Arsenic Removal: Part I

By Deepak Chopra

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Removal of Arsenic From Drinking Water with Ferroloox (Iron hydroxide based) Adsorption Technologies -by Deepak Chopra
1. Arsenic Chemistry

Arsenic Species

As (III) – $H_3AsO_3$, $H_2AsO_3^-$, $HAsO_3^{-2}$

As (V) – $H_3AsO_4$, $HAsO_4^{-1}$, $AsO_4^{-2}$

What is the significance of Arsenic speciation?

As (V) is more effectively removed by FERROLOX than As (III) but this is the case by most of the Adsorbents.

Arsenic Occurrence

Most of the surface waters as they get enough oxygen the Arsenic is Predominantly As (V)

Lack of oxygen in Ground waters are usually found with As (III). But some times they can be as As (V) or a combination of both As (III) and As (V).
WATCH’S SOLUTION

WATCH has changed the Arsenic Chemistry with OXYDES ($H_2O_2$)
And now maximum As can be removed with
Oxidizing As (III) to $\rightarrow$ As (V) before FERROLOX!

80% reduction and most effective?
With Solid Oxidizing Media ($MnO_2$ solid)
KATALOIX LIGHT with OXYDES
As (III) Oxidation

Nothing else is more effective
Than FERROLOX Process with Low cost and High removal capacity.
Arsenic Rule

✓ Best Available Technology
✓ Maximum Percent removal As (III)

<table>
<thead>
<tr>
<th>Removal Method</th>
<th>Product(s)</th>
<th>Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidation and Filtration</td>
<td>OXYDES + KATALOX LIGHT*</td>
<td>80%</td>
</tr>
<tr>
<td>Adsorption</td>
<td>FERROLOX</td>
<td>20%</td>
</tr>
</tbody>
</table>

*Learn more about Advanced Catalytic Filtration from our Online Learning system.

Increasing the service life and capacity of FERROLOX:
Using pretreatment OXYDES + KATALOX LIGHT increases FERROLOX capacity up to 500%
2. Adsorption Technology

FERROLOX® Media

Package: 60 Liters Drum

> 99% of surface for removal is internal

Treated Water

WATCh®

Watch Adsorption Specials
**Pressure Vessel**

**EBCT:** 2 – 10 minutes

- **Lower the EBCT**
  - Higher the unit flow rate
  - Smaller the size of the pressure vessel

**Beddepth**
- 1.5 – 5 feet
- 45 – 150 cm

**As (III) + (V)**
- <10µg/L

**Ferrolox**

Watch Adsorption Specials
**Systems Controls:** Manual vs. Automatic

**Pre-treatment:** Oxidation and pH adjustment

**Costs:** Watch always recommends Manual systems. Easy to operate, very less backwash residual.

Oxidation with (OXYMETAL) converting As (III) to As (V)

**Note:** All adsorbents (based on IRON) have greater removal capacity of As (V) than As (III)
pH adjustment:

Arsenic removal performance for FERROLOX can be increased by adjusting the pH with OXYMETAL. Lower is the pH, greater is the removal capacity.

Arsenic Removal Project: Buenos Aires

Inlet Arsenic = 46 – 50 µg/L As at pH 7.8,
Media life 10,000 BVs with outlet As 10 µg/L

pH adjustment with OXYMETAL
At pH 6.8, media life 30,000 BVs with outlet 10 µg/L As
3. Application - Why / Where?

Why Manual units?

Number One Reason – Very simple to operate

✓ Low operating costs
✓ Low investment costs
✓ Low arsenic in treated water < 2-3 µg/L (ppb)

FERROLOX has very high adsorption capacity 15 gram/kg
4. System Design

"Technology with increasing demand"

System configuration:
1. Single
2. Duplex
3. Parallel
4. Series

Pre-treatment:
1. Dosing station Watch-DOS
2. Proportional dosing
3. Oxidation (OXYMETAL)
4. pH adjustment with OXYMETAL
# 5. Operation Costs

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Cost per unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Vessel (s)</td>
<td>1</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>A</td>
<td>2 x A</td>
</tr>
<tr>
<td>Gravel</td>
<td>liters</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>FERRLOX media</td>
<td>liters</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

## Accessories

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
<th>Cost per unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up Flow (Packed Bed)</td>
<td>0 valves</td>
<td>none</td>
<td>n/a</td>
</tr>
<tr>
<td>Down flow (single)</td>
<td>5 valves</td>
<td>D</td>
<td>5 x D</td>
</tr>
<tr>
<td>Down flow (duplex)</td>
<td>10 valves</td>
<td>D</td>
<td>10 x D</td>
</tr>
<tr>
<td>System Manufacturing</td>
<td>Workshop</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Grand Total**

**Operational costs**

If **FERRLOX** adsorbent is used only for one time use, the major cost item is media replacement (90%). 5% costs are related to disposal and 5% is manual loading or unloading of the media.

**“FERRLOX can be regenerated“**

**Thank you for your time**