



Metals Removal by RapidPure UltraCeram

Introduction

Heavy metals in drinking water are a serious concern due to the adverse health effects that are associated with them. Exposure to these contaminants can cause issues ranging from skin irritation to kidney damage as well as increased chance of autoimmune dysfunction and even death in extreme cases. In order to determine if RapidPure UltraCeram media can address this issue, a panel of heavy metals was chosen for testing. Based on customer requests and market trends for claims in drinking water filtration, it was decided that testing would be conducted for arsenic, barium, cadmium, chromium, chromium VI, copper, iron, lead, selenium and silver. The results of this testing show that RapidPure UltraCeram media significantly reduced chromium VI, copper, iron, lead and selenium from water.

Materials and Methods

All testing was conducted on 90mm flat sheet disc samples with an effective surface area of 4,415.6mm² (0.0044m²) or 0.0475ft². RapidPure UltraCeram has an approximate basis weight of 313 gsm, so the samples used were approximately 1.38 grams each.

RapidPure UltraCeram lot 201477 (Carbon heat seal with silver)

Testing and analysis was conducted through third party labs. The metals spike was purchased from CPI International and analysis of filtrate was provided by TestAmerica in Tampa, FL. Filtering of the spike through the media was carried out by BCS Laboratories in Gainesville, FL. **Note: All metals provided were in their most predominant forms and dissolved by CPI into their standard solution. The only exception was the chromium which was specially requested to be the chromium +6 species.**

The following test method was provided by BCS:

- RapidPure UltraCeram
- Lot 201477
- Challenge started on 11/4/2014, by: GL KN
- Water Type: 35 Gallons Reverse Osmosis Water, filter: iSpring RCB4T & Carbon
- Chlorine: none, method: ortho tol.
- Initial pH: 5.65, adjusted to: 6.78 by: 1N NaOH approximate Volume: 2ml Lot: 111913
- Test: Heavy Metals: Arsenic, Barium, Cadmium, Chromium +6, Copper, Iron, Lead, Selenium, and Silver.
Samples sent to TestAmerica Tampa for analysis.
- Other: 60ml CPI Heavy Metal Spike 1000ppm (lot: 14H027), 0.16 grams copper sulfate pentahydrate (lot: E4265A1)
- Study date: 11/4/2014, start: 12:00
- Samples were taken at 1L, 10L, and 15L

60ml CPI Heavy Metal Spike 1000ppm (lot: 14H027), 0.16 grams copper sulfate pentahydrate (lot: E4265A1) was added to 35 Gallons of reagent Laboratory Grade water (RO). The water was homogenized and pH was adjusted to 6.0+/-0.5, and an influent sample was collected for analysis. Filters were cut out and secured into metal filter holders. The challenge water was then passed through each of the filters. Peristaltic pumps were set at 140ml/min and flow rate was measured to be 130-135 ml/min. Samples were taken at 1L, 10L and at 15L. Pressure began to increase dramatically from 1L to 10L. at 1L pressure was measured at an average of 1.4 psi, at 10L pressure spiked at 14.0 psi. Study was discontinued at 15L because pressure of system surpassed 20.0 psi.

Flow rate and pressure for the volume collected was recorded by validated measuring devices. Filters' influent and effluent samples were sent out to TestAmerica Tampa for analysis. All analysis was conducted, at minimum, in duplicates.

Data

TABLE 1.

Metals that were significantly reduced by RapidPure UltraCeram media and the percent reduction the terminal sample point (15 Liters).

Chromium VI	99.5%
Copper	98.1%
Iron	87.2%
Lead	99.5%
Selenium	81.7%

TABLE 2.

Metals Reduction by RapidPure UltraCeram at Three Sample Points

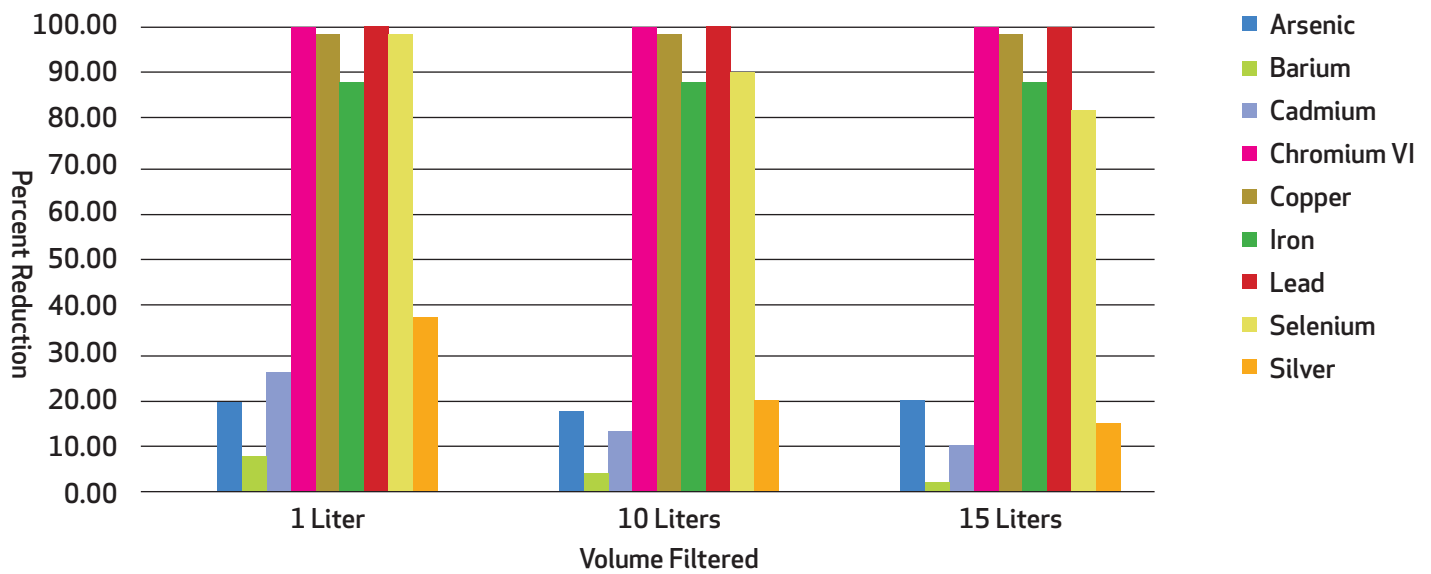


TABLE 3.

The reduction capability of rapidPure UltraCeram for each metal per area of media by weight.

NOTE: 2.5" x 5" filters contain ~1.5ft² of media and 2.5" x 10" filters contain ~3ft² of media.

REDUCTION OF METALS PER AREA BY MEDIA (BY WEIGHT)

	Influent conc mg/liter	mg/gram media	mg/ft ² media	2.5" x 5" filter	2.5" x 10" filter
Arsenic	0.41	3.74	108.33	162.49	324.99
Barium	0.42	3.69	107.07	160.00	321.21
Cadmium	0.40	3.63	105.18	157.77	315.53
Chromium VI	0.43	4.62	133.84	200.76	401.52
Copper	0.15	1.62	47.10	70.65	141.30
Iron	0.39	4.13	119.78	179.67	359.35
Lead	0.43	4.67	135.42	203.13	406.25
Selenium	0.41	4.37	125.72	190.08	300.15
Silver	0.40	3.69	106.96	160.45	320.89
TOTAL	3.44	34.15	990.40	1425.60	2971.20

Discussion

Chromium VI, copper, iron, lead and selenium were all significantly reduced when filtered through RapidPure Ultraceram. In fact, the chromium VI, copper, iron and lead were analyzed for but not detected during analysis. The percent reduction values were calculated using the detection limit as the effluent concentration. It is possible that the reduction percentage values for these metals were even higher than reported here. The RapidPure UltraCeram media was only able to reduce arsenic, barium, cadmium, and silver by less than 20% at the terminal sample point.

The testing was concluded at 15 Liters due to the increased pressure within the system, which surpassed 20 psi. The pressure increase was likely due to plugging of the filter from retention of the metals in the spike solution. There was a total of 3.44mg/L of metal being filtered through the media for 15 Liters or a total of 51mg of metals. Each sample was approximately 1.38 grams. Table 3 shows the estimation and reduction of each metal that would be expected by the media in terms of the area of weight.

NOTE: For the metals that were removed significantly, the total volume filtered could have been higher had the material not been plugging. It is unclear if plugging was due to all of the metals or if only certain ones were causing the plugging. It is possible that the total volume filtered and/or milligrams removed could be greater, for the successfully reduced metals, if each metal were filtered individually. However this would be neither time or cost effective to carry out.



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Patent pending.