

The Future of Laboratory and Field Filtration

Low Level Dissolved Metals Improvements

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1. Challenge

- Why do we need such low metals data?

2. Solutions

- Instrumentation & Processes
- Filtration

3. Evaluation of Filtration Devices

- Approach
 - Findings/Data
 - Recommendation
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- Environmental Laboratory
 - Chemistry, Microbiology, Aquatic Toxicity
- Locations
 - Richmond, Kelowna & Edmonton
- People
 - 50+ Staff
 - 10+ Professional Chemists
 - Industry Involvement: CALA, BCELTAC, ACPBC & EMA



Laboratory Perception

We are not CSI!



Why do we need such low metals data?

1. New Regulations/Environmental Protection
 - Example: “Water & Air Resource Protection Guidelines for Mine Proponents & Operators – Baseline Monitoring”. Draft BCMOE, 2009
2. Clients Requests
3. Market Competition

“Order of Magnitude” DL improvements needed



Agilent's 7700 Series ICP-MS

- Octopole Reaction System
- Interference Removal
- High Matrix Introduction
- Significantly Lower DLs



Image supplied by Encapture Photography

Other Issues Amplified at Low Levels

Systematic Validation:

1. **ICPMS** – Introduction Systems, Gases, Programming
2. **Water Source** – Ultrapure Water System
3. **Containers** – Various Suppliers
4. **Environmental Controls** – Storage, Workspace, Procedures
5. **Training**

Filtration continued to be the predominant challenge:

1. **Dissolved > Total**
 2. **Poor Low Level Duplicate Data**
 3. **False Positives**
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Filtration Techniques

- Syringe
- Gravity
- Vacuum

Contamination:

- Containers & Filters
- Sampling & Transfer
- Environment Conditions
- Training

Other Issues:

- Timing: Field vs. Lab
- Precipitation
- Extra Steps in Process

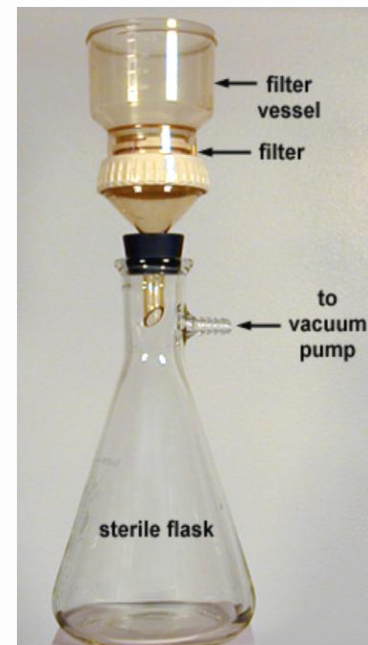


Evaluation of Commercially Available Filtration Apparatuses:

1. Traditional: membrane filtration apparatus
2. Syringe: VWR Supplied
3. Inline: SCP, Environmental Express, Waterra

Screening Considerations:

1. Contamination
2. Speed & Capacity
3. Convenience
4. Cost



Pre-Screening

Partnership With Environmental Express:

- Flipmate™ Product
- Product Required Optimization

Further Product Development & Testing

- Several Prototypes Developed
- Tandem Testing – CARO & EE
- Replicates = 10



Filtration - Assessment

Filter Type	Notes	B	Na	Mg	K	Ca	Ni	Cu	Zn	Pb
	Detection Limit	1	10	5	10	10	0.02	0.1	1	0.02
	Lowest Regulatory Limit	10	100	100	100	50	0.5	0.2	1	0.1
Filter A	Very Slow, High Cost	ND	49	ND	ND	ND	ND	ND	ND	ND
Filter B	Extensive Contamination	5	123	7	57	212	4.59	3.8	20	0.12
Filter C	High Cost, Contamination	ND	ND	ND	ND	22	ND	ND	ND	0.18
Flipmate Prototype A	Flipmate Original	ND	23	ND	ND	ND	ND	ND	2	0.09
Flipmate Prototype B	Prototype	23	688	12	43	146	ND	ND	29	ND
New Flipmate	Final Prototype	ND	13	ND	ND	15	ND	0.2	ND	ND

All numbers in ug/L

Metals Commonly Affected by Filtration:

B, Na, Mg, Al, K, Ca, Mn, Fe, Ni, Cu, Zn, Sr, Zr, Mo, Cd, Sb, Ba, Pb

General Study Observations:

- Lead:
 - DL = 0.02 ug/L; Regulatory Limit: 0.1 ug/L
 - Observations @ 0.12, 0.44, 0.18 ug/L
- Calcium
 - DL = 10 ug/L; Regulatory Limit: 50 ug/L
 - Observations @ 212, 22, 152 ug/L
- Manganese
 - DL = 0.05 ug/L; Regulatory Limit: 0.2 ug/L
 - Observations @ 0.15, 0.09, 0.08 ug/L

Final Filter Assessment:

Filter	Contamination (1-10)	Speed/Capacity (1-3)	Convenience (1-3)	Cost (1-3)	Total (Max = 19)
A	9	1	3	1	14
B	1	3	2	3	9
C	5	2	3	2	12
D - Flipmate	5	2	3	3	13
D - Flipmate 2	2	3	3	3	11
D - Flipmate 3	8	3	3	3	17

Environmental Express Flipmate

- **Simplifies Filtration Process**
 - Integrate, Closed, Single Use System
 - Simple to use in field and lab
 - Small Sample Volumes Possible
 - Vacuum and Gravity Options
- **Relatively Inexpensive**
 - Low Unit Cost
 - Low Cost of Use
 - Compact – Storage, Shipping
- **Quality Improvements**
 - Lower Cross Contamination Risk
 - Low “ Internal” Contamination

Improved LL Metals Data



1. Challenge – Need For Low Metals
 - Regulatory, Client, Industry Pressures
2. Solutions
 - Instrumentation and Process Improvements
 - Filtration Continues to Pose a Challenge
3. Evaluation of Filtration Apparatuses
4. Recommendation
5. Happy Clients





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