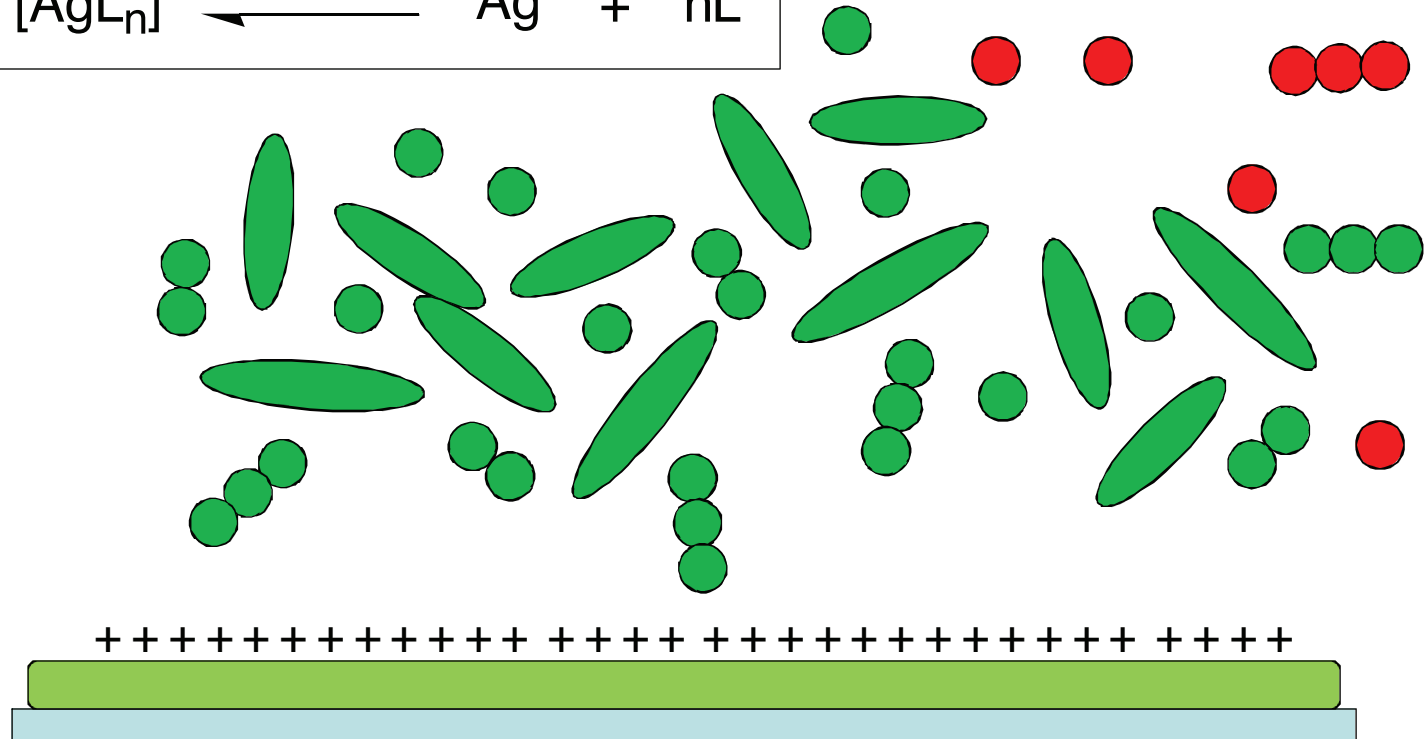
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FUNK FIGHTER INTELLIGENT CONTROL



***Funk Fighter system replenishes the surface
and the cycle continues***



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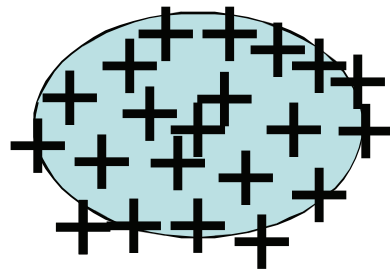


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SILVER PARTICLE RELEASE

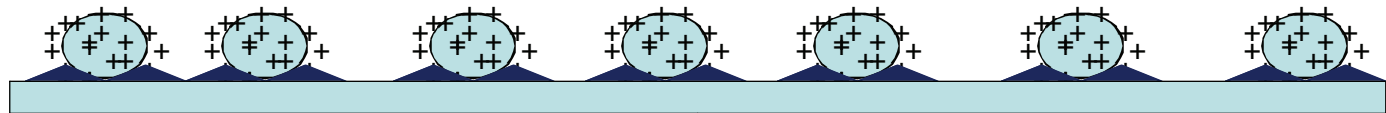


Particle Based Silver Products



*Particles (nano/micro) that incorporate both silver metal and silver ions are bound to the textile surface**

** Particles usually require extra binders*



Textile Surface



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COMMON, RECOGNIZED AND ACCEPTED



Technology	Gaps
• Ag⁺ encapsulated in glass, Ag⁺ is released by leaching (Ionpure™) • Ag⁺ ion-exchanged into zeolite framework (AglON®) • Ag⁺ salt of Zirconium Phosphate (Alphasan®) • AgCl and binder (Silpure®) • AgCl supported on TiO₂ (Sanitized®) • Fibers coated with Ag⁰ (X-Static®, Protex^{Ag})	• Silver Products: - Solids, difficult to formulate - Dispersing in aqueous systems challenging - Durability – loss of Ag upon washing - Discoloration (treatment bath, fabric) - High cost-to-treat
• Triclosan/ Zinc Pyrithione	
• Quaternary ammonium compounds (Aegis Microbe Shield, PHMB)	
	• Triclosan/Zinc – leaching, environmental concern
	• QAC – Biocidal action is by contact. Once the surface is fouled activity decreases.



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***CERTIFICATIONS, APPROVALS,
REGISTRATIONS, AND GLOBAL
COMPLIANCE***



US EPA APPROVED

BPD/R LISTED

OEKO-TEX® STANDARD 100 APPROVED

REACH COMPLIANT

BLUESIGN® CERTIFIED



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