

JAMES ROUNTREE

OWENS JET DUST COLLECTING SYSTEM

OH Sub No. 48(A)



Recd From: James Rountree

This is a low-tech inexpensive method of examining ambient air for particulate matter, and it provides more information than filter methods. The system was developed by Dr J. S. Owens during the early 1920s and was widely used in the investigation of the London smog problems and city smog problems elsewhere..

OPERATING PRINCIPLE: With sufficient humidity the sudden lowering of air pressure and temperature caused when air is sucked through a narrow slit causes condensation which collects the dust in the air and dust bearing droplets of water adhere to a glass plate. The air jet is a focused ribbon shaped jet, which disperses when it hits the glass plate. The dispersion of the air causes the temperature and the pressure to rise and the water condensation evaporates leaving the dust sample on the glass surface.

The sample can be viewed through a microscope and measurement down to 0.1 microns is achievable. The sample is suitable for microchemical analysis and x-ray analysis for metals.

The sample will contain ultrafine particulate matter and further computer-aided investigation is possible.

Surface area calculation could be an interesting development.

NOTE: CHROMIUM VI COMPOUNDS.

Bord Blomala

These questions were addressed to Dr Edward Porter at ~~this~~ Hearing on the 21st May 07. The reply was circumspect and indicated no special consideration of Chromium compounds in the EIS. The following was put to Dr Porter on my behalf.

FROM: JAMES ROUNTREE

I am a lay person with no qualifications. From my reading on the subject of Chromium emissions, I have concerns and I would prefer that Cr VI compounds were not present at all in stack emissions and ambient air. And I feel that total Chromium should be negligible.

We do not have the habit of concern about toxic chemicals like CrVI and we need to think about this.

1. Can the experts give an account of the various derivatives of Chromium Tri-Oxide Cr O3 in the incineration process?

e.g. Chromic Acid Cr H2 O4, Chromates ® Cr O4

Chromyl Chloride Cr O2 Cl2 and Chromyl Fluoride CrO2 F2

2. Can the experts give an account of the subsequent environmental decomposition of these compounds? And an account of the environmental research into the chemistry.

3. Do these arise, and to what extent?

- a. Water decomposition of Chromates (and Polychromates) releasing free Chromic Acid Cr H2 O4 at a distance from the stack.
- b. Chromate combinations with other compounds

e.g. Lead Chromate/ Lead Oxide Cr O4 Pb O Pb

Zinc Chromate Hydroxide Cr O4 H2 O2 Zn2H2O

3. If the experts can't answer these questions, then why not? And are they going to release these substances if they don't know? Why should they tolerate or conversely rely on environmental degrading of CrVI compounds to Cr III.

Obviously I am fussing about very low levels. The technical literature does not consider the low level issue and there is non-observance of the Community Right To Know List Of Chemicals in the incineration situation and you people probably feel justified,

Hexavalent Chromium, Cr(VI)

Hexavalent Chromium (Cr(VI)) by Ion Chromatography (IC), more specific for Cr(VI) and up to 1,000 times more sensitive than other methods

Introduction

Chromium exists primarily in trivalent (Cr(III)) or hexavalent (Cr(VI)) oxidation states. Cr(VI) is a notorious environmental pollutant because it is a strong oxidant and much more toxic than Cr(III). Cr(VI) exists as the

chromate ion in basic solutions and as dichromate in acidic solutions.

One of the traditional methods for determining Cr(VI) uses diphenylcarbohydrazide (DPC) to form an intensely colored complex with Cr(VI). The complex is measured quantitatively by its visible absorption at 520 nm. However, as in any colorimetric analysis, this test is subject to positive interferences from other colored materials in the sample as well as from other elements that form colored complexes with DPC.

Update 12-26-00. WCAS has been granted interim certification by California ELAP for hexavalent chromium in drinking water by EPA 218.6.

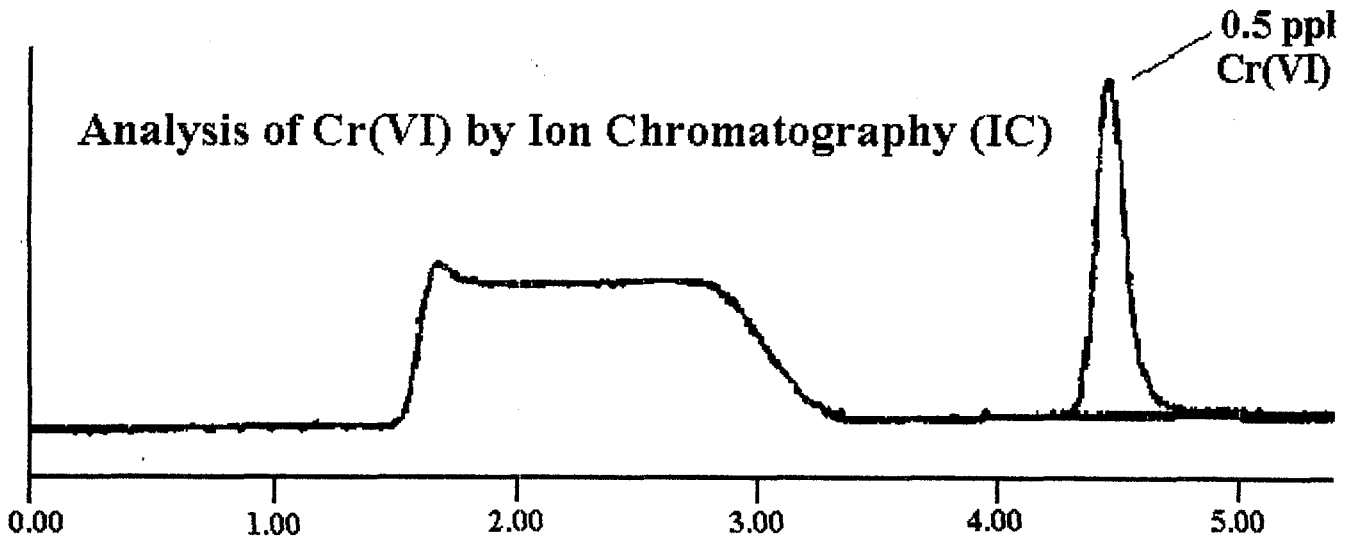
Cr(VI) by Ion Chromatography

A method was developed by others using ion chromatography (IC) to separate Cr(VI) from other positive interferences, followed by a post column reaction with DPC. This method has appeared as EPA Method 218.6 for water, EPA 3060A and 7199 for wastes, EPA 425 for stack samples, OSHA 215 for industrial hygiene samples, and South Coast Air Quality Management

District Method 205.1. Not only is it more specific for Cr(VI), but it can be 1000 times more sensitive. Detection limits in solution can be as low as 0.01 ug/L in dilute bicarbonate solutions. This method has been used in ambient air risk assessments to measure Cr(VI) to 1 ng/m³. Example reports with detection limits and quality control limits can be viewed (pdf files) at Cr(VI) by EPA 218.6 (waters) and Cr(VI) by EPA 3060A/7199 (soils and wastes).

NOTE: Without specific Cr(VI) testing, assume for test result from airborne dust is 60% Cr(VI) at least.

Biological urine testing of white rodents (at control + test sites) is important (with or without feed introduced) (grossing settles or shells are a combination too)



Column: Dionex IonPac AS7
Flow Rate: 1.5 mL/min.
Eluant: 250 mM $(\text{NH}_4)_2\text{SO}_4$
 100 mM NH_4OH

Post Column Reactor: 2 mM Diphenylcarbohydrazide
 10% Methanol
 1 NH_2SO_4
Detector: Vis 520 nm

Cr(VI) Stability

EPA has reported that soil samples were found to be stable for at least 30 days. However the holding time for wastewater samples is still 24 hours to our knowledge.

Once Cr(VI) is in an alkaline solution, such as sodium bicarbonate or sodium hydroxide, it appears to be very stable. In one study, Cr(VI) air samples in sodium bicarbonate were found to be stable for more than three months at room temperature.

Cr(VI) Extraction

EPA published Method 3060, an alkaline digestion, in the second edition of SW846, but withdrew it in the third edition. An updated version 3060A now

appears in Update III. A similar extraction method is used by NIOSH for air filters. EPA has noted that the 3060A extracts are stable for 7 days.

For a quotation...

Permanganate Interference

Using EPA 7199 (ion chromatography coupled with post column colorimetric detection), we have seen an interference when high levels of

permanganate causes a problem in EPA 7199 when permanganate is present in great excess over the chromate species.

We now have found conditions which

permanganate are present in a sample. Of course almost any type of colored species may interfere with the more traditional colorimetric analysis such as EPA 7196 offered by most other labs. With the addition of ion chromatography in 7199, such interferences are minimized. Even so large concentrations of permanganate do interfere in 7199. This interference appears to be due to a reaction of permanganate with the post-column reagent that gives a colored species with much less absorbance at 540 nm than either permanganate itself or the complex of chromium species with the post-column reagent. Thus

further reduce this interference. Using a different anion column, such as that used for EPA 300.0 to separate common inorganic anions, we have been able to separate permanganate and chromate. Detection with suppressed conductivity gives a detection limit of 0.1 ppm. An actual field sample rich in permanganate which gave a result of over 300 ppm Cr⁺⁶ by EPA 7199 gave a result of 2 ppm by this method with an average recovery of a matrix spike of 96%. Further work is ongoing to achieve lower detection limits using post column colorimetry and to document interference levels.

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