

Scientific References

Colloidal Silver & Hydrogen-Rich / Electrolyzed Water

A curated collection of peer-reviewed studies

This document compiles published, peer-reviewed scientific studies on the antimicrobial properties of colloidal silver and the antioxidant / anti-inflammatory effects of molecular-hydrogen-rich water (H₂). Studies are presented **as published**, including those with neutral or negative outcomes, so that the reader obtains a complete and honest picture of the current state of the science. The purpose of this document is **education and information only** — not a promise of treatment. These references concern the underlying materials, not the Argyros Nano product itself.

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Part A · Colloidal Silver — Antimicrobial Activity

A.1 Core antimicrobial evidence

1. Colloidal Silver as an Antiseptic: Two Opposing Viewpoints

Research Article · ResearchGate (2012)

Low concentrations of CS achieved antibacterial activity (MIC ≤ 5 µg/ml) against certain microbial species; preparations were non-toxic or of low toxicity.

<https://www.researchgate.net/publication/264458473>

2. Colloidal Silver as an Antimicrobial Agent: Fact or Fiction?

Journal of Wound Care · ResearchGate (2004)

Review: silver's multimodal mechanism carries a low risk of bacterial resistance; newer formulations better control ion release and systemic toxicity.

<https://www.researchgate.net/publication/8590102>

3. Efficacy of a Silver Colloidal Gel Against Selected Oral Bacteria in vitro

PMC6468711 · NCBI

Inhibited biofilm formation by *S. mutans* / *S. sanguis* / *S. salivarius* (caries bacteria). Colloidal silver was found less toxic than ionic silver, with good cell compatibility.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6468711/>

4. Exploring Metal Ions as Antimicrobial Agents in *Mycoplasma bovis*

PMC11767636 · NCBI (2025)

Colloidal silver showed the most effective activity, inhibiting 81.25% of isolates at 1.5 mg/L — outperforming conventional antibiotics.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11767636/>

A.2 Clinical applications — wounds, burns, infections

5. Topical Colloidal Silver for Recalcitrant Chronic Rhinosinusitis

PMC5905234 · NCBI

Clinical study of CS sinus rinses (0.015 mg/mL, 10 days): good safety profile, no major adverse events. Efficacy similar to antibiotics (not superior).

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5905234/>

6. Silver in Wound Care — Friend or Foe? A Comprehensive Review

PRS Global Open · LWW

In infected wounds, nanocrystalline silver dressings help in the early phase (2–3 weeks) by reducing bacterial load. A balanced, critical review.

<https://journals.lww.com/prsgo/fulltext/10.1097/gox.0000000000002390>

7. Nanocrystalline & Nanomolecular Silver: Antimicrobial/Anti-inflammatory Properties

PMC11662198 · NCBI

Clinical studies show accelerated healing and reduced inflammation vs. traditional treatments; action via biofilm inhibition and disruption of microbial cell functions.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11662198/>

8. Silver Hydrofiber Dressing on Burn Wound Healing: Meta-analysis

J Cosmetic Dermatology · Wiley (2023) — 11 RCTs, 794 patients

Meta-analysis: silver dressing (Aquacel-Ag) was more effective than silver sulfadiazine in burns, with faster healing and fewer dressing changes.

<https://onlinelibrary.wiley.com/doi/10.1111/jocd.15639>

9. Silver Dressings for Burn Wounds: Systematic Review (Cochrane-based)

PubMed 22030441 — 14 RCTs, 877 participants

OPPOSING FINDING (cited for honesty): the review concluded silver dressings were not clearly better than non-silver in preventing infection — the data remain conflicting.

<https://pubmed.ncbi.nlm.nih.gov/22030441/>

10. Multidrug-Resistant Pathogens in Wound Infections: Systematic Review

PMC11111159 · NCBI

Silver dressings showed consistent in-vitro antimicrobial activity against 10 multidrug-resistant organisms (MDROs) over 7 days — a promising tool against resistance.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11111159/>

Part B · Hydrogen-Rich / Electrolyzed Water

B.1 Antioxidant activity & general health

11. Antioxidant Effects of Continuous Intake of Electrolyzed Hydrogen Water

Heliyon · ScienceDirect / PMC9712568 (2022)

Healthy adults (n=64) drinking >500 mL/day EHW for >6 months had lower d-ROMs (oxidative stress marker) vs. controls (n=470).

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9712568/>

12. Health Benefits of EHW: Antioxidant & Anti-Inflammatory Effects

PMC10967432 · NCBI

Antioxidant capacity attributed to dissolved H₂ and a small amount of platinum nanoparticles from the electrodes; H₂ can cross the blood-brain barrier.

<https://pmc.ncbi.nlm.nih.gov/articles/PMC10967432/>

13. An Investigation into ERW in Overall Health & Wellness

ResearchGate (2023)

ERW scavenges reactive oxygen species (ROS) and protects DNA from oxidative damage — a mechanism linked to aging and chronic disease.

<https://www.researchgate.net/publication/371721390>

B.2 Metabolic syndrome, diabetes & fatty liver (NAFLD)

14. Health Effects of EHW for Metabolic Syndrome — 3-Month RCT

PMC10886336 · NCBI (Kochi University)

Randomized, double-blind, placebo-controlled (181 subjects): reductions in HbA1c, glucose, urinary 8-OHdG and 8-isoprostane in the EHW group; greater waist reduction with high physical activity.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10886336/>

15. Electrolyzed H₂-Rich Water for Oxidative Stress & Insulin Resistance

Diabetology International · Multicenter RCT (2021)

Multicenter, prospective, double-blind RCT: suppression of oxidative stress and improved insulin resistance.

[https://www.cell.com/heliyon/fulltext/S2405-8440\(22\)03141-3](https://www.cell.com/heliyon/fulltext/S2405-8440(22)03141-3)

16. 24-Week High-Concentration HRW on Metabolic Syndrome

DMSO · Tandfonline — RCT

Long-term (24-week) high-concentration HRW: improved body composition, lipid profile and inflammation markers in men and women with metabolic syndrome.

<https://www.tandfonline.com/doi/full/10.2147/DMSO.S240122>

17. Biological Effects of Hydrogen Water on Subjects with NAFLD: RCT

IJMS / PMC9598482 — 8 weeks, placebo-controlled

Beneficial trends in weight (~1 kg) and BMI; well tolerated; a trend toward improved lipid profile. (Many findings did not reach statistical significance — reported accurately.)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9598482/>

18. HRW Reduces Liver Fat & Improves Enzyme Profiles in NAFLD

PubMed 30982748 — RCT pilot, crossover

Pilot RCT: HRW may act as an adjuvant approach for mild-to-moderate NAFLD; larger studies are needed to confirm.

<https://pubmed.ncbi.nlm.nih.gov/30982748/>

19. HRW Ameliorates Metabolic Disorder via Gut Microbiota (Impaired Fasting Glucose)

PMC10295603 · NCBI — RCT

In patients with impaired fasting glucose, HRW was associated with reduced oxidized LDL, improved lipids and modification of the gut microbiome.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10295603/>

20. Hydrogen/Oxygen Inhalation for NAFLD: Placebo-Controlled Trial

PMC9279585 · NCBI — 13 weeks, 43 subjects

H₂/O₂ inhalation improved serum lipids and liver enzymes; mechanism explored via hepatocyte autophagy.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9279585/>

B.3 Neurodegenerative disease — Parkinson's (mixed results)

Honesty note: the data for Parkinson's disease are **conflicting**. Smaller studies showed benefit, while the largest multicenter trial did not confirm a statistically significant effect. Both sides are presented.

21. Pilot Study of H₂ Therapy in Parkinson's Disease (RCT)

Movement Disorders 2013 · via BMC Neurology

POSITIVE: drinking 1,000 mL H₂-water for 48 weeks significantly improved ($p < 0.05$) the total UPDRS score of patients on levodopa.

<https://link.springer.com/article/10.1186/s12883-016-0589-0>

22. Randomized Double-Blind Multicenter Trial of H₂ Water for Parkinson's

Movement Disorders 2018

NEUTRAL / NEGATIVE: the largest multicenter trial showed no significant benefit — a reminder that the evidence is not definitive.

<https://parkinsonsnewstoday.com/news/trial-fails-show-benefit-hydrogen-enriched-water-parkinsons-disease/>

23. H₂ Inhalation for Parkinson's: Pilot RCT

PMC8519836 · NCBI — 20 participants, 16 weeks

NEUTRAL: no significant difference in MDS-UPDRS between H₂ and placebo — small sample, larger studies needed.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8519836/>

B.4 Athletic performance, fatigue & muscle recovery

Note: results are largely positive but often from small samples; some studies report conflicting findings regarding physical performance.

24. 8-Day HRW on Muscular Endurance & Fatigue Recovery in Resistance Training

Frontiers in Physiology (2024) — RCT, double-blind, crossover, 18 men

Intake of 1,920 mL/day HRW for 7 days: support for muscular endurance and recovery; H₂ reduces post-exercise blood lactate and subjective fatigue.

<https://www.frontiersin.org/journals/physiology/articles/10.3389/fphys.2024.1458882/full>

25. HRW & Muscle Recovery in Elite Fin Swimmers

PMC11046232 · NCBI — RCT, double-blind, placebo, crossover

Across two strenuous sessions in one day: H₂ supported muscle performance, reduced muscle-damage markers (creatinase kinase) and soreness up to 24 h.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC11046232/>

26. Acute HRW on Aerobic & Anaerobic Exercise Responses

PMC10757640 · NCBI — RCT, double-blind, crossover

BALANCED FINDING: the literature includes conflicting results on physical performance; H₂ scavenges ROS and may reduce oxidative muscle fatigue.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10757640/>

B.5 Skin — aging, UV, dermatitis (mainly pilot studies)

Important: skin data come mainly from **small pilot studies** and animal models. They are encouraging but **not a proven treatment**; larger RCTs are required.

27. Progress in the Application of Molecular Hydrogen in Medical Skin Cosmetology

Clin Cosmet Investig Dermatol · Dovepress / PMC11887501

Review: HRW reduces oxidative stress and inflammation, with improvement in atopic dermatitis, acne and UV-induced pigmentation; action via NF-κB and Nrf2 pathways.

<https://pmc.ncbi.nlm.nih.gov/articles/PMC11887501/>

28. Pilot Study: Hydrogen-Water Bathing on Atopic Dermatitis in Humans

J Dermatol Sci (Clinical) · ScienceDirect (2023) — 6 patients

Pilot study: hydrogen-water bathing showed a possible therapeutic benefit in atopic dermatitis. The authors explicitly state that larger-sample RCTs are needed.

<https://www.sciencedirect.com/science/article/pii/S2212958823000848>

B.6 Safety & limits — mandatory reading

29. Electrolyzed-Reduced Water Review II: Safety Concerns

IJMS · MDPI / PMC9736533 (2022)

CRITICAL: the pH of ERW must not exceed 9.8 (risk of hyperkalemia). People with impaired kidney function should avoid use without medical supervision. Possible metal leaching from degraded electrodes.

<https://www.mdpi.com/1422-0067/23/23/14508>

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