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CLEAN WATER MADE EASY™

the newest, most effective patented filtration
solution to your oil / water separation problems!



Adsorb-it®/AM Filtration Fabric
with Surface-Bonded Antimicrobial

PROVIDING PRODUCTS AND SERVICES TO THE ENVIRONMENTAL INDUSTRY

Since 1986

Adsorb-it[®]
Geo-Textile Filtration Fabric

Adsorb-it[®] /AM
Antimicrobial Filtration Fabric



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Adsorb-it® Filtration Fabric

Adsorb-it®/AM Filtration Fabric

with Surface-Bonded Non-Leaching Antimicrobial



Adsorb-it® is a geo-textile quality non-woven filtration fabric manufactured from 100% recycled select fibers from the textile industry. It is designed with the unique ability to allow the virtually unrestricted flow of salt or fresh water through the fabric at rates in excess of 100 gallons per minute per square foot while retaining oils, oil sheen, and oil-borne contaminants in the fabric matrix.



Adsorb-it®/AM is our standard **Adsorb-it®** fabric that has been treated with a surface-bonded non-leaching antimicrobial that kills all known forms of bacteria as well as fungus, mold, and algae on contact. This antimicrobial treatment kills bacteria by physical, as opposed to chemical means, so there is no chemical leaching to the environment, and the antimicrobial remains active indefinitely. Use the **Adsorb-it®/AM** in place of our standard

Adsorb-it® fabric when bacterial control is required, or there is a chance of fungus, mold, or algae growth.

Adsorb-it® provides the solution for a multitude of environmental problems relating to water filtration and the removal of oils, oil sheen, and oil-borne contaminants.

Adsorb-it®'s wicking action allows the adsorbed media to be contained in the entire fabric as opposed to only the point of media contact, and allows the recovery of adsorbed media from the filtration fabric by physical means (wringing, pressing, centrifuge, etc.) after which the **Adsorb-it®** fabric may be reused with 85% to 90% efficacy.



**Equally effective wet or dry,
the oil will displace the water in the fabric.**

We manufacture a variety of products to assist in the maintenance and cleanup at fuel facilities, aboard ship, at the dock, at construction sites, manufacturing facilities, or anywhere there is a possibility of oil, oil sheen, or oil-borne contaminants impacting water or soil.

The fabric is ideal for use on construction sites where equipment can leak oil and contaminants onto the ground. Simply roll the fabric out on the ground at the staging areas.

Adsorb-it® has the ability to retain up to 20 times its weight in oils. When the fabric has reached the end of its serviceable life, the oil-saturated fabric can be incinerated for its fuel value, as opposed to landfill disposal, yielding a higher BTU per pound rating than coal, and burning with less than 1% residual ash.

Adsorb-it® inhibits oil and petroleum-based water pollution from spreading to the surrounding soil or from pollution perking from the soil to the water. It provides excellent erosion control and allows the proliferation of biota.

Adsorb-it® makes an excellent liner for ponds and drainage ditches where oil and petroleum pollution, or erosion is a problem. Oil and petroleum is held in the filter fabric and allowed to degrade naturally.

Adsorb-it® outperforms typical polypropylene products while allowing the virtually unrestricted flow of salt or fresh water and retaining the oils and petroleum-based products in the fabric matrix.

“There is no comparison against the polypropylene pads that we used to use.”

~satisfied customer

Adsorb-it® is highly effective for the filtration of bilge water prior to discharge, and as the final polish in oil/water separators.

See **Adsorb-it®** and the family of **Adsorb-it® Products** online
www.adsorb-it.com

Suggested Uses and Applications

Use **Adsorb-it®** Filtration Fabric and **Adsorb-it® /AM** Antimicrobial Fabric

for

Stormwater Filtration

Filter oil and oil-borne contaminants from: ditches and piping, retention ponds, sumps, catch basins, and stormwater vaults.

Adsorb-it® products are available for use in catch basins, approved by the Dept of Ecology, and much easier to install than other available catch basin inserts. We have **Antimicrobial products** available to control bacteria in stagnant or low-flow conditions.

Oil Water Separators

Use as a filter media before the final discharge to eliminate oil sheen.

Ask us about our simple **Polishing Filter Pack Unit** design, used by the US Navy, with screen plates covered with **Adsorb-it®**, and our drop-in **Oil Water Separator Filter Curtain** design.

Ditch or Pond Liners

Excellent liner for drainage ditches or retention ponds where erosion or oil pollution is a problem. Oils are held in the fabric matrix and allowed to degrade naturally. **Adsorb-it®** inhibits oil and oil-borne contaminant pollution on water from spreading to the surrounding soil, or perking from the soil to the water.

Sorbent

Retains up to **20 times its weight in oils** and oil-borne contaminants.

Outperforms polypropylene products and allows the virtually unrestricted flow of water through the fabric while retaining the oils and oil-borne contaminants in the fabric matrix.

Use **Adsorb-it®/AM** Antimicrobial Filtration Fabric to kill bacteria, as well as fungus, mold, and algae on contact

The antimicrobial works by physical, rather than chemical means, so it is non-toxic. It is surface-bonded to the **Adsorb-it®** fabric, so it will not leach into the environment, and will remain effective indefinitely.

Many of the **Adsorb-it® Sorbent Products** are available in **Adsorb-it® /AM Antimicrobial Filtration Fabric**.

Shoreline Protection

Conforms easily to uneven surfaces such as shorelines, streambeds, and rock formations.

Adsorb-it® inhibits oils and oil-borne contaminants in water from impacting the land and contaminants on land, from impacting the water. **Equally effective wet or dry; in salt or fresh water. The oil displaces the water in the fabric.**

Wastewater Filtration - FOG

Use in interceptors or grease traps or use to filter industrial mop water.

Highly effective in the removal of fats, oils, and greases (FOG) when used for filtration - virtually eliminating system blockages due to grease buildup. Excellent for the removal of oil and oil-borne contaminants from any wastewater stream.

Spill Response

Use for dock curtains, sweeps and skimmer pads for oil and oil sheen recovery on open waters or in marinas. **Adsorb-it®'s** wicking action allows the oils, oil sheen and oil-borne contaminants to be contained in the entire fabric as opposed to only the point of contact. Oil and oil sheen adhere to the **Adsorb-it®** fibers and are not displaced by water.

Oil Recovery

Allows the recovery of adsorbed oils and oil-borne contaminants.

Oil may be recovered from the filtration fabric by physical means (wringing, pressing, centrifuge, etc.) after which the fabric may be reused with little reduction in its efficacy.



Visit us online at www.adsorb-it.com

Adsorb-it[®] Geo-Textile Filtration Fabric

Adsorb-it[®] /AM Antimicrobial Filtration Fabric

Test Data and Technical Specifications

Adsorb-it[®] is a state-of-the-art geo-textile filtration fabric consisting of 100% recycled materials, and developed to provide the filtered removal of oils from water. The non-polar, lipophilic qualities of Adsorb-it[®] allow this filtration media to retain up to twenty times its weight in petroleum hydrocarbons, esters of fatty acids and glycerol (vegetable oils), and animal fats, oils, and greases (FOG).

The Adsorb-it[®] geo-textile filtration fabric allows the passage of water at rates in excess of 100 gallons per minute per square foot while retaining and wicking oils to the entire fabric as opposed to currently available filtration media that only adsorbs / absorbs at the point of contact. Adsorb-it[®] works equally well under wet or dry conditions. Oils that are filtered by the Adsorb-it[®] fabric are retained in the fabric and are not displaced by water, however, water that may be present in the Adsorb-it[®] fabric is displaced by the adsorbed / absorbed oils.

Adsorb-it[®] in blanket form is a durable, non-biodegradable geo-textile-quality fabric that conforms readily to rocky shorelines, sumps, and a variety of other custom applications. Adsorb-it[®] can be rolled or molded into canisters, fitted to frames, draped over containment booms, used as a geo-textile filtration layer in water retention ponds or virtually any application where the filtered removal of oil from water is required.

Adsorb-it[®] /AM Antimicrobial Filtration Fabric is our standard fabric treated with a surface-bonded non-leaching antimicrobial that kills all known forms of bacteria, fungus, mold, and algae on contact. This unique antimicrobial kills bacteria by physical rather than chemical means. It will not leach into the environment. Its effectiveness is not diminished by repeated use.

Test Data

The following are descriptions of bench tests and actual field tests conducted with Adsorb-it[®] and Adsorb-it[®] /AM. Click on the title to go to that test page.

- Vegetable Oil and Motor Oil Adsorption Capacity – Analysis by Weight
- Motor Oil / Diesel Fuel Adsorption from Water
- Efficacy of Adsorb-it[®] in Removing Residual Oil Sheen
- Oil Retention Study – Adsorb-it[®] vs Reactive Polymer
- Oil Sorption Properties of Adsorb-it[®] vs Competition
- Physical Test Results
- 100% Removal of Fecal Coliforms
- Rust Removal
- PAH Removal
- Removal of Emulsified Oil
- Wash Wastewater Filtration
- Adsorb-it[®] Sorbent's Potential Environmental Impact
- MSDS

All testing was performed using the USEPA and ASTM standard methods where applicable.

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Vegetable Oil and Motor Oil Adsorption Capacity Analysis by Weight

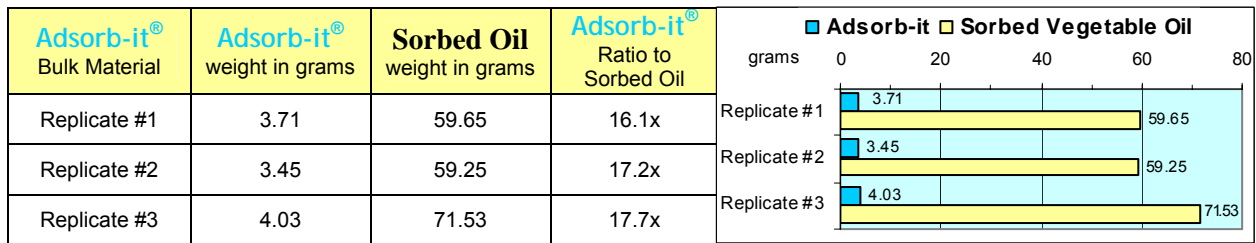
Tests were performed on **Adsorb-it**[®] sorbent media to determine its capacity to sorb oils.

Method

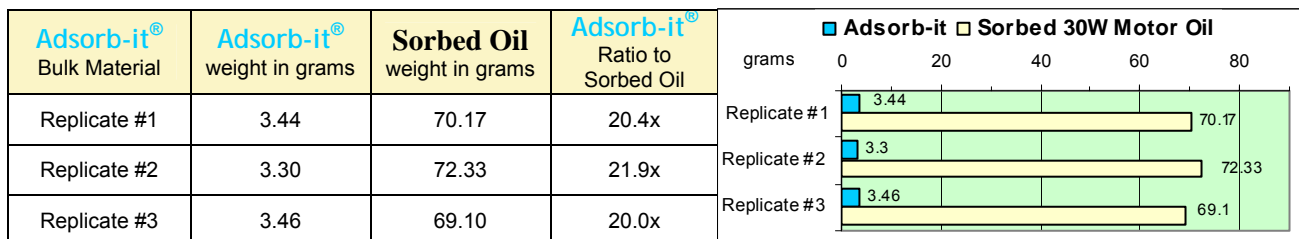
The tests were performed using guidelines described in ASTM Method F726-81, "Sorbent Performance of Adsorbents". This test method measures the maximum adsorption of oils and floating immiscible liquids. The materials tested were representative samples of **Adsorb-it**[®] bulk material. The oils used were 30W motor oil and a liquid vegetable oil. Three replicates were performed for each type of oil.

Results

Vegetable Oil - Adsorb-it[®] adsorbed approximately 17 times its weight in vegetable oil.



30W Motor Oil - Adsorb-it[®] adsorbed approximately 20 times its weight in motor oil.



Conclusions

The bulk **Adsorb-it**[®] material's adsorption capacity:

Approximately: 17 times its weight in vegetable oil and 20 times its weight in motor oil.

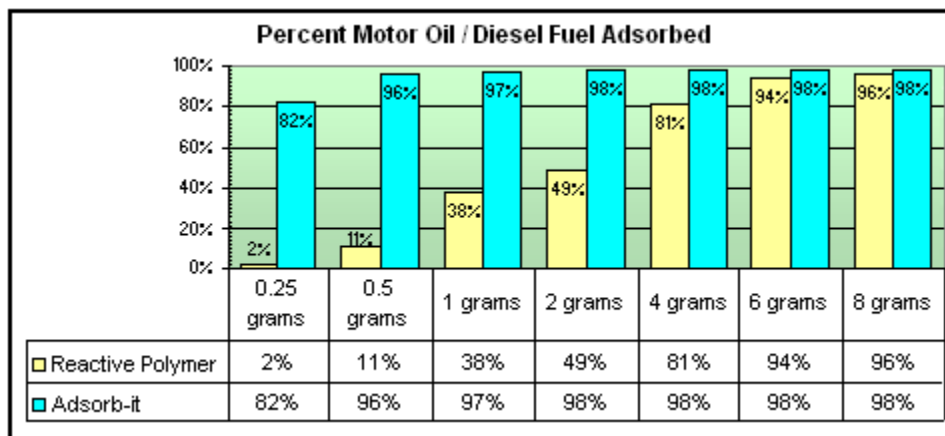
Motor Oil / Diesel Fuel Adsorption from Water

We used the following test to determine the degree of efficacy of the **Adsorb-it**[®] media as a sorbent for use in the removal of petroleum hydrocarbons from water after accidental spills or releases, and to determine its efficiency as compared to other well known sorbents.

Method

Adsorb-it[®] and a granulated *Reactive Polymer* were tested to compare the uptake of a motor oil / diesel fuel mixture from water. 200 ml of water and 10 grams of a motor oil / diesel fuel mix were added to pre-cleaned sample containers. Pre-weighed samples of sorbent, ranging from 0.25 grams to 8 grams, were added to each container and allowed to sorb. The sorbent was then removed and the contents of each jar were analyzed to determine the weight of motor oil / diesel fuel remaining. The graph below illustrates the results.

Results



Conclusions

Addition of 0.5 grams of **Adsorb-it**[®] sorbent material removes more than 96% of the oil / fuel mix. The *Reactive Polymer* requires 8 grams to achieve the same results. With the addition of 0.25 grams, the **Adsorb-it**[®] material reaches saturation, but removes more than 32 times its weight of the petroleum. The saturation point for the *Reactive Polymer* occurs at approximately 3.6 times its own weight in oil.

The **Adsorb-it**[®] sorbed the oil almost immediately on contact, while the *Reactive Polymer* sorbent required several minutes before its maximum saturation was reached. When small amounts of the granulated *Reactive Polymer* were added, removal of the saturated material was difficult because the material did not mat together. The **Adsorb-it**[®] sorbent was cohesive and easily removed from the water.

Efficacy of Adsorb-it® in Removing Residual Oil Sheen

Adequate equipment is available for the removal of gross oil contamination from surface waters. Subsequent to the removal of gross oil contamination by this equipment, inevitably, residual rainbow sheen remains.

Adsorb-it® effectively removes gross oil contamination and residual rainbow sheen. Oil and rainbow sheen can be removed from the water simply and easily by insuring that the water passes through the Adsorb-it® filtration fabric.

Here are some **Effective Methods:**

Surface Waters

Simply loop a section of Adsorb-it® over an existing boom or other media that will provide buoyancy. Allow the Adsorb-it® to drape well below the surface of the water and drag the Adsorb-it® and buoyancy media through the rainbow sheen at a rate that insures that the water passes through the Adsorb-it®. The lower extreme of the draped Adsorb-it® can be weighted to allow a more rapid drag rate. The oil is instantly adsorbed as the water passes through the Adsorb-it® and the sheen disappears, providing a professionally completed remedial response. Eco-Tec, Inc. can supply custom booms, sweeps, pads, wipes, and other configurations of sorbents manufactured from the Adsorb-it® Geo-Textile Filtration Fabric.



most oil/water separators, a residual rainbow sheen remains at the point of final discharge. Simply provide Adsorb-it® as a final filtration media and the final discharge oil sheen is eliminated.

Conclusions

These methods demonstrate that Adsorb-it® is the product of choice for removing the oil and residual oil sheen from water.

Shoreline Protection



Inhibit released-oil impacts to coastal and estuarial shorelines by placing the Adsorb-it® fabric on the shoreline in tidally influenced areas.

Oil/Water Separators

Oil/water separators can efficiently remove most of the oil as oily water passes through the system. With

Oil Retention Study A Comparison: **Adsorb-it®** vs Reactive Polymer

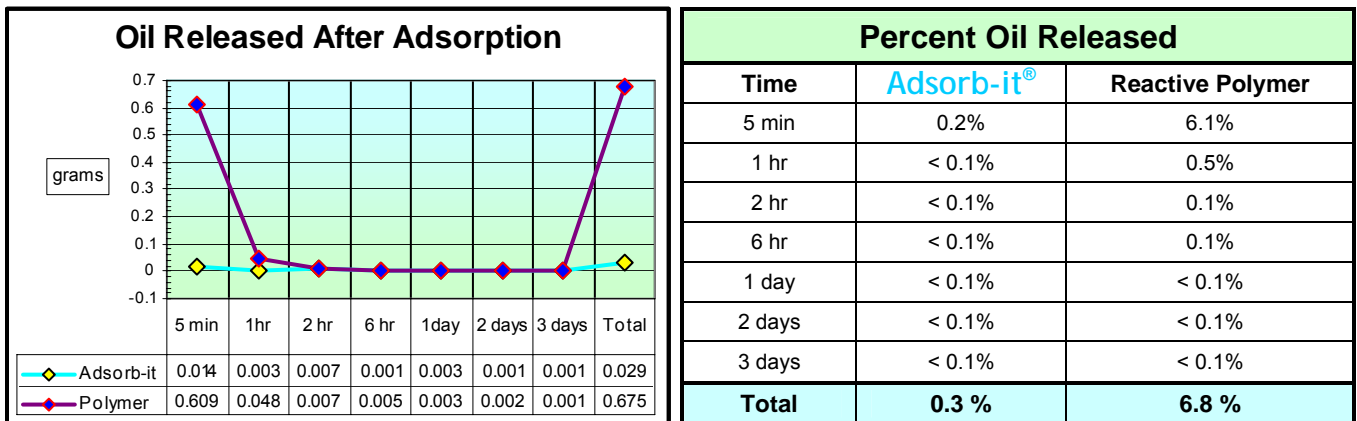
Studies have shown the remarkable ability of **Adsorb-it®** to filter and adsorb petroleum hydrocarbons. In many applications, filter media is required to endure long dry periods subsequent to the retention of these hydrocarbons. It is imperative that a filter media have not only the ability to retain petroleum hydrocarbons in wet or dry conditions, but to function cyclically through wet and dry periods with a high degree of efficiency.

Method

For comparison, a retention study was performed using **Adsorb-it®** geo-textile filtration fabric and a granulated reactive polymer. This study was performed to document the relative oil loss from each media through alternating periods of flushing and drying.

20 grams of **Adsorb-it®** and 20 grams of granulated reactive polymer were placed into a filtration apparatus. 10 grams of motor oil was poured onto the **Adsorb-it®** and 10 grams of motor oil was poured onto the granulated reactive polymer. Both were allowed to stand for 5 minutes. Subsequently, 1 liter of water was poured through each media. Additional flushing with water was continued at measured intervals up to 3 days. Flushing waters from each interval was collected and analyzed in accordance with EPA Method 413.1 to document the weight of any oil released from either media. The results of this study are presented in the graph and table below.

Results



Conclusions

Given the extreme test conditions, both products retained oil well after the first hour. The reactive polymer released a substantial amount in the first hour, which may be the time required to complete the media/oil reaction. Oil adsorption to the **Adsorb-it®** media was almost immediate. After one day, the percent of oil flushed from either media was less than measurable.

Adsorption Capacity of **Adsorb-it®** Compared to Other Oil Sorbent Media

Polypropylene products are the most widely used oil adsorbent products on the market today... not the best... just the most widely used. This study compares the adsorptive qualities of **Adsorb-it®**, 3M Polypropylene Pads, Heavy polypropylene geo-textile as used for storm water filtration, and Xoil bilge filter with Clerify filter media.

Method

ASTM Method F726-81, "Sorbent Performance of Adsorbents" measures the maximum adsorption of oils and floating immiscible liquids. Testing under these ASTM guidelines, representative samples of the media to be tested were treated with three equivalent solutions of 50 weight motor oil, #2 diesel fuel, and a 50/50 solution of motor oil and diesel fuel. Each media was tested 3 times with each solution and the results of the 3 tests were averaged for each tested media to obtain an accurate representation of the adsorption capacity. Results of this adsorption capacity comparison are presented in the tables below.

Results

#2 Diesel Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	1.175	0.5674	0.873	0.3857	
Oil-Saturated Weight	5.453	6.4084	7.919	5.97	
Weight of Oil	4.278	5.841	7.046	4.9843	
Adsorption (times its weight)	3.64	10.29	8.07	5.06	

50/50 Diesel / Motor Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	1.1508	0.7448	0.9049	1.0635	
Oil-Saturated Weight	5.5925	7.666	8.5334	6.1893	
Weight of Oil	4.4397	6.921	7.6285	5.1258	
Adsorption (times its weight)	3.85	9.29	8.43	4.82	

Motor Oil					Adsorption (times its weight)
weight in grams	Xoil Filter	Adsorb-it®	3M Pad	Heavy Propylene	
Dry Weight of Media	0.9886	0.7128	0.7935	0.98045	
Oil-Saturated Weight	5.2013	8.3665	8.9828	6.80125	
Weight of Oil	4.2128	7.6536	8.18925	5.8219	
Adsorption (times its weight)	4.26	10.74	10.32	5.94	

Conclusions

Test results clearly show that **Adsorb-it®** out-performed the other filtration media with an average adsorption factor in excess of 10 times the weight of the **Adsorb-it®** filtration fabric. 3M Polypropylene Pads ran second to the **Adsorb-it®**, however, it should be noted that 3M Polypropylene Pads cannot be used as a filtration media because water will not readily pass through the polypropylene pad, nor can they be re-used as the **Adsorb-it®** can be.

Adsorb-it® Filter Fabric Physical Test Results

To understand all the physical properties of the Adsorb-it® filter fabric, and to help in developing other applications, additional physical testing was conducted. Results of these physical tests are presented in the table below.

Results

Test	Method #	Result	Units
Mass Per Unit Area	ASTM 5261	12.8	oz/yd ²
Grab Tensile LD*	ASTM D4632	118	lbs
Grab Tensile CD*	ASTM D4632	89	lbs
Elongation at Peak LD*	ASTM D4632	131	percent
Elongation at Peak CD*	ASTM D4632	172	percent
Wide Width Tensile LD*	ASTM D4595	33	lbs/in
Wide Width Tensile CD*	ASTM D4595	23	lbs/in
Elongation at Break LD*	ASTM D4595	106	percent
Elongation at Break CD*	ASTM D4595	163	percent
Puncture Resistance	ASTM D4833	72	lbs
Trapezoid Tear Strength LD*	ASTM D4533	64	lbs
Trapezoid Tear Strength CD*	ASTM D4533	45	lbs
Permittivity (Constant Head)	ASTM D4491	2.02	sec-1
Permeability	ASTM D4491	0.72	cm/sec
Flow Rate	ASTM D4491	151	gal/min/ft ²
Apparent Opening Size	ASTM D4751	100-140	micron
*Note: LD=Lengthwise Direction (Machine Direction) CD=Crosswise Direction (Transverse Direction)			

Adsorb-it® /AM

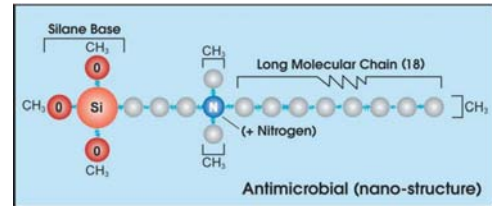
A NEW SURFACE-BONDED ANTIMICROBIAL FABRIC

Test Data Showing 100% Removal of Fecal Coliforms

INTRODUCTION

Water runoff frequently contains significant hazardous contaminants including indicator organisms such as fecal coliform. Such contaminants pose threats to humans directly during recreational uses of surface waters and seafood consumption; and to aquatic life through chronic and acute exposure to harmful bacteria. During stagnant or low flow conditions, the microorganisms flourish exponentially in environments rich in organic and inorganic nutrients. Treatment with water-soluble antimicrobials or disinfectants is not acceptable, as they would have an adverse effect on aquatic life when drained into the streams and surface waters. Also, water-soluble antimicrobials will dilute to sub-lethal levels allowing resistant bacterial populations to persist. Any antimicrobial media used to successfully control bacteria in stagnant or low flow conditions must not leach or dissolve into water, nor be consumed by the exponential bacteria growth. It should also provide adequate surface-area contact.

The Adsorb-it®/AM fabric has an antimicrobial nano-structure covalently bonded to its fibers which will not leach or dilute from the fabric, even with repeated washings. The patented antimicrobial kills microorganisms by molecular physical penetration, electrostatic attraction and electrocution. This physical, rather than chemical, mode of action does not lose strength with use, and does not promote adaptive organisms (super bugs). The antimicrobial spectrum is specific to single cell organisms such as bacteria, fungi, yeast, and algae. The antimicrobial is bonded to the Adsorb-it Filtration Fabric which allows the flow of water and bacteria to pass freely in all directions.



OBJECTIVE

This initial study is intended to provide the percent microbial removal over time, and specify the surface area of the fabric per volume of inoculated water used. Presently, little if any information is available on the efficiency of surface-bonded antimicrobial fabrics in removing microorganisms in stagnant or low flow water conditions. The objective was to conduct a timed bacterial efficacy study on the Adsorb-it® Filtration Fabric, covalently bonded to an antimicrobial nano-structure.

METHOD

Contaminated Water

Fecal coliform bacteria was used as the indicator species in this study. The bacterial seed mixture used was obtained from the clarifier at a local sewer treatment plant. A working standard of 40,000 cfu/100 ml was prepared from the seed mixture by adding 20 ml of the seed inoculum into eight liters of BOD phosphate buffered dilution water at pH of 7.2 and kept under aeration for 24 hours. The contaminated water was produced by adding 8 liters of the working standard to a plastic drum containing 80 liters of buffered distilled water at pH 7.2 and 10 grams of glucose as an organic substrate. This water was then aerated for 24 hours, and analyzed for fecal coliform bacteria. The laboratory determined that the contaminated water contained approximately 4,000cfu/100ml of fecal coliforms.

Test Container

Two containers measuring 18 inches long, 12 inches wide and 12 inches deep were used for the test. Each had a lid, which was kept closed except for sampling. The containers were insulated to maintain constant temperature for the duration of the experiment.

Antimicrobial Fabric Flotation Apparatus

A three-foot by one-foot strip of the treated Adsorb-it®/AM fabric was cut from a manufactured roll. The fabric was hot glued around the perimeter of a styrofoam frame, with a center cutout used for sampling. The material hanging below the frame was cut into one-inch strips, ending at the Styrofoam frame. This design allows three dimensional contact with the water as the fabric strips have a density greater than water, and hang down from the styrofoam float. A second apparatus was also constructed using untreated Adsorb-it fabric as the control for comparison.

PROCEDURE

The incubation containers were filled with 40 liters (10.6 Gals) of the synthetic contaminated water and allowed to equilibrate for 30 minutes. Initial samples were taken in sterile bacteria sample bottles. The antimicrobial flotation apparatus and the control flotation apparatus were positioned into each of the containers and the timed sampling sequence began. Water samples were taken using a 20 ml sterile glass tube. Four samples were taken from each corner of the container and two from the center; these were combined into sterile bacteria bottles for each timed sample event submitted for testing. The timed sequence of sampling progressed from minutes to hours. The samples were maintained at 4C, and submitted to the lab within 24 hours of sampling. The samples were analyzed by Method SM9222D for Fecal Coliform MF; the results are as follows:

RESULTS

<u>Constants</u>	<u>Adsorb-it/AM</u>	<u>Adsorb-it Control</u>
pH	7.2	7.2
Fabric surface area*	3.0 sq/ft	3.0 sq/ft
Volume water	40 liters/10.6 gal	40 liters/10.6 gal
Water temperature	70F	70F
Fabric weight	4 oz/124 grams	4 oz/124 grams
Ratio fabric/water	1 / 322	1 / 322

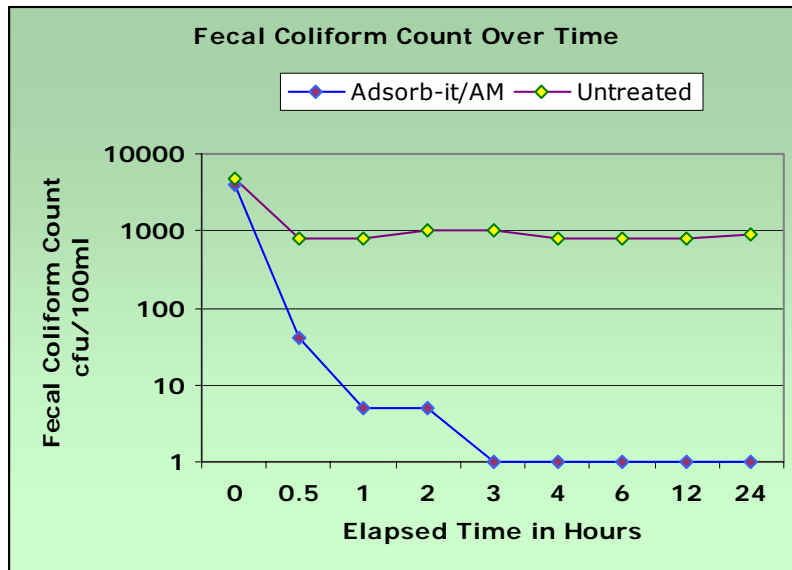
* Note: The surface area of the Adsorb-it® filtration fabric is far greater than its outside physical measurements. It has vast interstitial spaces between the fibers from its proprietary manufacturing process and the recycled fibers have surface area enhancement greatly increasing available surface area compared to virgin fibers.

Table I

Sample Times	Result Adsorb-it® /AM cfu/100ml	Result Adsorb-it® Control cfu/100ml	Percent Removal Compared to Control
Initial 0 min.	4000	4700	n/a
30 min.	40	800	95%
1 hour	5	800	99.40%
2 hours	5	1000	99.50%
3 hours	0	1000	100%
4 hours	0	800	100%
6 hours	0	800	100%
12 hours	0	800	100%
24 hours	0	900	100%

Note* Since the initial untreated control showed a reduction from 4700 to 800 in the first 30 min., one could assume that the fecal coliform were sensitive to some component of the untreated fabric, or were trapped within the vast interstitial spaces of the fabric, and therefore not recovered.

Graph I



DURABILITY AND PERFORMANCE STUDY

To verify if the covalently bonded antimicrobial treatment will retain its efficacy and not leach off the filtration fabric after repeated washing and drying, the following test was performed.

PROCEDURE

The first procedure was repeated using Adsorb-it®/AM that was washed 10 times with warm water and rung dry between washings. The treated fabric was allowed to hang dry over night. This was done to ensure that any antimicrobial not covalently bonded to the fabric’s fiber would be washed off along with any other component within the fabric that could be chemically detrimental to the fecal coliform. The washed fabric was attached to the flotation apparatus and placed within the incubation container. The conditions of the first procedure were duplicated; the results are as follows:

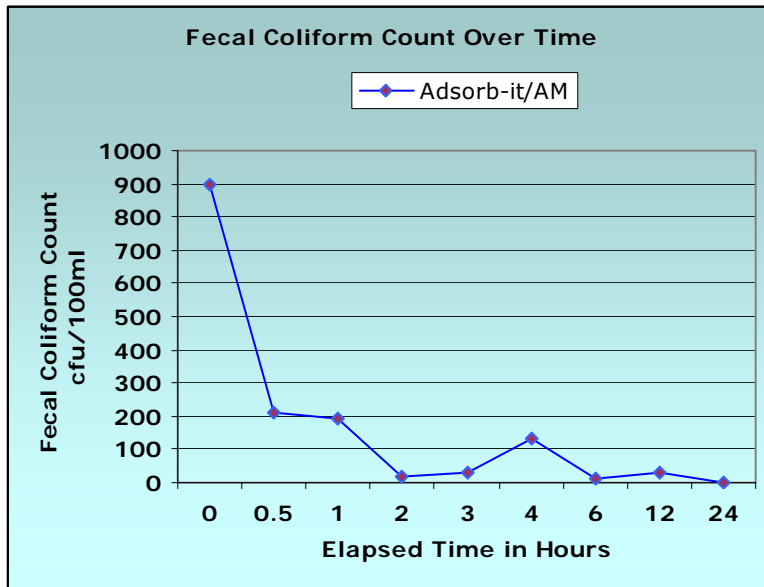
RESULTS

Table II

Sample Times	Result Adsorb-it®/AM cfu/100ml	Percent Removal Compared to Initial
Initial 0 min.	900	n/a
30 min.	210	76.6%
1 hour	190	78.8%
2 hours	20	97.8%
3 hours	30	96.6%
4 hours	130	85.5%
6 hours	10	98.8%
12 hours	30	96.6%
24 hours	0	100%

* Note: Possible sampling contamination error at the 4 hour sampling event.

Graph II



DISCUSSION

The Adsorb-it[®] fabric surface-bonded antimicrobial compared to the untreated control fabric removed 95 percent of the population of fecal coliforms in the first 30 minutes of contact, and 100 percent within a three hour period in the control study. The efficacy of the washed fabric removed over 76 percent of the fecal coliforms within the first 30 min. of contact, and 96.6 percent within three hours. Both stagnant water tests using the treated fabric and the washed fabric maintained 100 percent removal after 24 hours. It should be noted that this study was only monitoring the efficacy for fecal coliform bacteria, other gram(+) and gram(-) bacteria, mycelial fungi, yeast and algae were also being killed in the simulated contaminated water. Both the treated fabric and the untreated control experience a severe drop from the initial bacteria levels. This as noted may be caused by bacterial up take into the fiber matrix, shock to the bacteria being transferred into a new environment, or some component leaching off the unwashed fabric that is detrimental to the bacteria. The fecal coliform population stabilized to 800-1000 cfu/100ml in the untreated control, but dropped to non-detectable levels with the treated fabric. The washed fabric illustrated similar efficiency, however the initial fecal coliform count was 900 at the start of the test. This may be due to the longer stabilization time allowed before taking the initial sample.

CONCLUSION

Unlike a chemical pollutant, bacterial contamination is dynamic and grows exponentially from one bacterium into billions within 24 hours under optimal conditions. Bacteria will also adapt and mutate to develop resistant populations when water soluble antimicrobial agents or disinfectants are used. This is because they dilute out to sub-lethal levels allowing adapting resistant forms to persist, endangering water to resistant bacterial populations. The Adsorb-it[®]/AM tested in this study was designed to overcome these problems by using an immobilized surface-bonded antimicrobial which kills bacteria by molecular penetration and electrocution. Since the antimicrobial is covalently bonded to the fabric, it can't dilute to sub-lethal levels, and the physical kill mechanism is not consumed by repeat bacteria contact.



Rust-Rx Filter Sock

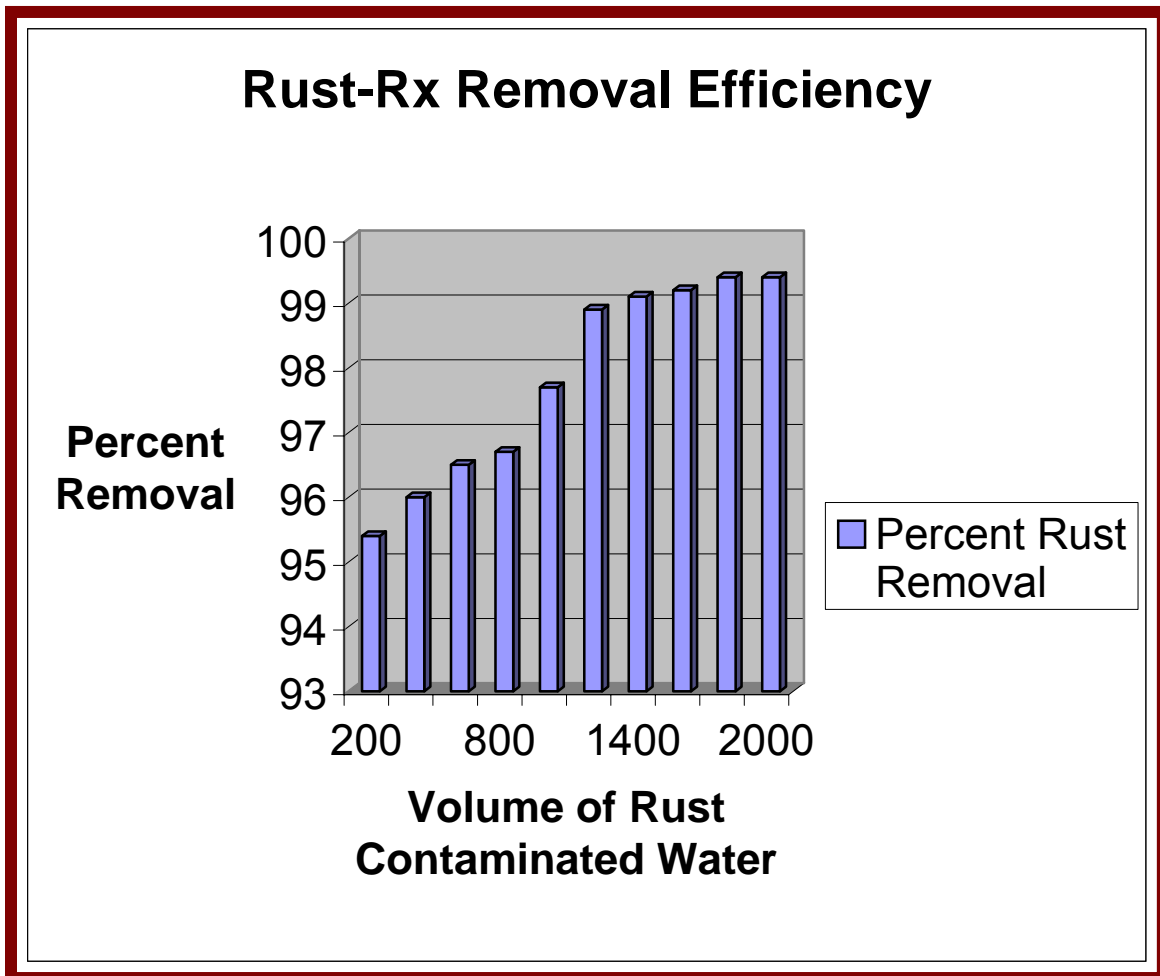
The Oil/Rust-Rx, a unique filtration sock, has been co-developed by **Adsorb-it[®]** and **Attitude Technology, Inc.**, using **Xextex[®]** fabrics. The filtration sock was designed to remove oil and rust from water discharged from underground utility vaults, fire sprinkler systems, or other systems which might discharge rust or oil into the environment. The sock uses an outer and inner layer of the patented X-tex[®] fabric for removal of oil from water, and two middle layers of a proprietary rust and sediment removal fabric.

A study was conducted using these fabrics together as found in the filtration sock to determine its efficiency of rust removal in a standardized water solution containing 1075 mg/L of Fe₂O₃. A spiked water mixture was prepared by adding Fe₂O₃ (rust) purchased from VWR to 3 liters of water adjusted to pH of 4.0. The water was adjusted to a low pH to ensure the finest particle size possible, as pH above 7.0 would cause the rust to precipitate as the hydroxide and increase its particle size. The mixture concentration of 1075 mg/L Fe₂O₃ was determined by EPA Method 160.2 Total Suspended Solids.

The fabrics were cut into two inch circles and placed in the filter vacuum manifold assembly. The rust water mixture was agitated with a stir motor to maintain consistency, and aliquots of 200 mL were pumped to the filtration funnel, then suction was applied. The filtrate of each successive 200 mL was then analyzed by EPA Method 160.2 Total Suspended Solids. The results were then compared to the original concentration of 1075 mg/L and reported as percent removal from the original concentration. The results and graph are as follows:

Original rust mixture concentration = 1075 mg/L

<u>mL</u>	<u>mg/L</u>	<u>% Removal</u>
200	49	95.4
400	43	96.0
600	38	96.5
800	35	96.7
1000	25	97.7
1200	11	98.9
1400	10	99.1
1600	9	99.2
1800	6	99.4
2000	6	99.4



Conclusion: The average of the rust removal is 98.3 percent for the 2000 mL of water rust mixture filtration test. The efficiency of the fabric improved as the pore size was reduced by the loading of the rust within the interstitial spaces of the fabric. The particle size of the rust water mixture was between 0.5 and 5 microns at a pH of 4. At higher pH, the performance would be better as the particle size would increase due to hydroxide flocculation.

Brent Hepner
Vice- President Product Development
Xextex Corporation

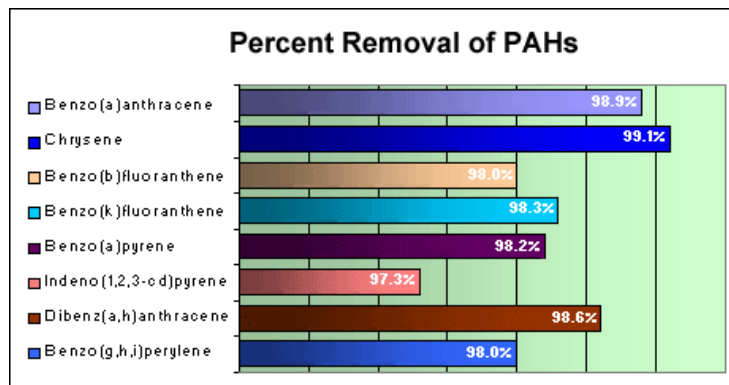
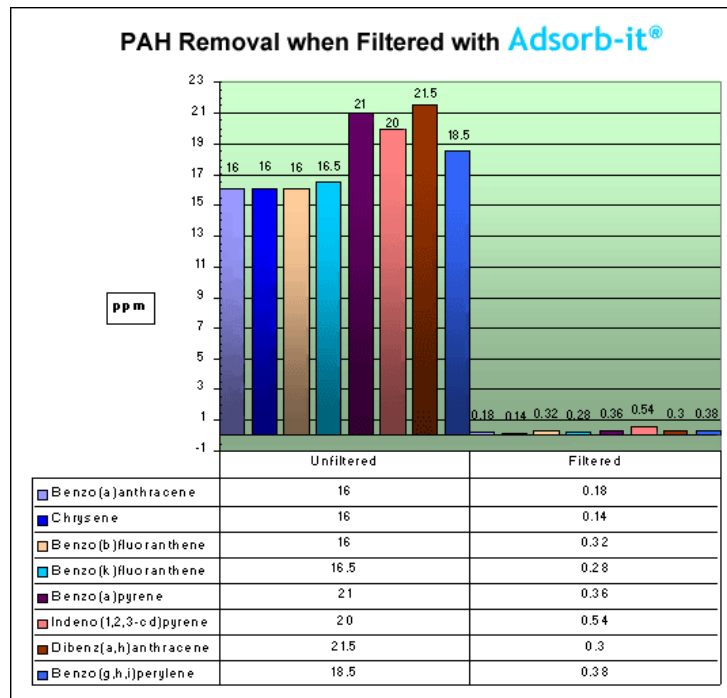
Polynuclear Aromatic Hydrocarbon (PAH) Removal

Many situations exist where PAHs need to be removed from groundwater during remedial actions.

Method

Analytical laboratory spiked aqueous samples were analyzed for PAH concentrations by USEPA Method 8270. Those spiked samples were then poured through 20 grams of **Adsorb-it®** geo-textile filtration fabric and the water passing through the **Adsorb-it®** fabric was again analyzed by USEPA Method 8270 providing the results of analytical chemistry presented in the graphs below.

Results



Conclusions

The PAH removal efficiency of **Adsorb-it®** is in excess of 97%.

Removal of Emulsified Oil with Adsorb-it®

Stubborn emulsions where oil has become dispersed are one of the most challenging filtration problems for industrial waste water. In an emulsion, oil is partially dissolved, consequently, most sorbents and filtration products are completely ineffective.

Method

Testing was performed using a laboratory prepared stock solution of 5 ml of motor oil and 5 ml of diesel fuel to 200 ml of water. 10 ml of a citrus-based degreaser was added to the solution and vigorously agitated creating a known emulsion.

Three separate concentrations of stock solution were created and tested:

- Low - 1.0 ml of stock solution to 1.0 liter of water
- Medium - 10 ml of stock solution to 1.0 liter of water
- High - 100 ml of stock solution to 1.0 liter of water

A 15 cm by 6 cm filter housing was used and filled with 20 grams of the bulk Adsorb-it® filtration media. The Adsorb-it® was wetted prior to the commencement of the test. The test solution was run through the Adsorb-it® at a rate of 500 ml per minute and the first filtrate was discarded. An additional portion of the test solution was run through the Adsorb-it® and collected for analysis. Filtered and unfiltered test solutions were sampled by USEPA Method 418 (USEPA Method 418 measures petroleum hydrocarbons as well as fats in soaps).

The samples were extracted and a silica gel cleanup was performed to remove the fatty acids and soaps from the samples allowing accurate measurement of the motor oil and diesel components.

Results of analytical chemistry are presented in the table below.

Results

Sample	Result (ppm) Unfiltered	Result (ppm) Filtered with Adsorb-it®	% Oil Removed by the Adsorb-it®
Low Level	24	3.2	87%
Med Level	140	7	95%
High Level	960	24	97%

Conclusions

At the medium and high levels Adsorb-it® removed greater than 90 percent of the oil. Competing products that remove floating oil have generally proven ineffective with partially dissolved or emulsified oil.

Wash Wastewater Filtration

Initial laboratory studies show **Adsorb-it**[®] sorbent to be very efficient in selectively adsorbing / absorbing petroleum and vegetable-derived hydrocarbons from water. This work was done using laboratory prepared and controlled test solutions. This test demonstrates **Adsorb-it**[®] 's sorbent effectiveness by testing real-world samples. Real-world samples measure not only the ability of the filter material to remove the pollutants of interest, but also to handle water that contains floating and dissolved hydrocarbons, emulsifiers, and detergents, as well as debris that might affect filter performance.

Method

We were provided a five gallon sample of effluent from a logging truck wash station. The sample was thoroughly mixed and split into two sub-samples. One sub-sample was tested to determine suspected organic and inorganic pollutants. The other sub-sample was passed through a filter system using **Adsorb-it**[®] filter media and the filtered water was analyzed for the same pollutants.

Results of analytical chemistry are presented in the table below.

Results

Parameter	Method #	Result Unfiltered	Result Adsorb-it [®] Filtered	Detection Limit	Units
Oil & Grease	EPA 1664	> 1000	6	5	ppm
Total Suspended Solids	EPA 160.2	230	10	5	ppm
#2 Diesel Fuel	NWTPHDX	910	3.4	.02	ppm
Motor Oil	NWTPHDX	15000	3	0.4	ppm
Arsenic	EPA 6020	ND*	ND*	0.006	ppm
Cadmium	EPA 6020	0.0018	ND*	0.0005	ppm
Chromium	EPA 6020	0.013	0.0044	0.001	ppm
Copper	EPA 6010	0.077	ND*	0.01	ppm
Lead	EPA 6010	0.011	ND*	0.01	ppm
Zinc	EPA 6010	2.1	0.85	0.01	ppm

Conclusions

As can be seen in the table above, **Adsorb-it**[®] sorbent was highly effective in removing organic pollutants and suspended solids from the sample. Especially notable is the reduction in oil and grease, diesel, and motor oil between the filtered and unfiltered samples.

Adsorb-it® Sorbent's Impact on the Environment

Sorbents used in the environment should be environmentally benign. A standard test of potential environmental harm is the Toxicity Characteristics Leachate Procedure (TCLP test) which measures the concentration of chemicals of concern released into the environment from solid substances.

Method

Adsorb-it® sorbent material was submitted to an analytical laboratory with NELAP (National Environmental Laboratory Accreditation Program) accreditation for the full suite of TCLP analyses. The results of the tests are summarized below.

Results

Volatile Organic Compounds (VOCs) / EPA Method 1311 / 8260B

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
Vinyl Chloride	ND*	0.2	mg/L	0.2
1,1-Dichloroethene	ND*	0.2	mg/L	0.7
2-Butanone	ND*	1	mg/L	200
Chloroform	ND*	0.2	mg/L	6.0
Carbon Tetrachloride	ND*	0.2	mg/L	0.5
Benzene	ND*	0.2	mg/L	0.5
1,2-Dichloroethane	ND*	0.2	mg/L	0.5
Trichloroethene	ND*	0.2	mg/L	0.5
Tetrachloroethene	ND*	0.2	mg/L	0.7
Chlorobenzene	ND*	0.2	mg/L	100

* ND=not detected at or above the method detection limit

RCRA Metals / EPA Method 1311 / 6010 / 7470

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
Arsenic	ND*	0.2	mg/L	5.0
Barium	0.25	0.005	mg/L	100
Cadmium	ND*	0.05	mg/L	1.0
Chromium	ND*	0.1	mg/L	5.0
Lead	ND*	0.1	mg/L	5.0
Selenium	ND*	0.5	mg/L	1.0
Silver	ND*	0.2	mg/L	5.0
Mercury	ND*	0.002	mg/L	0.2

* ND=not detected at or above the method detection limit

Chlorinated Pesticides / EPA Method 1311 / 8081

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
gamma-BHC (Lindane)	ND*	0.001	mg/L	0.4
Heptachlor	ND*	0.001	mg/L	0.008
Heptachlor epoxide	ND*	0.001	mg/L	0.008
Endrin	ND*	0.002	mg/L	0.02
Methoxychlor	ND*	0.01	mg/L	10
Chlordane (technical)	ND*	0.01	mg/L	0.03
Toxaphene	ND*	0.1	mg/L	0.5

* ND=not detected at or above the method detection limit

Chlorinated Herbicides / EPA Method 1311 / 8151

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
2,4-D	ND*	0.001	mg/L	10
Silvex (2,4,5-TP)	ND*	0.001	mg/L	1.0

* ND=not detected at or above the method detection limit

Semivolatile Organic Compounds/ EPA Method 1311 / 8270C

Parameter	Result	Detection Limit	Units	Maximum Contaminant Level
1,4-Dichlorobenzene	ND*	0.005	mg/L	7.5
2-Methylphenol	ND*	0.005	mg/L	200
3- & 4-Methylphenol	ND*	0.005	mg/L	200
Hexachloroethane	ND*	0.005	mg/L	3.0
Nitrobenzene	ND*	0.005	mg/L	2.0
Hexachlorobutadiene	ND*	0.005	mg/L	0.5
2,4,6-Trichlorophenol	ND*	0.005	mg/L	2.0
2,4,5-Trichlorophenol	ND*	0.005	mg/L	400
2,4-Dinitrotoluene	ND*	0.005	mg/L	0.13
Hexachlorobenzene	ND*	0.005	mg/L	0.13
Pentachlorophenol	ND*	0.005	mg/L	100
Pyridine	ND*	0.005	mg/L	5.0

* ND=not detected at or above the method detection limit

Conclusions

All parameters were well below the limits required by the test, showing that the **Adsorb-it**[®] sorbent material does not contribute to pollution of the environment.

Residual Ash and Heating Value

Samples of the **Adsorb-it**[®] sorbent material were tested to determine the residue and the heating value. The ash was determined to be 0.65% by ASTM method D482 and the heating value was determined to be 7600 BTU/lb by ASTM method D240.



MATERIAL SAFETY DATA SHEET

PRODUCT NAME

Adsorb-it

MANUFACTURER

Eco-Tec, Inc
 PO Box 690
 Vaughn, WA 98394
 USA

Emergency Telephone Number
 (888) 668-8982
 Information Telephone Number
 (888) 668-8982

HAZARDOUS INGREDIENTS / IDENTITY INFORMATION

Hazardous Components	None
Identity Information	Synthetic/polymer fiber blend

PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	N/A
Specific Gravity (H2O=1)	N/A
Vapor Pressure (mm Hg)	N/A
pH	N/A
Melting Point	480° - 570° F
Vapor Density (Air=1)	N/A
Evaporation Rate (Butyl Acetate=1)	N/A
Solubility in Water	Not Soluble
Appearance / Odor	Color: gray to blue-gray, odorless

FIRE / EXPLOSION HAZARD DATA

Flash Point (NEPA Fire Analysis, polymer fiber pg.4-49, Eighteenth Edition, 1997)	840° - 1040° F
Flammable Limits	1290 -1330
LEL	680°
UEL	750°
Extinguishing Media	Water spray, ABC dry chemical
Special Fire Fighting Procedures	Use self contained breathing apparatus when fighting fires in enclosed areas when exposure to smoke and gasses could occur (including cleanup and salvage operations).
Unusual Fire and Explosion Hazards	Protein type air foams would be ineffective on larger fires due to lack of cooling capacity which could result in re-ignition.

REACTIVITY DATA

Stability	Stable
Conditions to Avoid	None
Incompatibility	None
Hazardous Decomposition / By-Products	None
Hazardous Polymerization	Will not occur
Conditions to Avoid	None

HEALTH HAZARD DATA	
Routes of Entry	
Inhalation	Minor dust
Skin	None
Ingestion	N/A
Health Hazards (Acute and Chronic)	A fine, non-irritating dust may occur when handling loose fiber. Persons with breathing abnormalities may wish to wear a common filter mask. Dust is minor and does not occur with the fabric product.
Carcinogenic	N/A
NTP?	N/A
IARC Monographs?	N/A
OSHA Regulated?	No
Signs / Symptoms of Exposure	None
Medical Conditions Aggravated by Exposure	See: "Health Hazards" above
Emergency First Aid Procedures	N/A

PRECAUTIONS FOR SAFE HANDLING AND USE	
If Product is Released or Spilled	Use common industrial practices to clean up.
Waste Disposal Method	If unused, no special precautions are necessary. If used, dispose of in accordance with federal, state, and local regulations.
In certain types of cleanup applications the nature of the material recovered will classify the resulting spent material as a hazardous component. In such instances, the material should be disposed of via an approved hazardous waste disposal service and the appropriate manifesting obtained.	
Precautions to be Taken in Handling and Storing	Avoid generating dust when handling loose fiber.
Other Precautions	None

CONTROL MEASURES	
Respiratory Protection	Common dust mask is a good industrial practice but is not necessary.
Ventilation	No special ventilation is necessary
Protective Gloves	May be used but not necessary
Eye Protection	Safety glasses with side shields as a good industrial practice but is not necessary
Other Protective Clothing or Equipment	None required
Work / Hygienic Practices	Wash hands after handling as a good hygienic practice.

PREPARED BY

Eco-Tec, Inc. / Ecology Technology

per

Mary M. Peacock, Principal

Updated February 25, 2004