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Brief

The prepFAST-MC is a fully automated low pressure chromatography system that can isolate and collect discrete fractions from a dissolved sample. The syringe driven system allows sample loading, elution and column conditioning cycles all with user-defined parameters (time, volume and flow rate).

Features:

• Fully automated bioavailability
• Syringe control
  ✓ Load exact volume
  ✓ Dispense exact volume
  ✓ Accurate, precise flow rate
• All fluoropolymer flow path
• 3 Destination locations
• Flexible chemistry

![Total Dissolved and Bioavailable Metal in Carter Lake](image)

**Figure 1.** Concentrations for dissolved (blue bars) and bioavailable (red bars) trace metals are plotted. The percent bioavailable fraction of dissolved metals in Carter Lake, IA / NE (above each red bar) indicates a wide range from 8% (Ni) to 96% (Mn). Large ranges in the bioavailable fraction are expected in natural waters as variable organic ligand concentration, complexation, pH and ionic strength all affect the colloidal partitioning of each metal differently.
Abstract

A simple, fully automated prepFAST-MC method is used to extract bioavailable metals from the total dissolved fraction of natural, fresh waters. The operationally defined Chelex labile fraction is collected after a sample at natural pH is exposed to a bed of resin for 0.25 seconds (Bowles et al., 2005). Concentrations of Chelex labile and total dissolved metals determined by ICP-MS are used to calculate the bioavailability of each metal. Excellent reproducibility (rsd=0.7%; n=3) for replicate determinations of bioavailable Cu in natural waters is achieved through automation. Water collected from Carter Lake, IA / NE exhibits a range in bioavailability for a suite of metals (Co =24%, Mn =96%, Fe =35%, Cu =17%, Ni =8%, Zn =23%, Cd =19% and Pb =56%) that is typical of natural waters.

Figure 2. The prepFAST-MC system schematic illustrates four steps, 1) load sample into loop, 2) push sample onto column and collect colloidal, 3) elute and collect bioavailable, 4) condition and regenerate.

Figure 3. The three main steps in processing samples for the determination of bioavailable metals are illustrated: 1) 10 mL of sample at natural pH is passed through a Chelex column (~ 0.25 sec exposure time) retaining bioavailable metals and collecting the colloidal fraction (Destination 1), 2) Metals are eluted from the column at low pH (<1) and collected as the bioavailable fraction (Destination 2), and 3) Regenerate / recondition column for next sample (pH 6.7).
Figure 4. The bioavailable Cu fraction is plotted as a function of flow rate for inorganic Cu (green diamonds) Cu-NTA (100µg/L Cu, 1mM NTA, pH 6.1; blue diamonds) and Cu spiked lake water (red squares; natural pH). At a 20 mL/min flow rate (0.25 sec exposure) all inorganic Cu (100%) and approximately 40% of Cu-NTA is retained by the column while flow rate has little effect on the retention of Cu in natural lake water. These results are consistent with the operationally defined bioavailable fraction for Chelex resin (0.25 sec exposure time; Bowles et al., 2005).

Figure 5. Three replicate determinations of bioavailable Cu in natural waters indicate excellent precision is obtained through automating chemistry.
Figure 6. SC-4 DX top view with locations for Samples, Destination 1, Destination 2, and Destination 3. Vial sizes, styles and rack configurations are flexible.

Benefits:

- Fully automated
- Collect all bioavailable and colloidal fractions
- Routine
- Software controlled
- Excellent reproducibility through automation
- Flexible (can be adapted for other resins or chemistries)
- Inert flow path
- Micro column reduces sample/reagent volumes