Fluoride in Drinking Water

The direct concentration fluoride method is more precise and accurate than the SPADNS method.

The procedure provides rapid, uncomplicated determinations, and eliminates interferences associated with colorimetric methods. Interferences from polyvalent cations at the usual levels of a few parts per million are removed by the use of either of the suggested buffers. The electrode method has been approved by EPA, APHA and ASTM. The measurement of fluoride in drinking water is an approved ASTM method. Approval number ASTM D 1179.

Recommended Equipment:

1. Direct concentrations readout ISE meter. Other suitable meters with millivolt accuracy to 0.1 mV may be used; calibration curves will be required. Some of Orion’s compatible meters are EA 940, 920A, 920Aplus, 720 or 720Aplus.
2. Orion Fluoride Electrode, Orion 96-09 (ionplusÒ Sure-FlowÒ solid state Combination Electrode). No reference electrode is required.
3. Volumetric glassware and plastic beakers are recommended for Fluoride measurements.

Required Solutions:

1. Orion Catalogue No. 940907, Fluoride Standard, 100ppm as F-.
2. Orion Catalogue No. 900061, Reference Filling Solution, Optimum Results A.
3. Orion Catalogue No. 940909, TISAB II or Orion Catalogue No. 940911, TISAB III. TISAB is Total Ionic Strength Adjustment Buffer.
4. Distilled or Deionized water.

Set Up:

1. Assemble the combination Fluoride Electrode and check the electrode operation (Slope) as described in the electrode instruction manuals.
2. Prepare a 10ppm standard by pipetting 10 ml of the 100ppm fluoride standard, Orion Cat. No. 940907 into a 100 ml volumetric flask. Dilute to the mark with distilled or deionized water. Swirl to mix.
3. Prepare a 1ppm standard by pipetting 1 ml of the 100ppm fluoride standard, Orion Cat. No. 940907 into a 100 ml volumetric flask. Dilute to the mark with distilled or deionized water. Swirl to mix.
4. Connect the fluoride combination electrode to the meter as specified in the meter instruction manual.

Calibration Standard Preparation:

1. Using a graduated cylinder, transfer 50 ml of the 1ppm standard into a 150 ml beaker. Add 50 ml of TISAB II. Add a magnetic stir bar to the beaker and cover the beaker with a watch glass. (If TISAB III is used, measure 90 ml of the standard in the beaker and add 10 ml of TISAB III for the Calibration standard.)
2. Using a graduated cylinder, transfer 50 ml of the 10ppm standard into a 150 ml beaker. Add 50 ml of TISAB II. Add a magnetic stir bar to the beaker and cover the beaker with a watch glass. (If TISAB III is used, measure 90 ml of the standard in the beaker and add 10 ml of TISAB III for the Calibration standard.)

Sample Preparation:

1. Store about 1 liter of fresh water just prior to the analysis into a plastic beaker to maintain the consistency of the fluoride content in that particular “batch” of water.
2. Using a graduated cylinder, measure 50 ml of the sample into a 150 ml beaker. Add 50 ml of TISAB II. Add a magnetic stir bar to the beaker and cover the beaker with a watch glass. (If TISAB III is used, measure 90 ml of the sample in the beaker and add 10 ml of TISAB III for the sample measurement.)
3. Repeat this procedure three to five times to obtain five readings of the same for consistent results.

Analysis:

For instruments with direct concentration readout capability, consult meter manual for correct direct measurement procedures. Brief procedures for all meter types are found in the section How Ion-Selective Electrode Measurements are made.
1. Allow all the standards and the samples to attain room temperature for precise measurements since the electrodes are temperature sensitive.
2. Calibrate the meter using prepared standards, stirring the standards at a uniform rate.
3. Rinse electrodes with distilled or deionized water between measurements. Shake after rinsing to prevent solution carry-over. Do not wipe or rub the sensing element.
4. Measure samples, stirring at the same uniform rate used for calibrating the standards, and rinsing electrodes in distilled or deionized water between measurements.

### Results:

<table>
<thead>
<tr>
<th>SAMPLE NUMBER</th>
<th>CONCENTRATION (TISAB-II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample # 1</td>
<td>0.93</td>
</tr>
<tr>
<td>Sample # 2</td>
<td>0.94</td>
</tr>
<tr>
<td>Sample # 3</td>
<td>0.93</td>
</tr>
<tr>
<td>Sample # 4</td>
<td>0.95</td>
</tr>
<tr>
<td>Sample # 5</td>
<td>0.94</td>
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<tr>
<td>Mean</td>
<td>0.9380</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.0084</td>
</tr>
<tr>
<td>%CV</td>
<td>0.8920</td>
</tr>
</tbody>
</table>

### Storage:

For brief storage periods between sample measurements, store the electrode in least fluoride concentration standard. The solution in the Fluoride Combination Electrode should not be allowed to evaporate, causing crystallization. For longer storage periods, refer to the electrode instruction manuals. Fluoride electrodes, whose response may become sluggish with time, can often be restored to working order by brushing the sensing element on the flat tip of the electrode with fluoride toothpaste and a soft brush.

### References: