TITLE: Surface Decontamination of Pesticides (DDT) by DeconGel™

ABSTRACT

Surface decontamination efficacy determination of DeconGel™ on stainless steel, carbon steel, and concrete surfaces contaminated with Pesticides (dichlorodiphenyltrichloroethane (DDT)) was performed with LC/MS (Liquid Chromatography/Mass Spectrometry) according to Environmental Protection Agency (EPA) SW-846 Methods: 3500C (sampling) and 8321B (analysis).

HAZARDOUS MATERIALS RELEVANCE

Pesticides can be dangerous to consumers and workers during manufacture, transport, or during and after use. DDT (dichlorodiphenyltrichloroethane) is a chlorinated aromatic pesticide that is a restricted persistent organic pollutant. DDT is a reproductive toxicant to birds, possesses endocrine disrupting activity in animals, and is considered moderately hazardous to humans by the World Health Organization (WHO). DDT was chosen as a representative pesticide; DeconGel is expected to have similar efficacy towards the wide range of pesticides.

SUMMARY RESULTS

- Excellent surface decontamination was achieved by applying DeconGel onto surfaces contaminated with pesticides (DDT) resulting in encapsulation of contaminants by DeconGel's active components. Decontamination efficacies of DeconGel ranged from 96.1% (on concrete) to 98.7% (on carbon steel) to 98.7% (on stainless steel) for DDT determined by residual swipe analysis.
- Optimized experimental and analytical methods were successfully developed following standardized EPA sampling and analysis methods as guidelines for determination of organic compounds dissolved in a suitable solvent able to completely solvate DDT as well as DeconGel components. When necessary, experimental methods were customized to afford complete dissolution of organic contaminants. Additionally, analytical methods and associated equipment (LC column, LC gradient program, MS sample ionization parameters) were appropriately utilized to ensure accurate decontamination efficacy determination of DeconGel.

RESULTS

Table 1 shows the decontamination efficacies of DeconGel on stainless steel, carbon steel, and concrete surfaces contaminated with Pesticides (DDT) as determined by residual swipe testing.

Table 1. Decontamination efficacy of DeconGel on DDT Pesticide on stainless steel, carbon steel, and concrete surfaces as determined by residual swipe testing.

Swipe Testing (ppm)		**Formulation**
		DeconGel
Stainless Steel	Control	188.49 ± 0.94
	Residual	2.48 ± 0.04
	Decon. Efficacy (%)	**98.7 ± 0.0**
Carbon Steel	Control	190.20 ± 1.73
	Residual	2.51 ± 0.04
	Decon. Efficacy (%)	**98.7 ± 0.0**
Concrete	Control	168.32 ± 0.15
	Residual	6.61 ± 0.15
	Decon. Efficacy (%)	**96.1 ± 0.13**

2200x dilution factor for samples and controls

NOTES

- ASTM method E1728-03, a standardized swipe testing method used for sampling of contaminants, was the integral method used to accurately evaluate DeconGel's decontamination efficacy. Air-dried GhostWipe™ (Environmental Express; Mt. Pleasant, SC) swipes (pre-wetted with DMSO immediately prior to performing swipe analysis) were utilized in this swipe testing method.
- Standardized EPA SW-846 Sampling Method 3500C "Organic Extraction and Sample Preparation" was followed as a guideline to prepare all samples and controls. All samples, controls, and standards were prepared using the same solvent and appropriate experimental conditions to ensure accurate and LC/MS instrumental analysis.
- LC/MS instrumentation is a sensitive and accurate analytical tool for qualitative and quantitative determination of a large number of organic compounds. Standardized EPA SW-846 Analytical Method 8321B "Solvent-Extractable Nonvolatile Compounds by High-Performance Liquid Chromatography/Thermospray/Mass Spectrometry (HPLC/TS/MS) or Ultraviolet (UV) Detection" was followed as a guideline to prepare all samples and controls.
- To ensure accurate determination of DeconGel decontamination efficacy, a standard curve of the analyte of interest was prepared using sufficiently pure analyte; the respective standards were diluted to a known concentration (ppm) using the same solvent as used for 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, 0.025 g of contaminant was evenly applied on 1) stainless steel (commercial grade, 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 hours. Dried DeconGel samples were peeled off the contaminated surface, and the surface was swipe tested (ASTM method E1728-03) using an air-dried GhostWipe™ swipe (Environmental Express; Mt. Pleasant, SC) wetted with DMSO (2 mL) immediately prior to swipe analysis. Swipe and gel samples were suspended in 50 mL DMSO for 24 hours. Samples were then analyzed via LC/MS (see below).

Control Methods

For swipe control samples, a respective amount 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 an air-dried GhostWipe™ swipe (Environmental Express; Mt. Pleasant, SC) wetted with DMSO (2 mL) immediately prior to swipe analysis. Swipe samples were suspended in 50 mL DMSO for 24 hours and analyzed via LC/MS (see below).

Reagents and Standards

DDT (1,1,1-trichloro-2,2-di(4-chlorophenyl)ethane) (CAS# 50-29-3, Fisher Scientific; Fair Lawn, NJ) was used as received.

Analytical Instrumentation

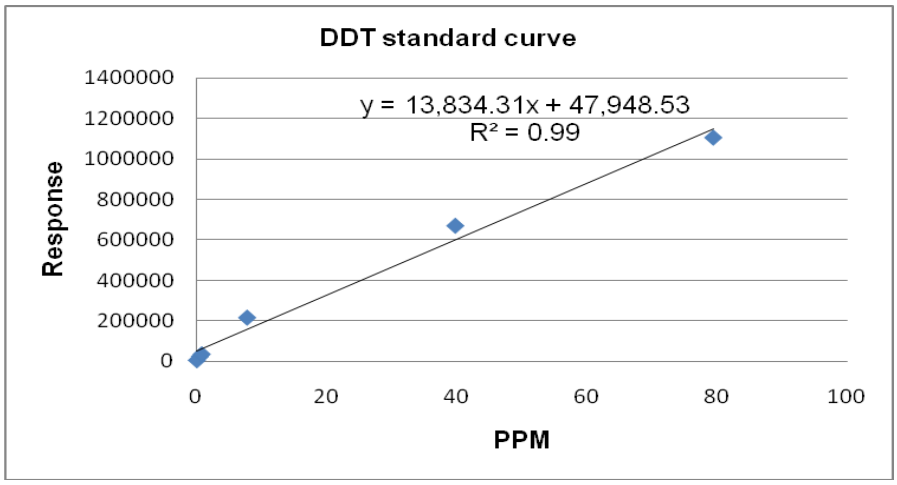
A Thermo LCQ LC/MS with autosampler in positive mode was used to determine DDT concentration (ppm, wt/wt) of all samples and controls, using a Grace Davison (Deerfield, IL) C18-Select analytical column (150 x 4.6 mm, 5 um).

A 6-point standard curve derived from three independently prepared stock solutions was prepared using DMSO as the working solvent. The calibration curve exhibits a curve fitting as approximated by the coefficient of determination of linear regression R^2, where $R^2 = 0.99$ (see Figure 1).

LC method using A= water (0.1% formic acid), B=acetonitrile (0.1% formic acid); start at 90%A to 2 min at 70%A, to 3 min at 50%A, to 5 min at 30%A, to 6 min at 100%B, hold until 16 min at 90% A hold until 17 min.

DDT LC/MS data: 9.9 min; lambda max = 244, 266 nm; $M^+ = 354$.

Figure 1. DDT standard calibration curve



APPLICATION INSTRUCTIONS FOR END-USERS

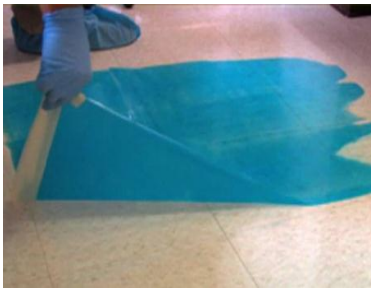
Use product directly as is from container. DO NOT DILUTE. Masking or painters tape can be applied along one edge of the area that is to be decontaminated to aid creating a peeled edge to grip for peeling the dried film. Apply DeconGel using a paint brush, a trowel, a handheld sprayer, or an industrial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

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