

WD-40 as a purported Cr(VI) neutralizer: experimental refutation and mechanistic explanation

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ABSTRACT

In the metalworking and paint industry, as SEEF B.V. has learned through contact with customers, WD-40 Multi-Use Product is sometimes used in the belief that it chemically reduces hexavalent chromium (Cr(VI)) to the considerably less toxic Cr(III), thereby “neutralizing” Cr(VI) contamination. As far as is known, this assumption has never been tested in a published study. This article examines the claim through two experiments: (1) exposure of already-dissolved Cr(VI) and of a characterized reference paint sample to increasing amounts of WD-40, analyzed using the validated diphenylcarbazide (DPC) color reaction and UV-Vis detection at 544 nm; and (2) direct exposure of solid Cr(VI) to WD-40. Neither experiment demonstrated a dose-dependent decrease in Cr(VI): for already-dissolved Cr(VI), recovery remained at 96.8%, and the reference paint sample showed no dose-response at all. Direct contact with solid Cr(VI) did produce a strongly reduced recovery (5.8%), but analysis of WD-40’s composition and of the experimental conditions identifies this as a solubility artifact: WD-40 is a water-insoluble mixture of aliphatic hydrocarbons containing no chemically reducing components, causing solid Cr(VI) to clump together in the oil phase rather than dissolve, thereby remaining outside the reach of the measurement. This is in contrast to recognized commercial Cr(VI) neutralizers. The results refute the assumption that WD-40 is an effective Cr(VI) neutralizer.

Keywords: hexavalent chromium; Cr(VI); WD-40; reduction chemistry; Cr(VI) neutralizer; DPC

1. Introduction

Hexavalent chromium (Cr(VI)) is a CMR substance (carcinogenic, mutagenic, reprotoxic) that occurs frequently in industrial applications such as paint, metalworking, welding, and surface treatment. Because of the health risks, industry has an ongoing need for practical means of reducing or eliminating Cr(VI) contamination to the non-toxic Cr(III).

SEEF B.V. regularly hears from customers in the metalworking and paint sectors that WD-40 Multi-Use Product is used for this purpose, in the belief that the product chemically reduces Cr(VI). This application appears to be based on informal knowledge passed on in practice: a systematic literature search found no published source that specifically describes or recommends WD-40 as a Cr(VI) reducing agent. Moreover, the assumption is at odds with the established chemistry of Cr(VI) reduction, which requires specific reducing components [1,2,3], components that are not present in the composition of WD-40 [4].

2. Theoretical framework

2.1 Cr(VI) reduction chemistry

The reduction of Cr(VI) to Cr(III) requires a suitable reducing component. According to the toxicological profile of chromium by the U.S. Agency for Toxic Substances and Disease Registry, reduction of Cr(VI) in water and soil occurs under the influence of organic material, ferrous iron (Fe²⁺), sulfide, and iron sulfide, particularly under acidic or anaerobic conditions [1]. Ascorbic acid has been experimentally confirmed as an effective reducing agent for Cr(VI) in aqueous solution [2], and ferrous sulfate is applied at pilot scale to reduce Cr(VI) in groundwater, followed by coagulation and filtration [3]. These components share a common characteristic: they are active electron donors, which makes them suitable reducing agents for Cr(VI) ions.

2.2 Composition of WD-40

According to the manufacturer’s safety data sheet, WD-40 Multi-Use Product consists of approximately 55–75 weight percent aliphatic hydrocarbons and petroleum base oil, supplemented with carbon dioxide as a propellant [4]. The product is expressly insoluble in water and contains no components known to act as a Cr(VI) reducing agent. On chemical grounds, therefore, no reducing effect on Cr(VI) is to be expected.

3. Materials and methods

3.1 Analytical method

In all experiments, Cr(VI) was determined using the diphenylcarbazide (DPC) color reaction, in which Cr(VI) forms a purple-red complex with 1,5-diphenylcarbazide under acidic conditions, which is quantified spectrophotometrically at 540–544 nm. This method is standardized in EPA Method 7196A [5] and in Standard Methods 3500-Cr B [6], and is validated and in routine use at SEEF B.V.

3.2 Experimental design

To distinguish a chemical effect from matrix influences, the effect of WD-40 was examined at two levels [7]: a pure Cr(VI) working solution (25 ppm), to which WD-40 was added (0–2 mL) after dissolution, and a characterized reference paint sample with a known Cr(VI) content, to which WD-40 was added (0–2 mL) prior to a complete, validated extraction procedure. This tests practical relevance, including matrix and film formation.

To investigate whether an observed effect is chemical in nature or related to solubility, solid (powdered) Cr(VI) was brought into direct contact with WD-40 and subsequently, without extraction chemistry, simply dissolved in water. This was additionally repeated at various volumes of WD-40 applied to solid Cr(VI), without a prior dissolution step [8].

4. Results

4.1 Dissolved Cr(VI) and reference paint sample

For an already-dissolved Cr(VI) solution (Table 1), the measured concentration after exposure to the highest tested amount of WD-40 remains nearly equal to the control: recovery 96.8%, within the normal measurement variation of the method. The blanks (WD-40 without Cr(VI)) remained below the detection limit, demonstrating that WD-40 does not cause an interfering signal in the DPC reaction in a purely aqueous system.

Condition	Mean concentration (µg/L)	Recovery vs. control
Control (0 mL WD-40)	248.7	100% (reference)
2 mL WD-40 (highest level)	240.7	96.8%
Blank (WD-40, no Cr(VI))	< LOD	n/a

Table 1: Recovery of Cr(VI) in an already-dissolved working solution (25 ppm), after exposure to WD-40.

For the reference paint sample, analyzed using the full extraction procedure (Table 2), there is no dose-dependent decrease: the difference from the control is positive (higher, not lower) at all levels and does not increase monotonically with the amount of WD-40.

Sample	WD-40 (mL)	Cr(VI) content (mg/kg)	RSD (%)	Difference vs. control
L0 (control)	0	1 265.0	3.1	0% (reference)
L1	0.25	1 300.7	1.7	+3.7%
L2	0.5	1 309.5	0.8	+4.6%
L3	1	1 384.5	2.5	+9.5%
L4	2	1 280.0	1.6	+1.0%

Table 2: Cr(VI) content after full extraction, per WD-40 level.

4.2 Direct exposure to solid Cr(VI)

When solid Cr(VI) was brought into direct contact with the highest tested WD-40 volume (2 mL) and subsequently, without extraction chemistry, simply dissolved in water, the measured recovery dropped sharply: an average of 5.8% (6.1% and 5.4%) of the nominal weighed-in Cr(VI) mass.

In an additional, direct repetition on solid Cr(VI) at higher WD-40 volumes, no measurement could be traced back to a reliable concentration: the solid Cr(VI) dissolved neither in the WD-40 nor in the subsequent dilution, but instead clumped together in the apolar phase. No Cr(VI) reduction was observed.

5. Discussion

The collected data consistently indicate no chemically reducing effect of WD-40 on Cr(VI). When Cr(VI) is already dissolved or is properly extracted, the measured amount does not change in a dose-dependent manner. The strongly reduced recovery that does occur arises only when solid Cr(VI) is brought into direct contact with WD-40 and subsequently dissolved in water.

This observation is readily explained by the composition of WD-40 [4]: as an oil-containing mixture of aliphatic hydrocarbons that is insoluble in water, the product does not mix with water. Solid Cr(VI) that comes into contact with WD-40 clumps together in the oil layer rather than dissolving, leaving it outside the reach of the measurement. This is a solubility and sampling effect, not a chemical reduction of Cr(VI) to Cr(III): as soon as the same substance is already dissolved or is properly extracted, the effect disappears entirely.

This mechanism stands in sharp contrast to recognized Cr(VI) neutralizers. WD-40 contains no comparable reducing component [1,4]. The application of WD-40 as a “neutralizer” observed in industry therefore does not appear to be based on an actual chemical effect. A possible explanation is that the well-known, visible properties of WD-40 as displacing moisture and leaving a protective oil layer on a

surface, are, in practice, confused with “neutralizing” chemical contamination, or that the product is confused with actual commercial Cr(VI) reducing agents. As far as is known, no published source is available for this explanation; based on this study, the industrial use of WD-40 as a Cr(VI) neutralizer appears to rest primarily on informal, practice-based assumptions rather than on documented chemistry.

6. Conclusion

WD-40 Multi-Use Product does not chemically reduce Cr(VI) to Cr(III). For an already-dissolved Cr(VI) solution and for a reference paint sample using the full extraction procedure, no dose-dependent reduction was demonstrated. In addition, Cr(VI) compounds are insoluble in the WD-40 matrix, which causes a reduced recovery when solid Cr(VI) is brought into direct contact with WD-40; this is therefore not a chemical reduction reaction.

For industrial practice, this means that WD-40 is not a suitable agent for reducing or neutralizing Cr(VI) contamination. Actual reduction of Cr(VI) requires a recognized commercial Cr(VI) neutralizer [1,2,3], optionally followed by a validated test method performed by SEEF B.V.’s laboratory.

References

- [1] Agency for Toxic Substances and Disease Registry (ATSDR). (2012). *Toxicological Profile for Chromium*. U.S. Department of Health and Human Services, Public Health Service.
- [2] Xu, X.-R., Li, H.-B., & Li, X.-Y. (2004). Reduction of hexavalent chromium by ascorbic acid in aqueous solutions. *Chemosphere*, 57(7), 609–613.
- [3] Qin, G., McGuire, M. J., & Blute, N. (2005). Hexavalent chromium removal by reduction with ferrous sulfate, coagulation, and filtration: a pilot-scale study. *Environmental Science & Technology*, 39(16), 6321–6327.
- [4] WD-40 Company. (2024). *Safety Data Sheet: WD-40 Multi-Use Product Aerosol*. San Diego, CA: WD-40 Company.
- [5] U.S. Environmental Protection Agency. (1992). *SW-846 Test Method 7196A: Chromium, Hexavalent (Colorimetric)*. Revision 1.
- [6] APHA, AWWA, & WEF. *Standard Methods for the Examination of Water and Wastewater, Method 3500-Cr B: Chromium by Colorimetry*.
- [7] SEEF B.V. (2026). Experiment 1: internal experimental protocol and calculation data — exposure of dissolved Cr(VI) and a reference paint sample to WD-40. Unpublished internal documentation.
- [8] SEEF B.V. (2026). Experiment 2: internal experimental protocol and calculation data — direct exposure of solid Cr(VI) to WD-40. Unpublished internal documentation.



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