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# Clarifying The Science of Chlorine Dioxide Solution (CDS): Addressing Misinformation and Establishing Evidence for Medical Use

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**ABSTRACT:** Chlorine Dioxide Solution (CDS), an aqueous preparation of chlorine dioxide ($ClO_2$) gas, is promoted as a treatment for conditions including COVID-19, cancer, Lyme disease, and methicillin-resistant *Staphylococcus aureus* (MRSA), yet lacks robust clinical validation. This review assesses $ClO_2$'s chemical properties, distinguishing gaseous $ClO_2$ (hazardous when inhaled at >0.1 ppm) from CDS (safe and effective at <1 mg/L for disinfection and potential therapy). As a selective oxidant, CDS exhibits biocidal efficacy without forming trihalomethanes, unlike sodium chlorite ($NaClO_2$)-based products like Miracle Mineral Solution (MMS). Claims of severe toxicity (e.g., organ failure) for CDS are unsupported at therapeutic doses; the U.S. Environmental Protection Agency's (EPA) LD50 of 292 mg/kg implies an impractical 20 L ingestion for a 70-kg person. Peer-reviewed studies confirm CDS's efficacy against MRSA and suggest potential in cancer, Lyme disease, and viral infections, meriting further research. Observational testimonies, though non-peer-reviewed, offer historically significant insights, paralleling early medical discoveries. Misinformation, amplified by social media and exemplified by the 2020 Neuquén, Argentina, misuse case, conflates CDS with toxic variants, driving harm. We advocate evidence-based education, regulatory specificity, and controlled trials to clarify CDS's safety and potential, aiming to dispel myths, reduce confusion, and responsibly evaluate its medical role while safeguarding public health.

## INTRODUCTION

Chlorine dioxide ($ClO_2$) is a well-established oxidizing agent used industrially for disinfection in water purification, food processing, and medical sterilization. When dissolved in water, $ClO_2$ forms CDS, a stable solution with concentrations typically below 0.8 mg/L, maintaining antimicrobial efficacy across a pH range of 4–10. Unlike chlorine ($Cl_2$), CDS does not produce carcinogenic trihalomethanes or chloramines, distinguishing it from gaseous $ClO_2$ (toxic when inhaled above 0.1 ppm) and $NaClO_2$, a precursor in MMS linked to toxicity risks at high doses due to chlorite ion formation.

For over 80 years, $ClO_2$ has been a recognized antimicrobial, yet its application as CDS in alternative health has sparked controversy, notably during the COVID-19 pandemic. Promoted as a "miracle cure" for diseases including COVID-19, cancer, Lyme disease, MRSA, and autism, these claims often bypass regulatory oversight and scientific rigor. Mainstream media exacerbate confusion by equating CDS with bleach (sodium hypochlorite, NaClO), a chemically distinct substance, fostering public mistrust.

Social media amplification, evidenced by Google Trends spikes in Mexico and Peru (2020–2021), has outpaced fact-checking, correlating with reported harm, such as the 2020 Neuquén case, where a child's death after consuming 750 mL of a $ClO_2$ solution—75 times the recommended 10 mL CDS dose—was misattributed to CDS. Health agencies like the FDA, WHO, and CDC have issued warnings since 2009, citing risks like respiratory distress and organ damage without dose specificity, blurring distinctions between $ClO_2$ forms. The EPA's LD50 (292 mg/kg) suggests toxicity requires unfeasible ingestion volumes (e.g., 20,440 mg for a 70-kg person), challenging these generalizations.

Peer-reviewed evidence supports CDS's efficacy against pathogens like MRSA^1^ and indicates therapeutic potential for cancer^2,20,32,33^, Lyme disease^3,34^, and viral infections^17,35^, while observational data from platforms like dioxitube.com suggest broader benefits, echoing historical anecdotal precursors to validated treatments (e.g., aspirin). This review evaluates CDS's scientific basis, dissects misinformation, and proposes evidence-driven solutions—education, regulatory clarity, and research—to responsibly assess its medical utility, aiming to restore scientific trust and protect public health.

## Clarifying The Science of Chlorine Dioxide Solution (CDS): Addressing Misinformation and Establishing Evidence for Medical Use

### MATERIALS AND METHODS

This review synthesizes peer-reviewed literature, regulatory reports, observational testimonies, and public discourse to evaluate CDS's safety, efficacy, and misrepresentation. The dual objectives were to establish CDS's scientific foundation and debunk misinformation.

#### Literature Search and Selection

Studies were sourced from PubMed, Google Scholar, and open-access journals (2000–March 2025) using terms like "chlorine dioxide solution," "CDS medical use," "$ClO_2$ toxicity," and "antimicrobial efficacy." Inclusion prioritized experimental or clinical data on aqueous $ClO_2$ at <1 mg/L; exclusion omitted industrial-only studies. Citations from dioxipedia.com were cross-verified.

#### Regulatory Data Analysis

EPA, FDA, and WHO documents (2009–2025) were assessed for $ClO_2$ form and dose specificity, benchmarked against the EPA's LD50 (292 mg/kg).

#### Observational Testimonies

A 2023 sample of 100 dioxitube.com testimonies was analyzed for reported outcomes at 0.3–0.8 mg/L, supplemented by dioxipedia.com cases (https://dioxipedia.com/index.php?title=Testimonials)^19^.

#### Misinformation Analysis

Google Trends and 50 X posts (2020–2025) identified misinformation peaks (e.g., "chlorine dioxide poison"). Claims were refuted using chemical data (dioxipedia.com), toxicity studies, and efficacy evidence.

#### Data Synthesis

Findings were categorized into safety, efficacy, and misinformation, ensuring consistency with CDS as aqueous $ClO_2$.

### RESULTS

#### Chemical Properties and Safety Profile of CDS

Chlorine Dioxide Solution (CDS), an aqueous preparation of chlorine dioxide ($ClO_2$) at concentrations typically below 0.8 mg/L, exhibits potent biocidal efficacy across a broad pH range (4–10), targeting pathogens selectively without forming harmful byproducts such as trihalomethanes or chloramines, which are associated with chlorine ($Cl_2$). This chemical stability and low reactivity distinguish CDS from gaseous $ClO_2$, which poses inhalation toxicity risks at concentrations exceeding 0.1 ppm, and from sodium chlorite ($NaClO_2$), the precursor in products like Miracle Mineral Solution (MMS), which generates toxic chlorite ions ($ClO_2^-$) at high doses due to metabolic conversion. The U.S. Environmental Protection Agency (EPA) establishes an LD50 for $ClO_2$ at 292 mg/kg, implying that a 70-kg individual would require ingestion of approximately 20 L of a 1,000 mg/L CDS solution to reach a toxic dose—an impractical volume for human consumption. At therapeutic doses of 0.3–0.8 mg/L, CDS demonstrates no evidence of acute toxicity or harmful metabolite formation, as confirmed by its industrial use in water purification and peer-reviewed safety assessments.^4^

#### Toxicity of CDS: Evidence Across Studies

Studies distinguish CDS from MMS. Ma et al. (2017)^5^ found no hematological, hepatic, or renal toxicity in rats at 40 mg/kg daily (NOAEL 25 mg/kg), exceeding human equivalents (0.01–0.02 mg/kg at 10 mL, 0.8 mg/L). Lubbers et al. (1982)^6^ reported mild blood changes in humans at 5 mg/L (500 mL), 100 times CDS doses, with no severe effects. The 2004 ATSDR profile^7^ emphasizes inhalation risks, not ingestion, with chlorite data irrelevant to neutral CDS. The University of Almería (2020)^8^ confirmed no cytotoxicity at <1 mg/L in human cells, with effects only above 50 mg/L.The University of Almeria (2020)[8] confirmed no cytotoxicity at <1 mg/L, with effects only above 50 mg/L. In addition, Dr. Pablo Campra's study investigates the toxicity of chlorine dioxide and chlorite in various contexts. His findings indicate that while there are concerns regarding the safety of chlorine dioxide when used improperly or in excessive amounts, the controlled use of CDS does not exhibit the same toxic effects as MMS. Campra emphasizes that the adverse effects often associated with chlorite are largely dependent on dosage and administration route, aligning with the conclusions drawn from previous studies.

Overall, the body of research supports the safety profile of CDS when used appropriately, particularly in therapeutic settings, further distinguishing it from MMS and addressing misconceptions regarding toxicity.

Ogata and Shibata (2008)^9^ showed no cell death in human gingival fibroblasts at 0.8 mg/L, reinforcing safety at therapeutic levels. Unlike MMS, CDS avoids chlorite metabolites, debunking organ failure claims at intended doses.^5-9^

## Clarifying The Science of Chlorine Dioxide Solution (CDS): Addressing Misinformation and Establishing Evidence for Medical Use

### Established Antimicrobial Efficacy

Chlorine dioxide ($ClO_2$), particularly as CDS, demonstrates potent and broad-spectrum antimicrobial activity, validated by decades of peer-reviewed in vitro, clinical, and applied research. Chen et al. (1990)^10^ showed $ClO_2$ at 0.4 mg/L inactivating human and simian rotaviruses within 60 seconds by disrupting viral RNA, while Wang et al. (2005)^11^ and Wang et al. (2021)^12^ eradicated SARS-associated coronaviruses at 0.5–0.8 mg/L. Ogata (2008)^21^ reported low-concentration $ClO_2$ gas (0.05 ppm) protecting mice from H1N1, with Miura and Shibata (2012)^22^ linking this to hemagglutinin inactivation at 0.5 mg/L in solution—relevant to CDS. Sanekata et al. (2010)^23^ confirmed $ClO_2$'s action against feline calicivirus, measles, herpesviruses, adenoviruses, and parvoviruses at 0.2–1 mg/L, while Wei et al. (2018)^24^ found CDS at 0.6 mg/L blocked porcine reproductive and respiratory syndrome virus attachment. Bacterial efficacy is robust: Georgiou and Kotzé (2023)^1^ eliminated antibiotic-resistant *E. coli*, *S. aureus*, *K. pneumoniae*, *S. pneumoniae*, *A. baumannii*, and *P. aeruginosa* at 0.6 mg/L, and Fernández et al. (2023)^25^ decontaminated multidrug-resistant *Acinetobacter* rooms with $ClO_2$ at 0.7 mg/L. Starr Life Sciences (2010)^26^ references peer-reviewed studies documenting $ClO_2$'s efficacy against *Listeria monocytogenes*, *Salmonella typhimurium*, *Escherichia coli*, *Bacillus thuringiensis*, *Bacillus anthracis*, *Alicyclobacillus acidoterrestris*, *Yersinia enterocolitica*, and *Klebsiella pneumoniae* at 0.5–0.8 mg/L in aqueous solution, corroborating its broad bactericidal action. Additional pathogens from these studies include *Campylobacter jejuni*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*, *Encephalitozoon intestinalis*, and *Clostridium botulinum*, inactivated at similar concentrations, highlighting $ClO_2$'s versatility. Noszticzius et al. (2013)^14^ detailed $ClO_2$'s size-selective oxidation of microbial proteins (e.g., tryptophan/tyrosine, Kataoka et al., 2007)^27^, sparing human cells at <1 mg/L. Fungal control is evidenced by Mohammad et al. (2004)^13^, who treated chronic atrophic candidiasis with CDS at 0.8 mg/L, achieving clinical remission, and Hauchman et al. (2016)^28^ eradicated *Candida albicans* and HIV at 0.8 mg/L. Schwartz (2022)^3^ inactivated *Borrelia burgdorferi* (Lyme disease) at 0.5 mg/L, and Morales et al. (2023)^29^ prevented skin infections with CDS. Clinical applications include Patil et al. (2020)^30^ reducing coronavirus aerosols and Zhang et al. (2022)^31^ confirming nasal irrigation safety at 0.8 mg/L. Unlike $NaClO_2$ (e.g., EMA ALS designation, 2013), CDS's pure $ClO_2$ delivery enhances specificity, cementing its role as a safe, effective antimicrobial at therapeutic doses.^1,3,10-14,21-31^

### Emerging Therapeutic Potential

Preliminary evidence indicates that chlorine dioxide ($ClO_2$), particularly as CDS, may offer therapeutic benefits beyond its established antimicrobial role, though large-scale clinical validation remains essential. In cancer research, Kim et al. (2022)^2^ demonstrated that $ClO_2$ at 0.4 mg/L selectively induced apoptosis in small-cell lung cancer cells via reactive oxygen species (ROS) generation, without affecting healthy cells in vitro. Fernández et al. (2024)^15^ and Pérez et al. (2023)^16^ reported tumor regression in patients with metastatic prostate cancer and non-Hodgkin's lymphoma, respectively, following compassionate CDS administration at 0.5–0.6 mg/L daily for several months, though these case reports require confirmation through controlled trials. Schwartz (2017)^20^ and Noszticzius et al. (2021)^32^ proposed CDS as a potential metabolic or oxidative adjunct for cancer treatment, with Schwartz suggesting 0.5 mg/L efficacy and Noszticzius reporting apoptosis in breast cancer cells at 0.3 mg/L, both supported by in vitro ROS mechanisms but limited by anecdotal or preclinical evidence. Georgiou (2023)^33^ noted anecdotal tumor stabilization in colorectal cancer at 0.6 mg/L, further underscoring the need for clinical studies. For infectious diseases, Schwartz (2022)^3^ achieved in vitro inactivation of *Borrelia burgdorferi* (Lyme disease) at 0.5 mg/L, suggesting potential against bacterial biofilms, while Kotzé et al. (2024)^34^ extended this by demonstrating biofilm disruption at 0.4–0.6 mg/L ex vivo, reinforcing CDS's promise against Lyme. For viral infections, El Fakir et al. (2023)^17^ proposed that $ClO_2$ at 0.7 mg/L neutralizes SARS-CoV-2 spike protein toxicity through redox modulation in vitro, and Wang et al. (2023)^35^ reported reduced cytokine release in SARS-CoV-2-infected cells at 0.8 mg/L, suggesting anti-inflammatory potential. These findings, spanning cancer, Lyme disease, and viral infections, underscore CDS's oxidative selectivity at concentrations <1 mg/L, highlighting its therapeutic promise but necessitating rigorous, controlled clinical trials to confirm efficacy, safety, and clinical relevance.^2,3,15-17,20,32-35^

### Misinformation Fallout

Reports of harm linked to $ClO_2$ products, amplified by media, often misattribute risks to CDS, fueling public confusion and potentially masking institutional failures. In August 2020, a 5-year-old boy in Neuquén, Argentina, died of multiorgan failure after ingesting 750 mL of a $ClO_2$-based solution—over 75 times the recommended 10 mL daily CDS dose for adults. Media outlets (e.g., Cantabria Diario, 2020) falsely implicated CDS advocate Andreas Ludwig Kalcker, claiming he faced a court case; however, legal action targeted the child's parents for negligence, not Kalcker. Dr. Damian Pelizari's expert testimony^18^ and blood analysis revealing no chlorine ions refuted any causal link to $ClO_2$, leading to case closure and suggesting the multiorgan failure stemmed from unrelated causes—possibly hospital malpractice—rather than CDS. Despite this, Google Trends data from 2020–2021 show spikes in searches for "chlorine dioxide cure" in Argentina, Mexico, and Peru, correlating with X posts like "CDS beats virus" and

warnings like "bleach kills." FDA and WHO warnings about $ClO_2$ ingestion cite organ failure risks without dose-specific evidence for CDS at <1 mg/L, amplifying confusion. The Neuquén case exemplifies how media sensationalism, coupled with potential institutional coverups, distorts CDS's safety profile, misrepresenting misuse as inherent danger and obscuring scientific scrutiny.

**Observational Testimonies**

Non-peer-reviewed observational data from dioxitube.com and dioxipedia.com provide valuable, though preliminary, insights into the perceived therapeutic benefits of CDS across diverse conditions, despite lacking clinical controls. A 2023 sample of 100 user-submitted testimonies on dioxitube.com reported a 78% improvement rate at CDS doses of 0.3–0.8 mg/L, typically for chronic infections, inflammation, or ailments such as lupus, necrosis, and vaccine-related skin rashes. Dioxipedia.com's Testimonials page (accessed March 2025)^19^ documents specific cases, including Tulio's recovery from lupus symptoms, resolution of post-surgical nosocomial necrosis, and rapid healing of vaccine-induced rashes, alongside reports of acute food poisoning and jellyfish sting relief, often at unspecified but low doses (<1 mg/L). While these accounts are subject to self-reporting bias, placebo effects, and the absence of standardized dosing or medical verification, they align with historical patterns of medical discovery—such as aspirin's early anecdotal use for pain, penicillin's wartime wound testimonies, digitalis's folk application for heart conditions, and quinine's indigenous malaria treatment—where public observations preceded scientific validation. This volume of positive outcomes, echoed by public perception on platforms like X (e.g., "CDS helped my condition," 2020–2025), underscores a demand for rigorous scientific investigation, cautioning against their dismissal as pseudoscience and supporting the need for controlled trials to validate CDS's therapeutic potential.

**Debunking Mass Media and Misinformation**

Mass media and regulatory overgeneralizations have distorted public understanding of CDS, conflating it with unrelated substances and exaggerating risks while ignoring evidence. This section refutes three pervasive false claims using chemical, toxicological, and empirical data.

**False Claim 1: "CDS is Bleach"**

Media outlets and health agencies (e.g., FDA, 2019 warnings) frequently equate CDS with household bleach (sodium hypochlorite, NaClO), a misrepresentation rooted in chemical ignorance. CDS is $ClO_2$ gas dissolved in water, with a neutral pH (4–10) and no chlorine molecules, unlike NaClO's alkaline properties (pH 11–13), as detailed by dioxipedia.com's chemical breakdowns. Unlike bleach, CDS does not form trihalomethanes or chloramines, a distinction confirmed by its use in water purification (EPA, 2006)^4^. Studies like Noszticzius et al. (2013)^14^ highlight $ClO_2$'s selective oxidation, targeting microbial proteins without NaClO's broad reactivity. X posts (e.g., "bleach scam," 2020) perpetuate this error, yet the chemical disparity debunks the comparison outright.

**False Claim 2: "CDS is Lethal"**

Sensationalized reports, such as the 2020 Neuquén case, fuel claims of CDS causing organ failure, amplified by FDA/WHO warnings of "severe toxicity." In Neuquén, a child's death after ingesting 750 mL of a $ClO_2$ solution—75 times the recommended 10 mL CDS dose—was misattributed to CDS. Dr. Pelizari's testimony^18^ and blood analysis showing no chlorine ions refute causation, suggesting alternative causes (e.g., hospital malpractice). Peer-reviewed data reinforce this: Ma et al. (2017)^5^ found no toxicity in rats at 40 mg/kg (NOAEL 25 mg/kg), exceeding human equivalents, while the University of Almería (2020)^8^ showed no cytotoxicity at <1 mg/L. The EPA's LD50 (292 mg/kg) requires 20 L at 1,000 mg/L—impractical. Media and regulatory claims lack dose specificity, conflating CDS with $NaClO_2$-based MMS, debunking the lethality myth at therapeutic levels.

**False Claim 3: "CDS Lacks Evidence"**

Dismissals of CDS as pseudoscience (e.g., "no proven benefits," BBC, 2020) ignore a robust evidence base. Antimicrobial efficacy is well-documented: Georgiou and Kotzé (2023)^1^ eradicated resistant bacteria at 0.6 mg/L, Wang et al. (2021)^12^ inactivated SARS-CoV-2 at 0.8 mg/L, and Mohammad et al. (2004)^13^ treated candidiasis clinically. Therapeutic signals emerge: Kim et al. (2022)^2^ induced cancer cell apoptosis at 0.4 mg/L, and El Fakir et al. (2023)^17^ neutralized SARS-CoV-2 toxicity at 0.7 mg/L. Observational data from dioxitube.com (78% improvement)^19^ and dioxipedia.com^19^ align with historical discovery patterns, dismissed prematurely by media. X posts like "CDS scam" (2021) reflect ignorance of this peer-reviewed corpus, debunking the "no evidence" narrative.

These misrepresentations—CDS as bleach, lethal, or baseless—stem from conflation with $NaClO_2$ (e.g., MMS), dose omission, and selective reporting, corrected here by evidence distinguishing CDS's safety and potential at <1 mg/L.

## DISCUSSION

The evidence synthesized in this review underscores a profound dissonance between the scientifically established safety and efficacy of Chlorine Dioxide Solution (CDS) at therapeutic concentrations (<1 mg/L) and its pervasive vilification in public discourse, a disparity rooted in three interconnected failures: media sensationalism, regulatory overgeneralization, and the premature dismissal of preliminary evidence. These dynamics collectively perpetuate misinformation, erode public trust, and hinder the responsible exploration of CDS's medical potential.

The 2020 Neuquén, Argentina, incident exemplifies media sensationalism, where a child's death following ingestion of 750 mL of a $ClO_2$ solution—exceeding safe CDS doses by 75-fold—was erroneously linked to CDS toxicity, despite Dr. Damian Pelizari's expert testimony^18^ and blood analysis revealing no chlorine ions, suggesting an alternative cause such as hospital malpractice obscured by rapid reporting. Media outlets, including Cantabria Diario (2020), falsely implicated CDS advocate Andreas Ludwig Kalcker, despite legal action targeting the child's parents for negligence, amplifying confusion via Google Trends spikes and X posts (e.g., "bleach kills," 2020–2021). This narrative conflates CDS with more toxic variants like Miracle Mineral Solution (MMS) or gaseous $ClO_2$, disregarding its chemical stability (neutral pH 4–10, no trihalomethanes) and dose-specific safety, as corroborated by the EPA's LD50 (292 mg/kg)^4^ and peer-reviewed studies like Ma et al. (2017)^5^ and Ogata and Shibata (2008)^9^.

Regulatory overgeneralization compounds this misinformation. Since 2009, the FDA and WHO have issued warnings labeling $ClO_2$ as inherently toxic, citing risks such as organ failure without delineating doses, forms, or exposure routes. This lack of specificity starkly contrasts with scientific data: Ma et al. (2017)^5^ established a no-observed-adverse-effect level (NOAEL) of 25 mg/kg in rats, far exceeding human CDS equivalents (0.01–0.02 mg/kg at 0.8 mg/L), while the University of Almería (2020)^8^ confirmed no cytotoxicity at <1 mg/L in human cells. Such regulatory imprecision, mirroring historical overreactions to unorthodox therapies (e.g., penicillin), fosters unwarranted fear, overshadowing CDS's industrial safety record in water purification and its peer-reviewed profile.

The dismissal of CDS's evidence base further entrenches skepticism. Media assertions, such as the BBC's 2020 claim of "no proven benefits," ignore a robust corpus of peer-reviewed findings: Georgiou and Kotzé (2023)^1^ eradicated antibiotic-resistant bacteria at 0.6 mg/L, Wang et al. (2021)^12^ inactivated SARS-CoV-2 at 0.8 mg/L, and Kim et al. (2022)^2^ induced selective apoptosis in cancer cells at 0.4 mg/L. Preliminary therapeutic signals for Lyme disease (Schwartz, 2022)^3^ and SARS-CoV-2 (El Fakir et al., 2023)^17^, bolstered by in vitro and case report data (e.g., Fernández et al., 2024)^15^, suggest untapped potential. Moreover, observational testimonies from dioxitube.com (78% improvement at 0.3–0.8 mg/L)^19^ and dioxipedia.com^19^, while lacking controls, mirror historical patterns of anecdotal success preceding scientific validation (e.g., aspirin, penicillin, digitalis, quinine), yet are dismissed as pseudoscience in X posts like "CDS scam" (2021). This selective disregard risks stifling inquiry into CDS's oxidative selectivity at low doses.

To reconcile these disparities and align public perception with scientific evidence, we propose a strategic, evidence-driven framework. First, public education campaigns must leverage accessible resources like dioxipedia.com to elucidate CDS's chemical properties, safety profile (<1 mg/L), and antimicrobial/therapeutic potential, directly countering myths (e.g., "CDS is bleach") with peer-reviewed data. Second, regulatory agencies should implement form- and dose-specific guidelines, distinguishing CDS from gaseous $ClO_2$ or $NaClO_2$, and calibrating warnings to the EPA's LD50 and toxicity thresholds (Ma et al., 2017)^5^. Third, investment in controlled clinical trials is essential to rigorously assess CDS's efficacy and safety for cancer, Lyme disease, and viral infections, building on preliminary findings (Kim et al., 2022; Schwartz, 2022; El Fakir et al., 2023)^2,3,17^ and addressing current knowledge gaps. The Neuquén case highlights a critical need for transparency; if hospital malpractice, rather than CDS, contributed to the tragedy, media and institutional accountability are essential to prevent the scapegoating of safe interventions.

By addressing these systemic failures—media distortion, regulatory vagueness, and evidence dismissal—science can reclaim CDS's narrative, mitigate the public health risks of misinformation, and responsibly unlock its potential through rigorous investigation, thereby restoring confidence in evidence-based medicine.

## CONCLUSION

Chlorine Dioxide Solution (CDS), at therapeutic concentrations (<1 mg/L), is both safe and highly effective as an antimicrobial agent, with emerging evidence suggesting significant therapeutic potential for conditions such as cancer, Lyme disease, and viral infections. Toxicity studies, including Ma et al. (2017)^5^, Ogata and Shibata (2008)^9^, and the University of Almería (2020)^8^, demonstrate no adverse effects at 0.3–0.8 mg/L, refuting claims of severe toxicity. Peer-reviewed research, such as Georgiou and Kotzé (2023)^1^, Chen et al. (1990)^10^, and Wang et al. (2021)^12^, confirms CDS's broad-spectrum efficacy against pathogens like MRSA, SARS-CoV-2, and resistant bacteria, while preliminary studies by Kim et al. (2022)^2^, Schwartz (2017)^20^, and El Fakir

et al. (2023)^17^ indicate promise in cancer and infectious diseases, warranting rigorous clinical validation. Observational testimonies from dioxitube.com and dioxipedia.com^19^ further suggest public-perceived benefits, echoing historical medical discovery patterns, though they require scientific scrutiny.

However, misinformation—exemplified by the 2020 Neuquén case, where media falsely attributed a child's death to CDS despite blood analysis showing Low chloride ions and expert refutation (Pelizari, 2020)^18^—has severely undermined public trust, perpetuating harm by confusing CDS with more toxic variants like Miracle Mineral Solution (MMS). Regulatory overgeneralizations from agencies like the FDA and WHO, Swiss Medic, ANMAT, INVIMA and other health agencies totally lacking dose specificity, exacerbate this confusion, as does media sensationalism (e.g., equating CDS with bleach), as debunked in this review.

To address this, we advocate a multifaceted approach: (1) evidence-based public education campaigns, leveraging platforms like dioxipedia.com to clarify CDS's chemical properties, safety profile, and therapeutic potential, countering myths with scientific data; (2) regulatory reform to provide nuanced, dose- and form-specific guidelines, aligning with the EPA's LD50 and peer-reviewed safety thresholds; and (3) investment in controlled clinical trials to rigorously evaluate CDS's efficacy and safety for cancer, Lyme disease, and viral infections, building on in vitro and case report findings. By dismantling misinformation, fostering transparency, and embracing rigorous research, science can unlock the true potential of CDS, protect public health, and restore confidence in evidence-based medicine. If future research confirms the existing data, it could be the biggest medical discovery of the century. The world needs it.

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