POWERED BY KT CHEMICALS | DECONGEL

TITLE: Surface Decontamination of Cyanide Compounds (Potassium Ferricyanide) ($K_3[Fe(CN)_6]$)) by DeconGel™

ABSTRACT

Surface decontamination efficacy determination of DeconGel™ on stainless steel, carbon steel, and concrete surfaces contaminated with a cyanide compound (potassium ferricyanide) was performed with ICP-OES (Inductively Coupled Plasma-Optical Emission Spectroscopy) according to Environmental Protection Agency (EPA) SW-846 Methods: 3005A (sampling) and 6010C (analysis).

HAZARDOUS MATERIALS RELEVANCE

Cyanide can cause acute toxicity through skin contact, ingestion, and inhalation. Potassium ferricyanide ($K_3[Fe(CN)_6]$) is an iron-containing compound possessing similar physical characteristics to potassium cyanide (KCN), a water soluble form of cyanide. Cyanide is utilized in gold and silver mining and electroplating industrial applications. Both ACGIH[1] and NIOSH[2] have set maximum exposure limits for cyanide compounds. Potassium ferricyanide was chosen as a representative cyanide compound for evaluating DeconGel's efficacy; DeconGel is expected to have similar efficacy towards the wide range of cyanide compounds.

HIGHLIGHTS

- Excellent surface decontamination was achieved by applying DeconGel onto surfaces contaminated with cyanide compounds resulting in encapsulation of contaminants by DeconGel's active components. Decontamination efficacies of DeconGel ranged from 98.2% (on concrete) to 98.9% (on carbon steel) to 99.4% (on stainless steel) as determined by swipe analysis.

- Optimized experimental and analytical methods were successfully developed following standardized EPA sampling and analysis methods as guidelines for determination of inorganic compounds in aqueous samples. When necessary, experimental methods were customized to afford complete dissolution of inorganic contaminants, and to ensure accurate decontamination efficacy determination of DeconGel.

RESULTS

Table 1 and shows the decontamination efficacies of DeconGelon stainless steel, carbon steel, and concrete surfaces contaminated with cyanide as determined by residual swipe testing.

---

[1] American Conference of Industrial Hygienists (ACGIH); http://www.acgih.org/home.htm (2010)
[2] National Institute for Occupational Safety and Health (NIOSH); http://www.cdc.gov/niosh/ (2010)

Table 1. Decontamination efficacies of DeconGel against potassium ferricyanide on stainless steel, carbon steel, and concrete surfaces as determined by residue swipe testing method.

Swipe Testing (ppm)		Formulation
		DeconGel
Stainless Steel	Control	3.31 ± 0.01
	Residual	0.020 ± 0.007
	Decon. Efficacy (%)	**99.4 ± 4.2**
Carbon Steel	Control	3.45 ± 0.06
	Residual	0.036 ± 0.018
	Decon. Efficacy (%)	**98.9 ± 3.4**
Concrete	Control	3.13 ± 0.07
	Residual	0.057 ± 0.045
	Decon. Efficacy (%)	**98.2 ± 3.2**

1400000x dilution factor for samples and controls

NOTES

- ASTM method E1728-03 (a standardized swipe testing method used for the sampling of inorganic contaminants) was the integral method used to accurately evaluate DeconGel's decontamination efficacy. GhostWipe™ (Environmental Express; Mt. Pleasant, SC) swipes (pre-wetted with DI H_2O) were utilized in this swipe testing method.
- Standardized EPA SW-846 Sampling Method 3005A "Acid Digestion of Waters for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICP Spectroscopy" was followed as a guideline to prepare all samples and controls. Because potassium ferricyanide reacts violently with acid releasing poisonous cyanide gas, all samples were digested solely in DI H2O (≥ 17 M-Ohm). To reduce the viscosity of samples, a 1:00 dilution in water took place on all samples and controls after ample soaking and vigorous shaking to incorporate any contaminant contained within swipes and to ensure full dissolution of the gel. All samples, controls, and standards were prepared using the same dissolution solution and experimental conditions to ensure both correct instrument calibration and accurate analytical results.
- To ensure accurate determination of DeconGel decontamination efficacy, calibration standards of the analyte of interest were prepared using either a sufficiently pure analyte or an appropriate ICP-MS Standard (Ricca Chemical Company; Arlington, TX); the respective standards were diluted to a known concentration (ppm) using the same digestion method as that used for samples and controls. Instrument blank controls were DI H_2O (≥17 M-Ohm).
- ICP-OES instrumentation is a sensitive and accurate analytical tool for qualitative and quantitative determination of a large number of inorganic compounds. Standardized EPA SW-846 Analytical Method 6010C "Inductively Coupled Plasma-Atomic Emission Spectrometry" was followed as a guideline to prepare all samples and controls.

CALCULATIONS

Decontamination Efficacy (Swipe Testing) =
[(Contaminant (ppm) of Swipe Control) – (Contaminant (ppm) of Residual Swipe)/Contaminant (ppm) of Swipe Control] x 100%

MATERIALS AND METHODS

Sample Method

In a typical procedure, 0.05 g of contaminant was evenly applied on 1) stainless steel (surface area: 56.3 cm^2), 2) carbon steel (commercial grade, surface area: 100 cm^2), or 3) concrete (industrial grade, surface area: 56.3 cm^2) coupons. Approximately 6.0 g of DeconGel was poured onto the contaminated surface and let to dry for 24-48 hours. Dried DeconGel samples were peeled off the contaminated surface, and the surface was swipe tested (ASTM method E1728-03) using a GhostWipe™ swipe (Environmental Express; Mt. Pleasant, SC). Swipes were suspended in 100 mL of DI H_2O and shaken vigorously. After 24 hours, the samples were shaken again prior to a 1:100 dilution in DI H_2O. The samples were then shaken again and analyzed via ICP-OES (see below).

Control Methods

For wipe control samples, 0.05 g of contaminant was evenly applied on 1) stainless steel (surface area: 56.3 cm^2), 2) carbon steel (commercial grade, surface area: 100 cm^2), or 3) concrete (industrial grade, surface area: 56.3 cm^2) coupons, and the surface was swipe tested (ASTM method 1728-03) using a GhostWipe™ swipe (Environmental Express; Mt. Pleasant, SC). Swipe samples were suspended in 100 mL DI H_2O and shaken vigorously. After 24 hours, the samples were shaken again prior to a 1:100 dilution in DI H_2O. The control samples were then shaken again and analyzed via ICP-OES.

Reagents and Standards

Potassium ferricyanide, ($K_3[Fe(CN)_6]$), (CAS# 13746-66-2, Fisher Scientific; Fair Lawn, NJ), was used as received.
A 10.0 ppm calibration standard was prepared by dilution of iron ICP-MS Standard (Ricca Chemical Company; Arlington, TX) to the proper concentration. DI H_2O ($\geq$ 17 M-Ohm) was used as the blank sample.

Analytical Instrumentation

A Thermo ICP-OES instrument model radial iCap 6300 was used to determine cyanide concentration (ppm) of all samples and controls using a freshly prepared 1000 ppm calibration standard.

Analyte (iron) was analyzed at 271.4 nm
Pump Speed: 0.5 mL/min

APPLICATION INSTRUCTIONS FOR END-USERS

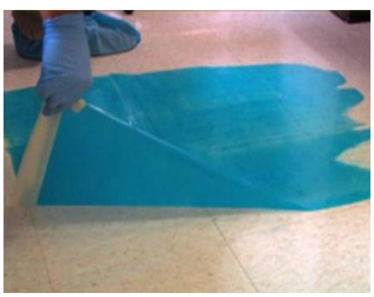
Use product directly as is from container. DO NOT DILUTE. Masking or painters tape can be applied along one edge of the area that is to be decontaminated to aid creating a peeled edge to grip for peeling the dried film. Apply DeconGel using a paint brush, a trowel, a handheld sprayer, or an industrial grade sprayer.

The thickness of the gel and the number of coats is dictated by the surface to be decontaminated. Coating thickness required for good peel characteristics varies with substrate and generally increases with substrate porosity. It is recommended that first time customers test DeconGel on a small sample area to confirm the required film thickness and dry time for their specific application. If the film is difficult to peel, please apply an additional coat. A razor blade is useful to start the peel. Lay the blade nearly flat and fillet the edge of the film to create a tab that can be pulled. For surfaces that the gel adheres to well, such as concrete, 12” – 24” strips can be cut in the film resulting in less force being required to peel the film.

- Let DeconGel dry for 24 hours

Dry time will vary depending on humidity, temperature, air flow and thickness of the DeconGel. This can take from as little time as an hour for thin coats in a dry environment with plenty of airflow, to overnight or longer if thicker coats are applied in humid environments. Dry times exceeding 24 hours may sometimes be required for good peel performance on bare concrete, wood and other highly porous substrates and substrates with deep cracks or grooves. However, 18-24 hours is often sufficient dry time on good quality concrete. It is recommended that users test a small area to determine drying time prior to applying DeconGel for an entire job. Supplemental heat or air circulation will accelerate DeconGel’s drying time for any job.

- Peel DeconGel off the surface by starting from one of the edges



When dry, the product locks the contaminants into a polymer matrix. The film containing the encapsulated contamination can then be peeled. DeconGel peels from most non-porous and porous hard surfaces if the dried film is thick enough. If the film is difficult to peel, add another coat, let dry, and peel. In most cases the DeconGel will come off in a single sheet but for odd shaped surfaces you may be required to score DeconGel in order to peel it off.

- Dispose of the dried DeconGel in accordance with the local, state and Federal disposal regulations of the contaminant/substance you are removing. DeconGel itself has no special disposal restrictions.

For questions about DeconGel or to place an order, visit our website at www.decongel.com or contact us at:

KT Chemicals, Inc.
1002 N Central Expy Suite 499
Richardson, TX 75080
(855) 932-2228
info@kt-chemicals.com