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國立中興大學
National Chung Hsing University



NSP for Life !

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友善生命之"物理作用"衍生多重功能--醫藥、寵物抗菌劑

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新型"矽片銀"--安全性與有效性

“矽片銀”功能及應用項目

抗菌/皮膚敷料傷口癒合/燒燙傷/蚊蟲咬止癢/

凝血止血/除臭

抗菌(anti-MRSA)功能

“矽片銀”產品特色 (本產品與市場一般的“奈米銀”產品比較)

1. 抗菌高效性 (包括anti-MRSA, anti-biofilm特殊功效)
2. 低毒性/安全性 (Safety: 矽片銀 (TAg) > 傳統銀粒子 (AgNP) > 銀離子(silver sulfadiazine or trade name, Silvadene or SS))
3. 穩穩定性/長效性/高附著性 (high stability against heat, against oxidation by O₂/UV)

● Note: **MRSA** (Methicillin-resistant *Staphylococcus aureus*) : 對甲氧苯青黴素 (methicillin)具有抗藥性的金黃色葡萄球菌。MRSA對許多抗生素具有抗藥性且難以醫治。

天然矽片/矽片銀--醫藥/保健外敷用膏

有效性: 超級細菌---抗藥性金黃色葡萄球菌
(Methicillin-resistance Staphylococcus aureus (MRSA))

C-Pian mouthwash
漱口水



C-Pian Skin Cream
外敷用膏



C-Pian Skin Silver-Cream
(external use only)

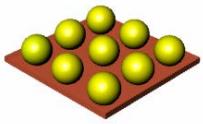


- 天然 natural
- 無毒 nontoxic
- 抑菌 antimicrobial
- 除臭 deodorant
- 抗病毒 anti-virus
- 牙周病 gum disease

- 抑菌 antimicrobial
- 舒緩疼痛 (外敷) skin-irritation
- 消炎止癢(外敷) anti-itch
- 凝血/止血敷料 blood-clotting/hemostasis

- 殺菌 antimicrobial
- 燒燙傷 anti-burn
- 蚊虫蚊傷 after bites

矽片銀之多元應用



醫藥/醫療器材: 皮膚敷料, 特殊用抗菌劑, 醫材(植入式骨材)表面抗菌塗料, 凝血/止血敷料

Medical Uses: wound dressing, Anti-MRSA, surface antimicrobial coating
(bone/medical devices, blood clotting/hemostatic spray)

淨水處理/過濾材料
Waste water treatment/
air filter



低熔點導電銀漿奈米銀粉
Silver/Graphene dispersed
paste Nano-Ag powder for
conductivity

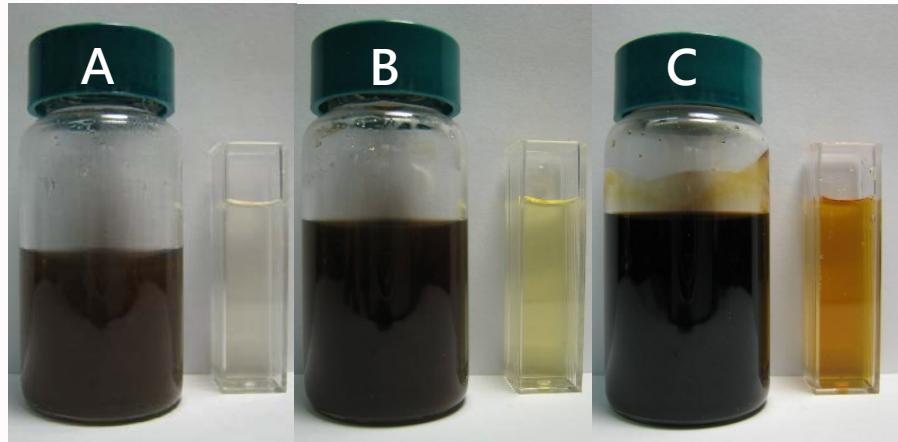
Colloid, Paste and Powder forms

易分散及熱穩定：銀膏、銀粉

安全性: 矽片銀 > 銅 = 鋅
>> 傳統銀粒子(高細胞毒性)

環境用抗菌、抗霉、除臭、抗菌水溶液
Environmental uses (Ag sprays)

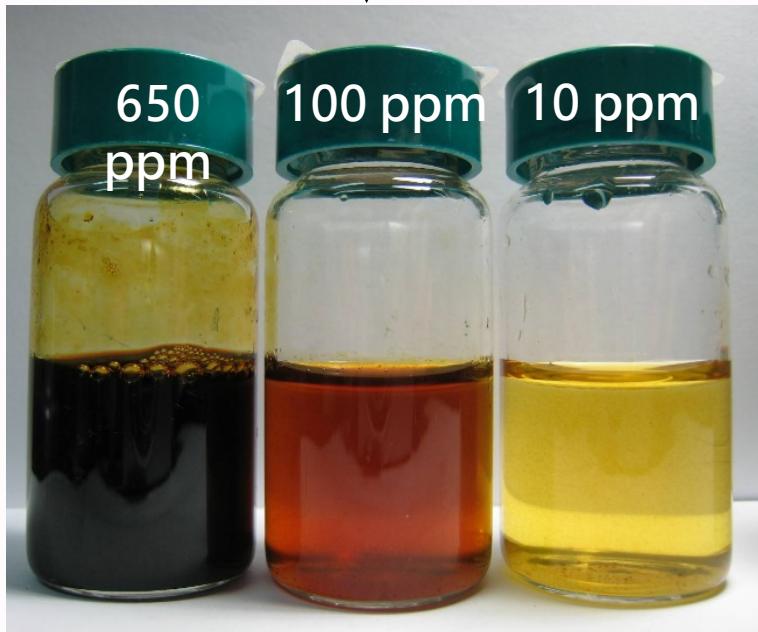
紡織品抗菌 (塑膠母粒或塗佈)
抗菌PE/PP/PET膜
Antimicrobial agents for fabrics,
package films, 3C equipment...



金黃色或墨色[奈米矽銀]溶液或粉體
(golden or ink-colored solution and powder)

1. Highly effective for anti-microbial and anti-MRSA uses
2. low toxicity (cytotoxicity and genotoxicity)

water dilution
↓



dried
→



highly stable against air/oxygen

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paste or powder forms and thermally stable
over process temperature

AgNP/NSP consequently rendering the mitigation of the inherent toxicity of Ag-NP

台大醫學院骨科張志豪教授—2021
矽片銀具安全性--低細胞毒性/無基因毒性

PLOS ONE

RESEARCH ARTICLE

Composition of nanoclay supported silver nanoparticles in furtherance of mitigating cytotoxicity and genotoxicity

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Abstract

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Chih-Hao Chang, Yu-Hsuan Lee, Zhen-Hao Liao, Mark Hung-Chih Chen, Fu-Chou Peng, Jiang-Jen Lin. Composition of nanoclay supported silver nanoparticles in furtherance of mitigating cytotoxicity and genotoxicity. *PLOS ONE* 16(2): e0247571. <https://doi.org/10.1371/journal.pone.0247571>

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Data Availability Statement: All relevant data are within the manuscript and its Supporting Information files.

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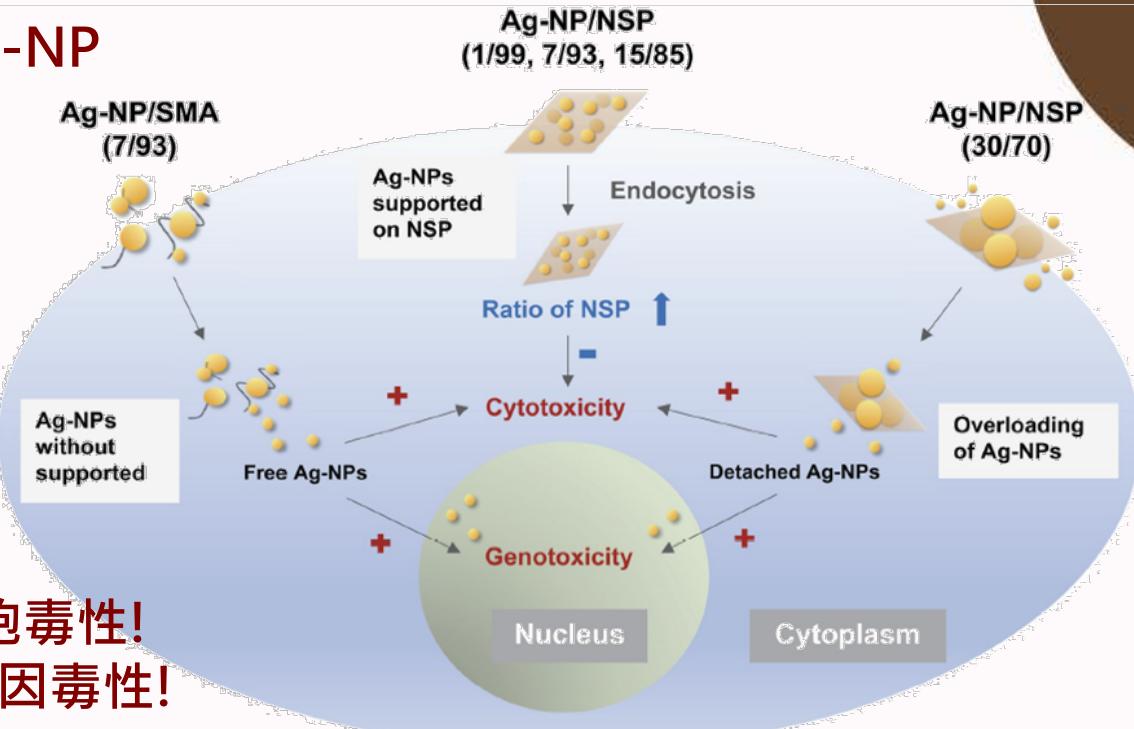


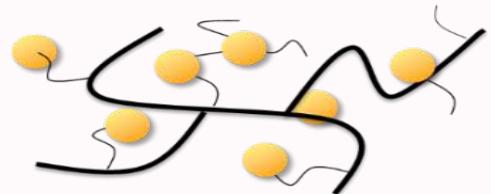
Fig 4. Conceptual illustration of the interactions between the hybrids, Ag-NP/SMA (7/93) or Ag-NP/NSP (ranging from 1/99–30/70) with cells.

- The supporting effect of NSP on Ag-NP : dependent on the weight ratio of 15/85 (Ag to NSP), for controlling adherence of AgNP-on-NSP, revealed by TEM direct observation.
- NSP may support Ag to mitigate the inherent toxicity of AgNP in cell toxicity and no genotoxicity.

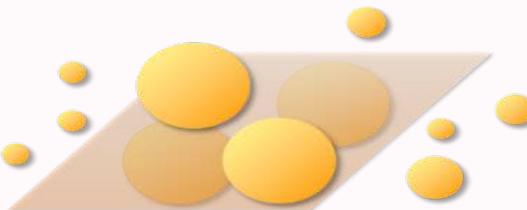
物理機制 – NSP supporting 銀粒子,阻止其進入細胞核/DNA,故沒有基因毒性!
(comparing SMA-polymer stabilized Ag and conventional nanoparticles usually
entering cells through various forms of endocytosis)

台大醫學院骨科張志豪教授

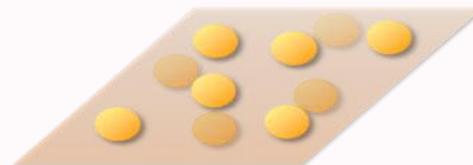
天然矽片載體效果--粒子不進入核細胞
矽片銀具安全性--低細胞毒性/無基因毒性



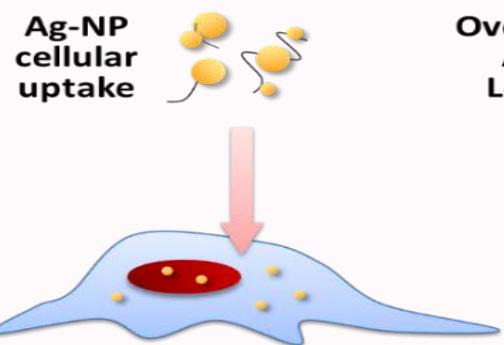
Ag-NP/SMA
(7/93)



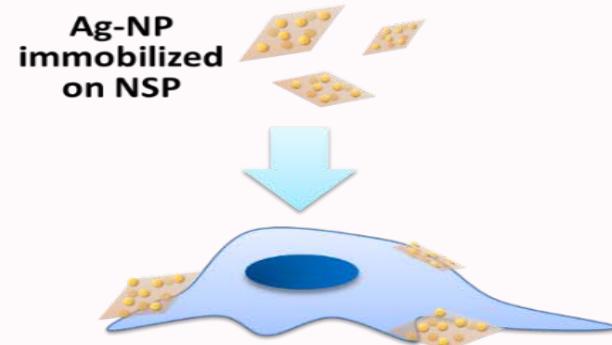
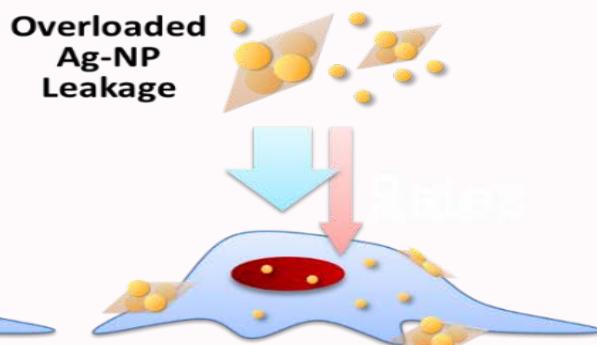
Ag-NP/NSP
(30/70) (50/50)



Ag-NP/NSP
(1/99) (7/93) (15/85)



Genotoxicity & Cytotoxicity

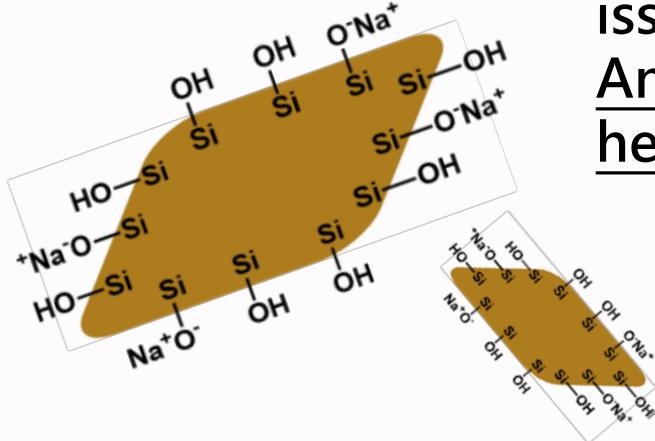


Non-toxic

Mitigating Cytotoxicity and Genotoxicity of Silver Nanoparticles 31 Chang/Lin, Composition of nanoclay supported silver nanoparticles in furtherance of mitigating cytotoxicity and genotoxicity, PLOS ONE , 2021,16, e0247531
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病毒 vs. 細菌 vs. 細胞 --- NSP physical interaction 之差異

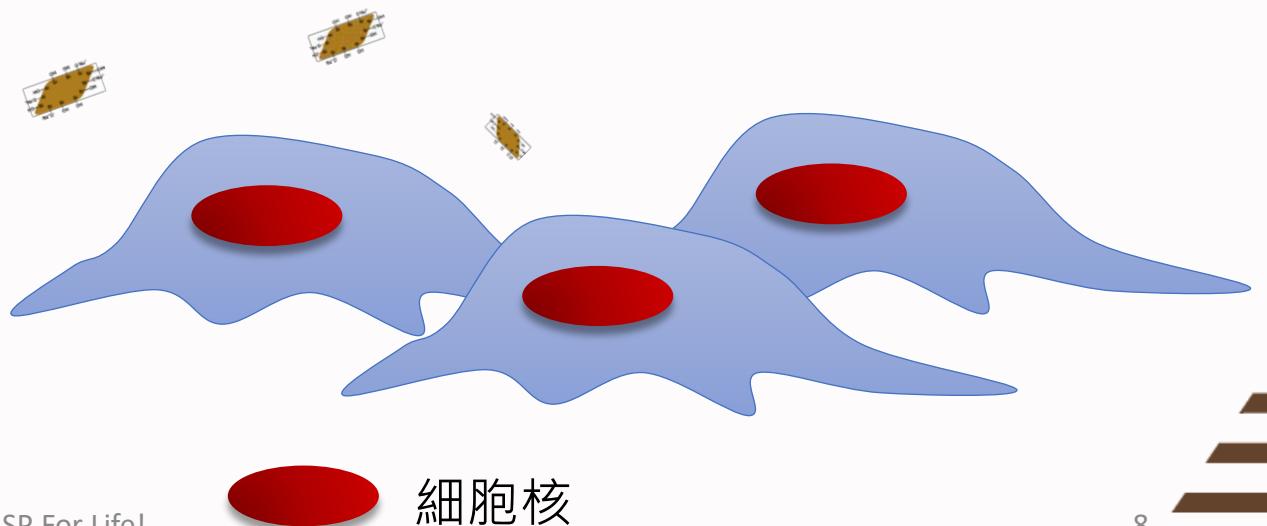


What will it happen when NSP contact with living cell?
Regarding to the toxicity of cytotoxicity and genotoxicity issue:

Answer: NSP-supported AgNP is not entering the cell nucli, hence causing none of genotoxicity.

物理機制 – NSP supporting 銀粒子,阻止其進入細胞核/DNA,故沒有基因毒性!

231 Chang/Lin, Composition of nanoclay supported silver nanoparticles in furtherance of **mitigating cytotoxicity and genotoxicity**, PLOS ONE , 2021,16, e0247531



抗菌除臭噴劑 Antimicrobial Spray (commercial product in Taiwan since 2009)



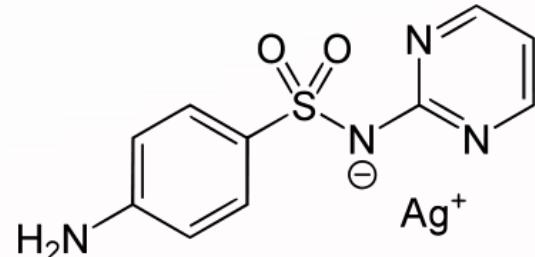
“矽片銀”之應用 - 抗菌性佳及傷口癒合快速

154. Chia-Yu Chu*, Fu-Chuo Peng, Ying-Fang Chiu, Hsing-Chuan Lee, Chien-Wen Chen, Jiun-Chiou Wei and Jiang-Jen Lin*, 2012.

Nanohybrids of Silver Particles Immobilized on Silicate Platelet for Infected Wound Healing, PLoS One, 7, e38360

比較市面最好之商標品 SS

Silver sulfadiazine (Silvadene)銀礦胺乳膏



Adverse effects(缺點): hypersensitivity(過敏), discoloration of the skin(皮膚變色) and silver accumulation in organs (器官殘留)... 傷口癒合可能變慢

台大矽銀



TAg

已開發: 1. 已於2014年取得台灣發明專利 第I 462754 號“親水
抗菌膜”to A.T.P. CO., LTD.)
2. 數項敷材產品已取得國家第一類醫療器材許可證並已於市面
上販售抗菌皮膚敷料(已獲藥字號燒燙傷藥膏)

Regarding NSP-Ag for inhibiting Ag (ion)-resistant bacteria (anti-MRSA)

144.Hong-Lin Su*, Siou-Hong Lin, Jiun-Chiou Wei, I-Chuan Pao, Shu-Her Chiao, Chieh-Chen Huang, Shinn-Zong Lin and Jiang-Jen Lin*, 2011. Novel Nanohybrids of Silver Particles on Clay Platelets for Inhibiting Silver-Resistant Bacteria, PLoS One, 6 · e21125

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Novel Nanohybrids of Silver Particles on Clay Platelets for Inhibiting Silver-Resistant Bacteria

Hong-Lin Su^{1,3*}, Siou-Hong Lin¹, Jiun-Chiou Wei², I-Chuan Pao¹, Shu-Her Chiao¹, Chieh-Chen Huang¹, Shinn-Zong Lin^{4,5,6}, Jiang-Jen Lin^{2,7*}

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THANK YOU

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