Measurement of Extractable/Leachable Anion Contamination Levels on Drive Components by Ion Chromatography (IC)

1.0. PURPOSE
This document outlines methods for the sample preparation and measurement of extractable/leachable anion contaminants of the order of 1 ppb from disk drive components by Ion Chromatography (IC).

2.0. SCOPE
Ionic contamination of components is a concern because such contamination can result in corrosion within the disk drive. Components may be tested for surface contamination by extracting briefly with deionized water. The water may be at ambient or elevated temperature. Alternately, components may be immersed and extracted in water at elevated temperature for an extended time period for a more rigorous extraction (leaching). The extraction water is then analyzed using IC to identify and quantify extracted anions. Anions which are commonly controlled include chloride and sulfate. It is possible to detect and measure many other anions and cations which may be of concern.

This document includes four sample preparation methods. They are:

1. A procedure for extracting parts with ambient temperature (22°C ± 3°C) water for 10 minutes (media 10 minutes or 3 minutes if equivalency can be shown).
2. A procedure for extracting parts with ambient temperature (22°C ± 3°C) water for 24 hours.
3. An extended soak at 80°C for 1 hour.
4. An extended soak at 80°C for 24 hours.

The 10-minute ambient soak is intended for routine and/or ongoing monitoring. The 24-hour ambient soak is intended for ionic contaminants inside the bulk and exclude surface contaminants come from environment. Depending on the circumstance, characterizing new materials with varying extraction conditions (time, temperature) may be desirable. The extended soaks are intended for a more thorough extraction of ionic species in samples. After characterization, specific extraction conditions may be chosen which are appropriate for each sample. Other conditions may be used for extraction if required. The conditions used should always be noted (See Section 10.0.).

Quantification of fluoride, chloride, nitrate, phosphate, and sulfate are assumed. Detection limits depend on the purity of the water used for sample and standard preparation, the size sample used, instrument set-up, as well as operator skill and laboratory cleanliness. Facilities may deviate from this procedure as long as equivalency is shown and acceptable detection limits are obtained.
3.0. INTERFERENCES

3.1. Coelution
Ion Chromatography uses the retention times of known peaks in standards as a means of identification of unknown peaks in the samples. Retention time is not a means of absolute identification, as different ions may have similar retention times.

3.2. Weakly Retained Ions
Ions that are weakly retained by the column, such as weak organic acids (acetate, formate, etc.) may elute in the vicinity of fluoride, interfering with quantification, in the case of carbonate base separation mode.

3.3. Water Dip
Water in the sample causes a negative deflection in the baseline due to its lower ionic strength and hence conductivity than the eluent. This dip in the baseline may interfere with the proper integration of fluoride, in the case of carbonate base separation mode.

3.4. Mixtures of Anions at High and Low Concentrations
An ion present at high concentration may have a very large peak that overlaps or completely masks a nearby peak of an ion at low concentration.

3.5. Carry Over
It is possible that very strongly retained anions present in a sample may elute in the next analysis. This can be corrected by increasing the run time or by increasing the concentration of the eluent.

3.6. Environment
The cleanliness of the test environment should be consistent with background requirements for the analysis.
4.0.  EQUIPMENT

A typical setup is suggested below. There are many variations possible, depending upon sample concentrations, matrices, and ions of interest. There are two types of columns for separation of inorganic anions and organic anions. Carbonate-based anion-exchange columns are designed for isocratic separation and hydroxide selective anion-exchange columns are designed for determination at low concentration anions.

Concentration methods may be used to improve detection limits. Matrix elimination may be helpful in order to decrease elements in the sample which will hinder analysis or degrade the columns.

4.1. Instrumentation

4.1.1. Ion Chromatograph System

4.1.1.1. A micro bore system or standard bore system may be used. A micro bore system has a higher sensitivity response than a standard bore system on equal sample injection volume. Use the bore system most suitable for each sample and the sensitivity response desired.

4.1.1.2. Anion Guard Column
   The guard column protects the separator column by trapping contaminants in the sample before they reach the separator column.

4.1.1.3. Anion Separator Column

4.1.1.4. Anion Suppressor

4.1.1.5. Concentrator column or sample loop.

4.2. Supplies

4.2.1. Plastic (Polypropylene recommended) Volumetric flasks
   (25, 50, 100, 250, 500, 1000 and 2000 ml)

4.2.2. Class A Volumetric Pipets, or variable volume Pipettors with tips (5-50 ul)

4.2.3. Plastic (Polypropylene recommended) graduated cylinders (10, 25, and 100 ml)

4.2.4. Plastic (Polypropylene recommended) wide mouth bottles with caps (30, 50, 125, 250 ml)
4.2.5. Plastic (Polypropylene recommended) beakers, various sizes (50-150 ml)

4.2.6. Plastic (Polypropylene recommended) bags, various sizes (5-30cm)

4.2.7. Plastic (Polypropylene recommended) beakers and lids, of sufficient inner diameter to contain media if being tested

4.2.8. Plastic (Polypropylene recommended) spacer rings, 2.0 mm ± 1.0 mm thick

4.2.9. Evaporating dishes and plastic (Polypropylene recommended) trays to hold parts as needed

4.2.10. Disposable Pasteur Pipets with dispensing bulbs

4.2.11. Plastic (Polypropylene recommended) tweezers for handling components

4.2.12. Disposable plastic (Polypropylene recommended) syringes (10 ml)

4.2.13. Two beakers of the same size (250 ml) for heating water

4.2.14. Thermometer for measuring water temperature

4.2.15. Gloves (PVC or other, which have low extractable ionics. Latex should not be used)

4.2.16. Mechanical shaker

4.2.17. Heat sealer

4.2.18. Water bath

4.2.19. Deionized water (≥18MΩ-cm recommended)

4.2.20. Na2CO3 (concentrated solution or salt. High purity grade)

4.2.21. NaHCO3 (concentrated solution or salt. High purity grade)

4.2.22. NaOH (50% solution or salt. High purity grade)

4.2.23. Anion Standard (s)

All labware used should be thoroughly cleaned by rinsing well with deionized water. Detergent is not recommended. IPA may be used to remove oily residues. Supplies used for IC should be isolated for IC use only. When possible, supplies should be left soaking in deionized water when not in use, and the water changed daily.
4.3. Reagents and Standards

4.3.1. Ultrapure deionized water. Water should be filtered if it contains particles larger than 0.2 um. Water may be from an in-house treatment system, or a point of use purification system. The purity of the water should be monitored on a routine basis. All subsequent IC results are limited by the purity of the water used for standard and sample preparation.

4.3.2. Eluent Solution

4.3.2.1. A few mM eluent solution of Na2CO3, NaHCO3 or mixture of these is used for carbonate-based anion-exchange method. Sodium carbonate (0.5M) and sodium bicarbonate (0.5M) concentrate solutions can be obtained from chemical suppliers. To prepare the eluent add appropriate amount of the 0.5 M Na2CO3 stock and 0.5 M NaHCO3 stock to a volumetric flask and fill to the mark with deionized water. Eluent should not be kept for more than a month due to possible algae growth.

4.3.2.2. 100mM NaOH and 5mM NaOH are use for the hydroxide selective anion-exchange method. To prepare the eluents add quantity amount of 50% solution of sodium hydroxide (19M) to deionized water. The eluent should be stored under a helium atmosphere to ensure contamination free operation and proper pump performance.

4.3.2.3. An eluent generation system is used for carbonate-based anion exchange method and hydroxide selective anion exchange method. Add deionized water to the eluent generator to generate a carbonate/bicarbonate eluent or a hydroxide eluent optionally and automatically.

4.3.3. Stock Standard Solution

Combined anion standards containing fluoride, chloride, nitrate, phosphate, and sulfate may be purchased. Stock solution or salts for measurement should be traceable to standard of international standard or national standard. (See 11.1, 11.2 and 11.3 for references).
5.0. CALIBRATION

5.1. The instrument should be calibrated when the calibration check standard no longer meets the requirements in 6.3.

5.2. The calibration range should bracket the expected concentration range of the samples. If limits are imposed on component anion content, the calibration range and sample dilution need to be consistent with these.

5.3. Method Detection Limits (MDL) should be determined for all ions quantified. Values below the MDL should not be reported. Accepted methods for determining the MDL should be used.

Calculate the MDL as follows:

\[
\text{MDL} = (t) \times (S)
\]

\( t \) = Student’s t value for a 95% confidence level and standard deviation estimate with n-1 degree of freedom.

\( S \) = standard deviation of the replicate analysis

5.4. Linearity over the selected range should be established. The calibration curve for each ion should contain at least three points (from 3 standards) if it extends over one order of magnitude, and at least five points if it covers two orders of magnitude.

5.5. The calibration standards should be prepared by pipetting the required amount of stock standard into a volumetric flask, and diluting to the mark with \( \geq 18 \, \text{M} \Omega \cdot \text{cm} \) water.

Example Calculation: 

\[
\frac{C \, (cs)}{V \, (cs)} = \frac{C \, (ss) \times V \, (ss)}{V \, (cs)}
\]

where 

\( C \, (cs) \) = Concentration of Calibration Standard in ng/ml 
\( C \, (ss) \) = Concentration of Stock Solution in ng/ml 
\( V \, (cs) \) = Final Volume of Calibration Standard in ml 
\( V \, (ss) \) = Volume of Stock Solution used in ml

5.6. Standards should be prepared regularly. It is recommended that standards be prepared each time they are used. If standards are stored for more than a day, the stability of the standard solutions should be established.

5.7. Standards should be stored in air tight containers, preferably in a refrigerator.
5.8. A calibration curve based on peak area should be established for each ion of interest using a linear regression analysis. The correlation coefficient, $R^2$, Should be 0.99 or better (0.97 for fluoride).

6.0. QUALITY CONTROL

6.1. The instrument should be calibrated regularly, and the chromatograms used for calibration archived.

6.2. Water blanks and method blanks must be prepared and analyzed for every batch of samples, or every 15 samples, whichever is more frequent. The water blank should consist of a sample of the $\geq 18$ MΩ-cm water being used for extraction. The method blank should consist of a sample which has undergone all the steps as a component sample, without a component. Criteria for levels of anionic species allowable in the blanks should be established.

6.3. A calibration check standard should be run at the beginning and end of every analysis run, and after every 15 samples. This should be a mid-range standard. The results of the analysis should be within ± 10% of the prepared concentration for each ion being analyzed. If not, the problem should be identified and corrected before proceeding with the analysis.

7.0. PROCEDURE FOR WATER EXTRACTION OF COMPONENTS

7.1. Requirements for Sample Preparation

7.1.1. Sample Size
For on-going monitoring of ionic contamination on disk drive components, select the parts in the condition they would be in on the drive production line. A quantity of parts should be used such that if there are limits imposed on ion content, and the appropriate concentration can be accurately measured. The number of parts and amount of water used can be varied to maximize the final ion concentration if necessary.

7.1.2. Prepare and analyze by IC a blank on labware, deionized water source and other equipment to be used for the extraction.

7.1.2.1. Use 25 mls of water total to rinse all extraction supplies -transfer the same water sample from one container to the next. This way, each container does not have to be checked one at a time.

7.1.2.2. Test the collected sample on the ion chromatograph to determine background levels of ionic contaminants. If background is above
acceptable limits, re-clean all the supplies and run blanks until acceptable limits are achieved.

7.2. Ambient Temperature Extraction of Components for 10 minutes.

7.2.1. Use clean tweezers to transfer samples into clean polypropylene, wide-mouth bottles or clean Plastic bags.

7.2.2. Use a graduated cylinder to measure the appropriate volume of ambient temperature de-ionized water.

7.2.3. Pour the water into the wide mouth bottle and cap the bottle or into the bag and seal the bag immediately.

7.2.4. Place the container on a mechanical shaker and agitate at 50rpm or 100rpm ± 10 rpm for 10 minutes.

7.2.5. Enough water must be used and the container placed on the shaker so that all of the components are submerged.

7.2.6. Remove the component from the container using clean tweezers.

7.2.7. Analyze the sample extract by IC.

7.2.8. For components with awkward shapes or large sizes, other containers may need to be used instead of bottles or bags. Any special sample preparation should be documented.

7.3. Ambient Temperature Extraction of Components for 24 hours

7.3.1. Follow the same extraction procedure as in Section 7.2.1- 7.2.5

7.3.2. Take the components from the container using clean tweezers.

7.3.3. Rinse the components with running DI-water for 20 seconds.

7.3.4. Follow the same extraction procedure as in Section 7.2.1- 7.2.3

7.3.5. Place the container on a flat table for 24 hours.

7.3.6. Analyze the sample extract by IC.

7.3.7. For components with awkward shapes or large sizes, other containers may need to be used instead of bottles or bags. Any special sample preparation should be documented.
7.4. Ambient Temperature Wash of Media for 3 or 10 minutes

7.4.1. A plastic (Polypropylene recommended) beaker or Plastic bag of sufficient inner diameter should be used so that the media lays flat on the bottom.

7.4.2. Place media into beaker. If the bottom of the beaker or the bag is very flat, a spacer should be used between the beaker bottom and the media to ensure that the bottom surface of the media is in sufficient contact with water.

7.4.3. If more than one piece of media is to be extracted per sample, alternate the disks with a single Plastic (Polypropylene recommended) spacer ring. Disk separation is required to expose the maximum surface area of the disk to water.

7.4.4. Using a graduated cylinder, measure a minimum of 15 ml/disk of ambient temperature de-ionized water and place in the beaker or the bag. Enough water to completely immerse the disks must be used. (The volume of water used should be noted)

7.4.5. Cover beaker with lid or seal the bag.

7.4.6. Place the beaker on a mechanical shaker and agitate at 50 rpm ± 10 rpm for 10 minutes (or 3 minutes if equivalency can be shown).

7.4.7. Remove the media from the beaker using clean tweezers.

7.4.8. Analyze the sample extract by IC.

7.5. Extended Extraction at 80 C for 1 or 24 hours

7.5.1. Water for extraction

7.5.1.1. On a hot plate, heat deionized water in a beaker to 80 C.

7.5.1.2. To monitor the water temperature, place a thermometer in a second beaker of the same size. Fill with the same quantity of water at the same temperature as the water in the first beaker. Heat both beakers simultaneously. Do not use this water for extractions.

7.5.2. Prepare and analyze by IC a blank on labware to be used for the extraction.

7.5.2.1. Use 25 mls total of 80 C water to rinse all extraction supplies - transfer the same water sample from one container to the next. This way each container does not have to be checked one at a time.
7.5.2.2. Test the collected sample on the ion chromatograph to ensure no ionic contaminant is present. If contamination is present, re-clean all the supplies and run another method blank until no ionic contamination is detected.

7.5.3. Extended Extraction of Components

7.5.3.1. For components, it is recommended that a quantity of parts that gives a minimum surface area of 10 cm$^2$ should be extracted per 25 ml of water in wide mouth bottles or plastic bags. Enough water must be used so that the components are submerged.

7.5.3.2. Use clean tweezers to transfer samples into clean polypropylene, wide-mouth bottles.

7.5.3.3. Use a graduated cylinder to measure the known volume of de-ionized water which has been pre-heated to 80°C. CAUTION: WATER IS HOT!

7.5.3.4. Pour the water into the wide mouth bottle and cap the bottle or into the bag and seal the bag immediately.

7.5.3.5. Shake the bottle gently for two minutes.

7.5.3.6. Place the bottle into a 80°C oven or water bath for 1 or 24 hours.

7.5.3.7. Remove the bottle from the oven or water bath after 1 or 24 hours.

7.5.3.8. Remove the component from the container using clean tweezers.

7.5.3.9. Analyze the extraction water by IC.

8.0. SAMPLE INJECTION

8.1. Follow the instrument manufacturers directions.

8.2. Run the baseline for 1/2 hour prior to use, or until steady.

8.3. If performing manual injections, inject a quantity of the sample that is three times the size of the sample loop.
8.4. If using an auto sampler, prepare schedule.

9.0 CALCULATIONS

9.1. Obtain from the chromatogram the sample extract’s ion concentration in ng/mL. Record this value as $A$.

9.2. Calculate the amount of each ion extracted from the component in $C_{pr}$ (ng per sample) or $C_{ps}$ (after subtracting the method blank: ng per sample) or $C_{sr}$ (ng/cm²) or $C_{ss}$ (after subtracting the method blank: ng/cm²). The calculations are as follows. An appropriate number of significant figures should be used.

Equation 9.2.a: $C_{pr} = \frac{(A_s*V)}{N}$

Equation 9.2.a': $C_{ps} = \frac{((A_s-A_b)*V)}{N}$

Equation 9.2.b: $C_{sr} = \frac{A_s*V}{N*S}$

Equation 9.2.b': $C_{ss} = \frac{(A_s-A_b)*V}{N*S}$

$C_{pr}$ = Concentration before method blank is subtracted in ng/sample

$C_{ps}$ = Concentration after method blank is subtracted in ng/sample

$C_{sr}$ = Concentration before method blank is subtracted in ng/cm²

$C_{ss}$ = Concentration after method blank is subtracted in ng/cm²

$A_s$ = ion concentration of the sample extract in ng/mL

$A_b$ = ion concentration of the method blank in ng/mL

$V$ = Volume of water used for extraction in mL

$N$ = number of samples extracted

$S$ = extracted surface area per sample in cm²
10.0. REPORTING METRICS

10.1. All QC results should be reported with the data. This includes all the items below. Other items may also be added to the report at the analysts or requesters discretion.

10.2. The concentrations of all standards used to construct any calibration curves used, the date of calibration, and minimum reporting limits for each anion quantified.

10.3. The prepared concentration and measured concentration of the calibration check standards.

10.4. All blank values (water and method).

10.5. Whether the blank concentrations were subtracted for calculations.

10.6. Which sample preparation method was used, and any variations on the method.

10.7. Number of parts, surface area, and volume of water used for samples.

10.8. This is just an example of Ionic measurement conditions form and results form.
### Anions – Measurement Conditions (Blank form)

#### Hardware

<table>
<thead>
<tr>
<th>Sample name</th>
<th>Sample name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maker</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td></td>
</tr>
<tr>
<td>Separation column</td>
<td>(Column Inner Diameter)</td>
</tr>
<tr>
<td>Eluent</td>
<td></td>
</tr>
<tr>
<td>Injection mode</td>
<td>Concentration / Loop</td>
</tr>
<tr>
<td>Injection volume</td>
<td></td>
</tr>
</tbody>
</table>

#### Calibration

**Concentrations**

**Anion Standard Sources**

Dilution rate of Standard solution

- F
- CI
- NO2
- Br
- NO3
- PO4
- SO4

**Other anions**

- Example: Acetic acid
- Example: Formic acid

#### Extraction Conditions

<table>
<thead>
<tr>
<th>Sample name</th>
<th>Sample name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td></td>
</tr>
<tr>
<td>Agitation</td>
<td></td>
</tr>
<tr>
<td>Heater</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Container</td>
<td></td>
</tr>
<tr>
<td>UDI water quality</td>
<td>Extraction Volume</td>
</tr>
<tr>
<td>Sample size per extraction</td>
<td>Surface area of sample</td>
</tr>
</tbody>
</table>
Anions – Analysis results form (Blank form)

<table>
<thead>
<tr>
<th></th>
<th>Sample name As (Unit: )</th>
<th>Method blank Ab (Unit: )</th>
<th>Cpr, Cps, Csr, Css (Unit: )</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Br</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total anions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cpr, Cps, Csr, Css: Concentrations (see 9.2. for reference)
## Anions – Measurement Conditions (Example)

### Hardware

<table>
<thead>
<tr>
<th></th>
<th>Sample name-A</th>
<th>Sample name-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maker</td>
<td>Maker-A</td>
<td>Maker-B</td>
</tr>
<tr>
<td>Model</td>
<td>Model-A</td>
<td>Model-B</td>
</tr>
<tr>
<td>Separation column (Column Inner Diameter)</td>
<td>Type-A (ID: 4 mm Standard bore)</td>
<td>Type-B (ID: 2 mm Micro bore)</td>
</tr>
<tr>
<td>Eluent</td>
<td>Na2CO3/NaHCO3</td>
<td>DI-Water/KOH</td>
</tr>
<tr>
<td>Injection mode</td>
<td>Loop</td>
<td>Concentration</td>
</tr>
<tr>
<td>Injection volume</td>
<td>100ul</td>
<td>1.0ml</td>
</tr>
</tbody>
</table>

### Calibration

<table>
<thead>
<tr>
<th>Concentrations</th>
<th>ppb</th>
<th>ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anion Standard Sources</td>
<td>Maker-A</td>
<td>Anions standard</td>
</tr>
<tr>
<td>Dilution rate of Standard solution</td>
<td>1000/100</td>
<td>1000</td>
</tr>
<tr>
<td>F</td>
<td>5/50</td>
<td>5</td>
</tr>
<tr>
<td>Cl</td>
<td>10/100</td>
<td>7.5</td>
</tr>
<tr>
<td>NO2</td>
<td>15/150</td>
<td>25</td>
</tr>
<tr>
<td>Br</td>
<td>10/100</td>
<td>25</td>
</tr>
<tr>
<td>NO3</td>
<td>30/300</td>
<td>25</td>
</tr>
<tr>
<td>PO4</td>
<td>30/300</td>
<td>37.5</td>
</tr>
<tr>
<td>SO4</td>
<td>40/400</td>
<td>37.5</td>
</tr>
<tr>
<td>Other anions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example: Acetic acid</td>
<td>40/400</td>
<td>40</td>
</tr>
<tr>
<td>Example: Formic acid</td>
<td>40/400</td>
<td>40</td>
</tr>
</tbody>
</table>

### Extraction Conditions

<table>
<thead>
<tr>
<th></th>
<th>Sample name-A</th>
<th>Sample name-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>10 min</td>
<td>60 min</td>
</tr>
<tr>
<td>Agitation</td>
<td>Orbital shaker/100 rpm</td>
<td>none</td>
</tr>
<tr>
<td>Heater</td>
<td>none</td>
<td>Water bath</td>
</tr>
<tr>
<td>Temperature</td>
<td>ambient</td>
<td>80°C</td>
</tr>
<tr>
<td>Container</td>
<td>PP bag</td>
<td>PP bottle</td>
</tr>
<tr>
<td>UDI water quality</td>
<td>18.2MΩ</td>
<td>18MΩ</td>
</tr>
<tr>
<td>Extraction Volume</td>
<td>10 ml</td>
<td>20 ml</td>
</tr>
<tr>
<td>Sample size per extraction</td>
<td>1 sample</td>
<td>2 samples</td>
</tr>
<tr>
<td>Surface area of sample</td>
<td>10 cm²/sample</td>
<td>5 cm²/sample</td>
</tr>
</tbody>
</table>
Anions – Analysis results form (Example-1)

<table>
<thead>
<tr>
<th>Sample name-A As (Unit: ppb)</th>
<th>Method blank Ab (Unit: ppb)</th>
<th>Cpr, Cps, Csr, Css</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V = 10ml, N=1 (Unit: ng/sample)</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Cl</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>NO2</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>Br</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>NO3</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>PO4</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>SO4</td>
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<td>2</td>
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<td>Acetic acid</td>
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<td>10</td>
</tr>
<tr>
<td>Formic acid</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>Total anions</td>
<td>200</td>
<td>36</td>
</tr>
</tbody>
</table>

Cps : Concentration (see 9.2. for reference)

(Example-2)

<table>
<thead>
<tr>
<th>Sample name-A As (Unit: ppb)</th>
<th>Method blank Ab (Unit: ppb)</th>
<th>Cpr, Cps, Csr, Css</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>V= 10ml, S= 10cm²/part, N= 1 (Unit: ng/cm²)</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Cl</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>NO2</td>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>Br</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>NO3</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>PO4</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>SO4</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Formic acid</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>Total anions</td>
<td>200</td>
<td>36</td>
</tr>
</tbody>
</table>

Css : Concentration (see 9.2. for reference)

11.0. REFERENCES


11.2. USEPA Method 300.1 Determination of Inorganic Anions in Drinking Water by Ion Chromatography