

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

METALS ADSORPTION SYSTEM FOR GROUNDWATER

EBS has designed a 2-stage metal adsorption system for dissolved metals in groundwater. The concentrations of the metals will be in parts per million or parts per billion range. The adsorption is site specific, and EBS offers bench testing and laboratory analysis, if needed.



EBS 2-drum metals treatment system for groundwater. Unit A (left) is an EBS Liquid Composite Sorbents Media R-100 UltraSorber+. Unit B (right) is an EBS Liquid Bonechar BCHR-830 UltraSorber

EBS Metals Adsorption System for Groundwater:

The EBS Passive Heavy Metals Treatment Unit is designed to remove heavy metals (lead, cadmium, chromium, zinc, nickel, mercury, and others). It is built onto a rugged skid to be mobile and easy to move with a standard forklift. The longevity of the units will depend on the concentration in the water, the flow rates and the turbidity. Lower concentrations at low flow rates (3-5 gallons per minute) could last up to 12 to 24 months, whereas higher flow rates at higher concentrations, might only last for 6 to 9 months. Sites with organics (gasoline, PCE, TCE, etc.), can have additional carbon filters added to the system for an additional cost.

Maintenance: Change out filters when needed. EBS has supplied 50 filters with this kit.

Operations: The EBS system is passive, and does not require electricity. It is built on a pallet and will need a forklift to put into place.

Inflow and outflow are: 1 1/2". EBS can add a different standard connection size, for an additional cost, if requested.

Manufacturing Time: EBS takes 2 weeks to build the units and shipping takes about 1 week.

Shipping can range from \$800 to \$1500.00. Shipping Time should be about 2 weeks max.

Includes Items A-F

ITEM A

Heavy Metal Removal Special Blend Filter

Quantity (1) EBS LIQUID CLAY R-100 UltraSorber+

EBS UltraSorber Plus

Virgin quality Clay Media, Liquid Phase Unit

General Specifications:

300 lbs of Special Blend Clay Media

8 x 30 mesh size

Max. Liquid Flow: 12 GPM

Liquid Flow Recommended: 10 GPM

Lineal Face Velocity: 3.62 gpm/ft sq. @ 10 GPM

Residence Time: 4.50 min. @ 10 GPM

Max. Pressure: 8 psi

Pressure Drop: 1.5 PSI

Material Construction:

16 awg. carbon steel

12 awg Bolt Ring Closure, Chemical Resistant

Gasket

Interior Finish: Epoxy Coated

Exterior Finish: Enamel Paint

Shipping Weight: 234 lbs

Bottom Outlet: MNPT 2"

Top Inlet: FNPT 2"

Dimensions: 34" H x 23" D; sampling port

ITEM B

Heavy Metal Removal Special Blend Filter

Quantity (1) EBS LIQUID BONECHAR BCHR-830 UltraSorber

EBS Virgin quality Bone Charcoal, Liquid Phase Unit

Used for Removing Heavy Metals

General Specifications:

300 lbs of Special Media Mix with Bone Charcoal

8 x 30 mesh size

Max. Liquid Flow: 12 GPM

Liquid Flow Recommended: 10 GPM

Lineal Face Velocity: 3.62 gpm/ft sq. @ 10 GPM

Residence Time: 4.50 min. @ 10 GPM

Max. Pressure: 8 psi

Pressure Drop: 1.5 PSI

Material Construction:

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

16 awg. carbon steel
12 awg Bolt Ring Closure, Chemical Resistant
Gasket
Interior Finish: Epoxy Coated
Exterior Finish: Enamel Paint
Shipping Weight: 370 lbs
Bottom Outlet: MNPT 2"
Top Inlet: FNPT 2"
Dimensions: 34" H x 23" D; Sampling Port Assembly

ITEM C

Quantity (1) Sampling Port Assembly

EBS LIQUID SAMPLE KIT SP-200

Liquid Phase Sample Kit Assembly

Consists of:

- Sample Ports Valve Assy (3)
- Quick Connect Fittings and Tubing 1"
- Pressure Gauges (2)
- Plumbing and Labor

ITEM D

Quantity (1) Sampson Bag Filtration Vessel

EBS SAMPSON BAG FILTRATION BF-201

Bag Filter Housing

High Capacity, Low Pressure Drop

Clamp Lid

304 Stainless Steel Construction

40 GPM Max Continuous Flow

1.5" FNPT Inlet/Outlet

Design Pressure: 150 psi at 225 °F

No.4 size, 4" x 14 " bags

Drain & Vent Connections

ITEM E

Quantity (50) Sampson Filters

EBS LIQUID FILTERS SF-202

PE-50-P4SH Sampson Filter Bag

Polyester Glazed Felt

5 Micron

Plain, no cover

Dimensions: 4" x 14" OAL

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

Zinc Plated Steel Ring
Strap Handle
Box of 50

ITEM F **Skid Assembly**

EBS SKID ASSEMBLY SA-500

Carbon Steel Construction
6 ER-SKID-55X40-025-CS
Carbon Steel Skid Platform Painted Epoxy
Skid size will be 55"x 40"
Forkliftable & Portable
Platform Assembly Included The Following:
- All components will be assembled fastened &
plumbed on the platform

ITEM G (OPTIONAL; CAN BE ADDED)

Carbon Media Filter

EBS CARBON MEDIA CM-165

Quantity (0)CARB-LP-170-CS UltraSorber
Virgin quality carbon, Liquid Phase Unit
General Specifications:
165 lbs of Bituminous Coal Carbon
8 x 30 mesh size
Max. Liquid Flow: 12 GPM
Liquid Flow Recommended: 10 GPM
Lineal Face Velocity: 3.62 gpm/ft sq. @ 10 GPM
Residence Time: 4.50 min. @ 10 GPM
Max. Pressure: 8 psi
Pressure Drop: 1.5 PSI
Material Construction:
Carbon Steel
Bolt Ring Closure, Chemical Resistant Gasket
Exterior Finish: Epoxy Finish
Shipping Weight: 250 lbs
Bottom Outlet: MNPT 1 1/2"
Top Inlet: FNPT 1 1/2"
Dimensions: 48" H x 20" D
Comes with 6 Media Bags of 25 lbs

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

PAYMENT TERMS

Price: PLEASE CALL 415-381-5195

Shipping: \$800 - \$1500 depending on location

Taxes: Sales tax applies to California. (7.00%-8.75%) and will be added to the purchase

EBS accepts VISA/MC/Discover/American Express

Upon approved credit application, EBS requires bills to be paid in 30 days after receiving the item. Please call Jim Jacobs at EBS (415-381-5195) or jimjacobs@ebsinfo.com for more information or to put in an order.

Environmental Bio-Systems, Inc.
707 View Point Road
Mill Valley, CA 94941 USA

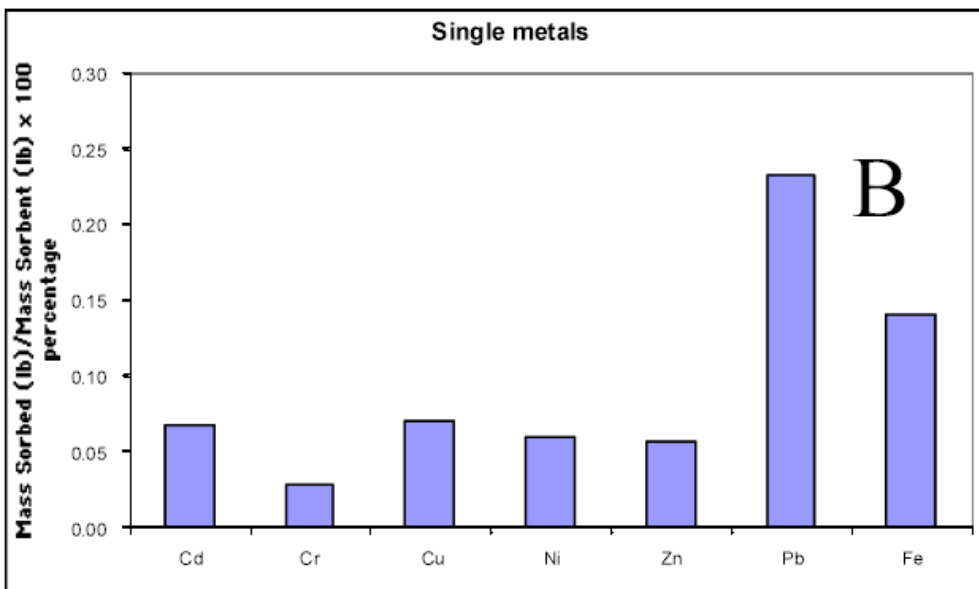
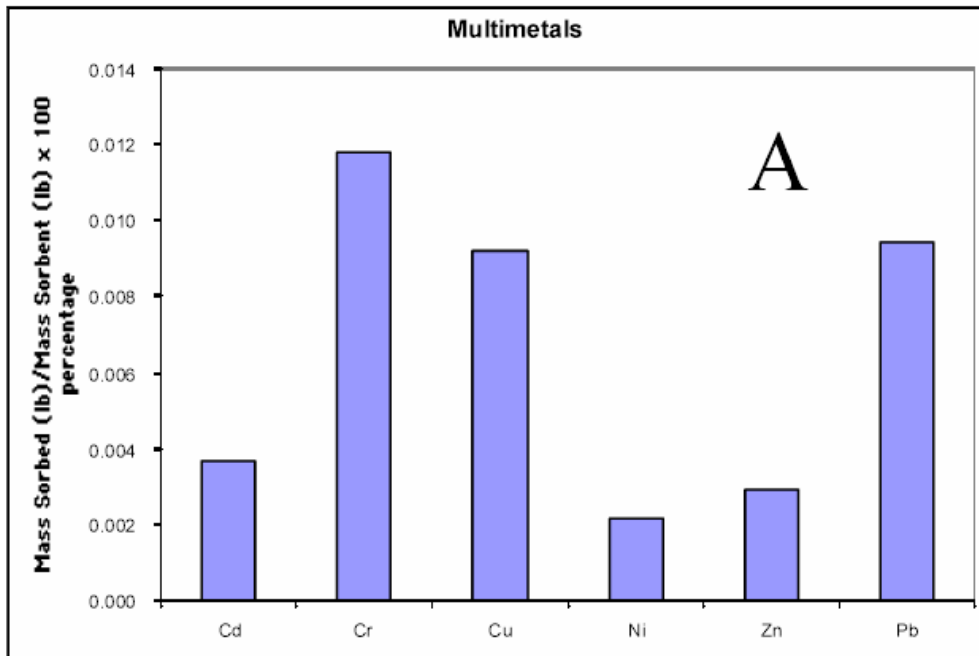
Research into the capacity of the EBS Metals Treatment System are shown below. Individual site conditions may vary. EBS does offer bench testing services with soil or groundwater with the EBS media.

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

EBS UNIT A - HEAVY METAL REMOVAL SPECIAL BLEND FILTER

EBS Liquid Composite Sorbents Media R-100 UltraSorber+



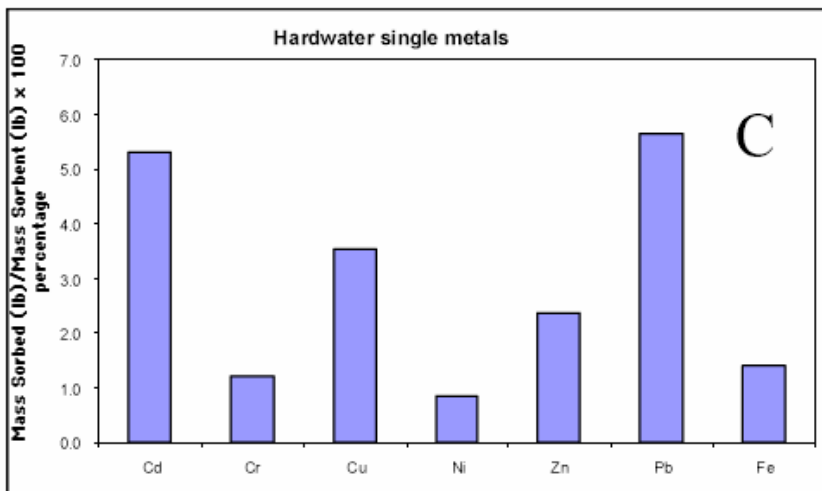
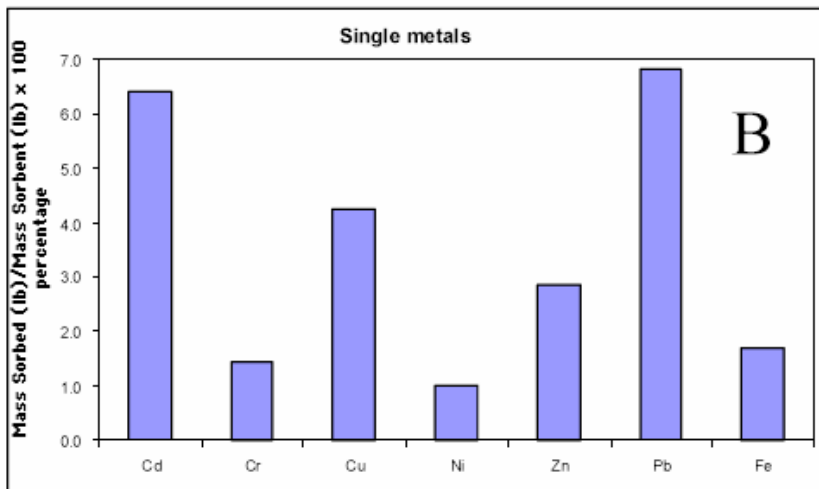
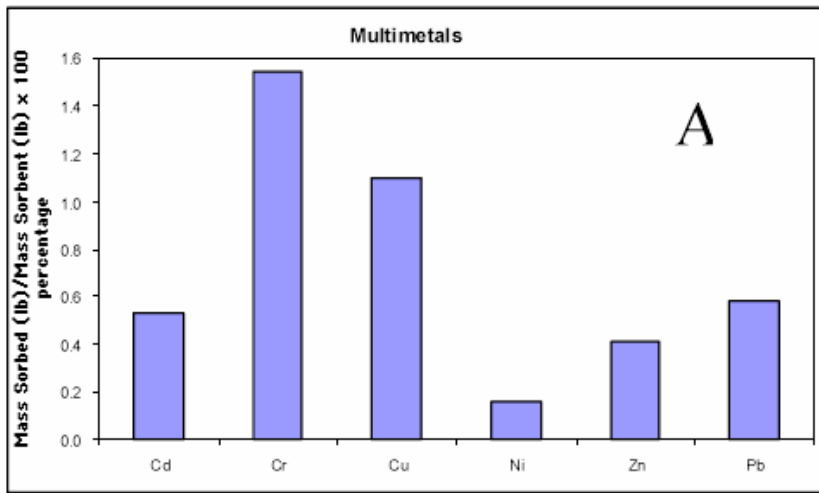
Bar charts quantifying the approximate sorption capacity of the EBS Liquid Composite Sorbents Media R-100 UltraSorber+ for each of six metals. Graph A shows the capacity data for each metal in the presence of other metals; Graph B shows the capacity data for each metal without other metals being present. The example for Graph B shows 0.75 lb of lead (Pb) will absorb to 300 lbs of EBS Liquid Composite Sorbents Media R-100 UltraSorber+.

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

EBS UNIT B - HEAVY METAL REMOVAL SPECIAL BLEND FILTER

EBS Liquid Bonechar BCHR-830 UltraSorber



Bar charts quantifying the approximate sorption capacity of the EBS Liquid Bonechar BCHR-830 UltraSorber

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

PRODUCT INFORMATION - EBS Liquid Bonechar BCHR-830 UltraSorber
CARBON TYPE: BCHR-830

ADSORPTION OF METALS

Lead - Very effective with short retention time (ie. 1 minute and below).

Aluminium - Very effective in removing soluble aluminium. Adsorption influenced by pH and retention time. Best results at pH 7 or above.

Cadmium - EBS Liquid Bonechar BCHR-830 UltraSorber is better than conventional precipitation and/or coagulation processes. Superior results in soft water. Retention time on par with aluminium.

Copper - Adsorption dependent upon pH and retention time.

Zinc - Efficiency dictated by contact time and pH. Both pilot plant and full scale plant performances good.

Iron - Dependent upon form of iron. Better results with organic iron than with inorganic. Inorganic results dependent upon valency short retention times suffice.

Manganese - Very effective. Pilot results good. Competition from other methods of oxidation.

Silver - Quite rapidly adsorbed. Better at low concentrations in solute. High deposits of silver on char inhibit adsorption. Adsorption better at pH 5.

Arsenic Largely dependent upon form of arsenic (ie. AsIII or AsV). PH has considerable influence. At low pH almost no adsorption occurs. Affected by Protonation.

Nickel - Adsorption best at higher pH. Requires high retention time. At pH 5 almost no adsorption.

Mercury - Best with organic mercury. Inorganic mercury is dependent upon valency (mercury I and II). Although similar the higher charges monatomic mercury II has a greater affinity for BCHR-830 than mercury I.

Chromium - Much dependent upon form present, ie. cation or anion, and valency (chroma III or chrome VI). Chrome III adsorbs well.

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

ADSORPTION OF NON-METALS

Fluoride - Adsorption onto the EBS Liquid Bonechar BCHR-830 UltraSorber is good, but influence by pH. Adsorption is better at lower pH. Concentration of fluoride present also influences performances. Activated carbons do not adsorb fluoride. Competition is from activated aluminium and special ion exchange resins which are very costly.

Color Reduction - Retention time required is usually about 6 - 15 minutes, dependent upon chemical make up of color. Can be used in slow sand, rapid gravity or pressure filters.

Bromine - EBS Liquid Bonechar BCHR-830 UltraSorber is effective in removing free bromine. The bromine form is important too, in presence of potassium and sodium adsorption decreases.

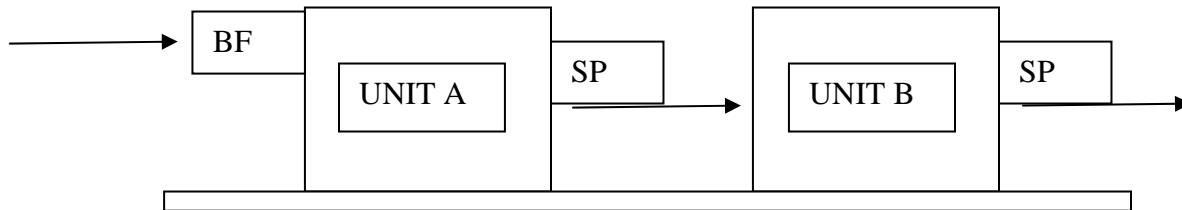
Pesticides - Good at removing organo-chlorine pesticides (ie. dieldrin, septachlor, etc.). Not very good at atrazine, etc.

Chlorine / Chloramines – the EBS Liquid Bonechar BCHR-830 UltraSorber can effectively reduce both.

ENVIRONMENTAL BIO-SYSTEMS, INC.

Since 1989: Innovative Solutions for a Better Environment

Engineering Schematic of the EBS Metals-Treatment System



UNIT A
HEAVY METAL REMOVAL
SPECIAL BLEND FILTER

EBS Liquid Composite Sorbents
Media R-100 UltraSorber+

300 lbs Special Blend Modified
Clay Media and modified
fibrous carbon
Max Flow: 12 GPM
Residence time: 4.50 min @ 10
GPM
Max Pressure: 8 psi
Dimensions: 34" H X 23" D
Forklift Skid Assembly

UNIT B
HEAVY METAL REMOVAL
SPECIAL BLEND FILTER

EBS Liquid Bonechar BCHR-
830 UltraSorber

300 lbs Bone Charcoal
Max Flow: 12 GPM
Residence time: 4.50 min @ 10
GPM
Max Pressure: 8 psi
Dimensions: 34" H X 23" D
Forklift Skid Assembly (one
skid)

SP = Sampling Port

BF = Sampson Bag Filtration Vessel with 50 filters

→ Groundwater Flow Direction (3-10 GPM)

EBS PASSIVE HEAVY METALS MOBILE TREATMENT UNIT

Environmental Bio-Systems, Inc. 707 View Point Road Mill Valley, CA 94941 Tel: 415-381-5195 Fax: 415-381-5816 www.ebsinfo.com	James Jacobs, P.G., C.H.G. 11-20-07
--	---