Determination of Hexavalent Chromium in Dyes

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Introduction

Hexavalent chromium [Cr(VI)] is the most toxic form of the metal chromium. In addition to regulations concerning its concentration in drinking water, many governments regulate Cr(VI) in consumer products. Leather products can be colored with dyes containing trivalent chromium, and sweat can transfer the chromium from the leather to the skin. It is possible that some of the trivalent chromium oxidizes to Cr(VI). For example, leather gloves were found to contain Cr(VI).[1] In this application brief, we analyze two dyes for Cr(VI) using a sensitive ion chromatography (IC) method with postcolumn reaction to produce a colored complex detected by visible absorbance.[2] Figure 1 shows that Cr(VI) was not found in a 1:100 dilution of the Fast Red dye while 56.1 µg/L Cr(VI) was found in a 1:100 dilution of the Metal Complex Black. Spiking both diluted dye samples with 30 µg/L Cr(VI) yielded recoveries of 99.3 and 101% for the red and black dyes, respectively, demonstrating method accuracy. This IC method delivers an easy, fast, sensitive, and accurate determination of Cr(VI) in dyes.

Conditions

- System – Thermo Scientific™ Dionex™ ICS-3000 with a DP dual pump, VWD absorbance detector, and AS autosampler
- Chromatography – See Figure 1.
- Sample Preparation – Samples were diluted 1:100 with deionized water and then passed through a Thermo Scientific Dionex OnGuard™ II P cartridge (P/N 057087) prior to analysis.

Column:	Thermo Scientific Dionex IonPac™ AS7 Analytical, 4 × 250 mm, Dionex IonPac NG1 Guard, 4 × 50 mm
Eluent:	250 mM ammonium sulfate, 100 mM ammonium hydroxide
Temperature:	30 °C
Flow Rate:	1.0 mL/min
Inj. Volume:	10 µL
Detection:	Visible absorbance at 530 nm
Postcolumn Reagent:	2 mM diphenylcarbazide, 10% methanol 1 N sulfuric acid
Reaction Coil:	1500 µL
PCR Flow Rate:	0.5 mL/min
Backpressure:	1200–1300 psi
Samples:	1) Cr(VI) standard 2) Fast Red (100× dilution) 3) Metal Complex Black (100× dilution)
Cr(VI) concentration:	1) Cr(VI) standard 50.0 µg/L 2) Fast Red (100× Dilution) ND 3) Metal Complex Black 56.1 (100× Dilution)

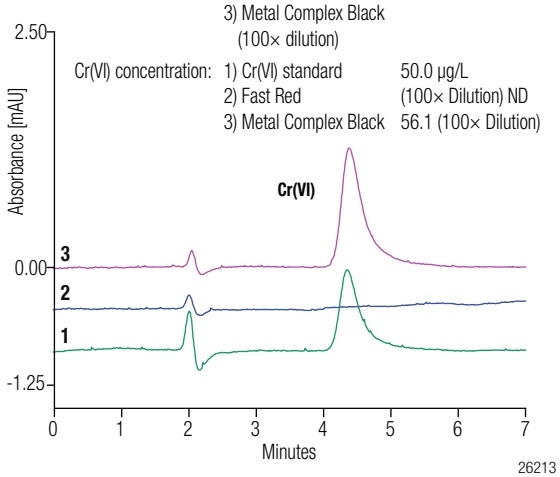

Figure 1. Chromium [Cr(VI)] in dyes.

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References

1. Peterson, J.; Murphy, B.; Perati, P.; Richter, B. *LCGC The Applications Notebook*, **2007**, June, 28.
2. Dionex (now part of Thermo Scientific) Application Update 144. *Determination of Hexavalent Chromium in Drinking Water Using Ion Chromatography.* Dionex LPN 1495, 2003, Sunnyvale, CA.

Acknowledgement

Thanks to the Textile Testing Center, Thailand Textile Institute for kindly providing the samples.

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