SEAL Analytical

Thomas Cain
A SEAL ANALYTICAL BRAND

PULSE
INSTRUMENTATION

FLARED TUBING
FLARED END PERISTALTIC PUMP TUBING

World Leader in Sample Preparation, Segmented Flow and Discrete Analyzer Technology

Colorimetric Determination of Anions on Discrete and Segmented Flow Analyzers

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Methods

- Chloride
- Sulfate
- Phenol
- Ortho-Phosphate

Topics

- Method Principle
- Reagents
- Interferences
- Hardware Requirements
- Additional Considerations

Chloride

Chloride

Method Principle

- Color Reagent
  - Contains Mercuric Thiocyanate and Ferric Nitrate
- Chloride
  - Displaces Thiocyanate in Mercuric Thiocyanate
- Free Thiocyanate Reacts with Ferric Ion Present
  - Forms Colored Ferric Thiocyanate Complex

Chloride

Reagents

- Combined Chloride Color Reagent
  - One Reagent Test
  - Stable Prepared Reagent
  - Store in Amber Bottle at Room Temperature
  - Prepare or Purchase

Chloride

Reagents

- Prepared Chloride Color Reagent
  - Requires Two Stock Solutions
  - Easy to Prepare

- Purchased Chloride Color Reagent
  - Removes Risk During Preparation
  - Filter Prior to Use

Chloride

Interferences

- Color and Turbidity
  - Filter Prior to Analysis
  - Software Blanking Feature
- Sulfite and Thiosulfate
  - Reducing Agents
- Bromide and Iodide
  - Positive Interference

Chloride

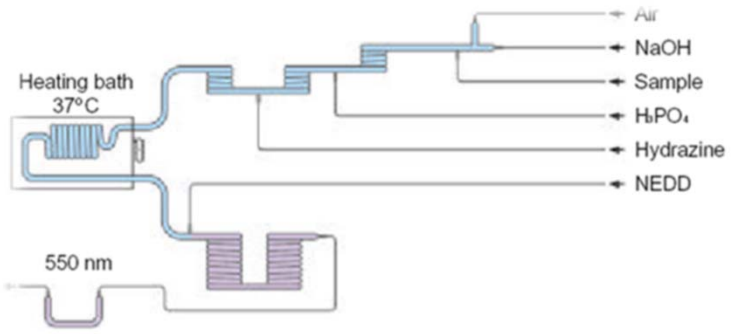
Hardware Requirements

- Discrete or Segmented Flow Analyzer
  - 480 nm Filter Required
- No Heating Bath Required
- Color Reagent Stored at Room Temperature
  - Reagent Chiller Off

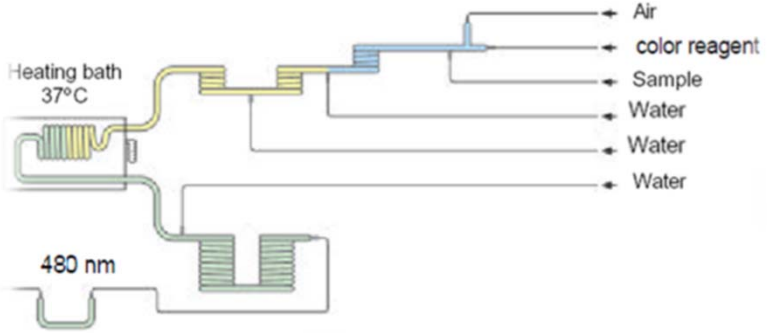
Chloride

Hardware Requirements

- Discrete Analyzer
  - Method Added in Software



- Segmented Flow Analyzer
  - Multi-Test Manifold



Chloride

Additional Considerations

- Waste Disposal
  - Hazardous Waste
    - Isolate Photometer Waste on Flow Analyz
  - Minimal on Discrete Analyzer
    - Isolate Cuvette Waste
  - Waste Treatment
    - Minimize Disposal Cost

Sulfate - Colorimetric

Sulfate - Colorimetric

Method Principle

- Color Reagent
  - Barium Chloride + Methylthymol Blue → Blue Complex
- Sulfate Displaces Methylthymol Blue to Form Barium Sulfate
  - Blue Color Diminishes
- Excess Methylthymol Blue Forms Grey Color
  - Equivalent to Sulfate Concentration

Sulfate - Colorimetric

Reagents

- Barium Chloride Solution
  - Easy to Prepare
- Color Reagent
  - Prepare Day Prior to Use
  - Store in Amber Bottle
  - Store in Refrigerator

Sulfate - Colorimetric

Reagents

- Sodium Hydroxide Solution
  - Easy to Prepare
  - Stable as Prepared

- EDTA Buffer
  - Recommended System Wash Solution
  - Stable as Prepared

Sulfate - Colorimetric

Interferences

- Cations
  - Ion-Exchange Column Included in Method
- Acidic Samples
  - Release Cations in Column
- Color and Turbidity
  - Filter Prior to Analysis

Sulfate - Colorimetric

Hardware Requirements

- Segmented Flow Analyzer
  - 460 nm Filter
- No Heat Bath Required
- Ion Exchange Column
  - Preparation Considerations
    - Ion Exchange Resin
    - Avoid Air Entering Column

Sulfate - Turbidimetric

Sulfate - Turbidimetric

Method Principle

- Barium Chloride
  - Sulfate + Barium Chloride → Barium Sulfate
- Barium Sulfate Suspension
  - Sodium Chloride + Stabilizer
- Turbidity Measured at 420 nm

Sulfate - Turbidimetric

Reagents

- Barium Chloride Crystals
  - Dry Chemical
  - Prepared Reagent

- Conditioning Reagent
  - Hydrochloric Acid
  - Ethanol or Isopropanol
  - Stabilizer

Sulfate - Turbidimetric

Interferences

- Color and Turbidity
  - Filter Prior to Analysis
- Chloride
- Silica and Polyphosphates
- Aluminum

Sulfate - Turbidimetric

Hardware Requirements

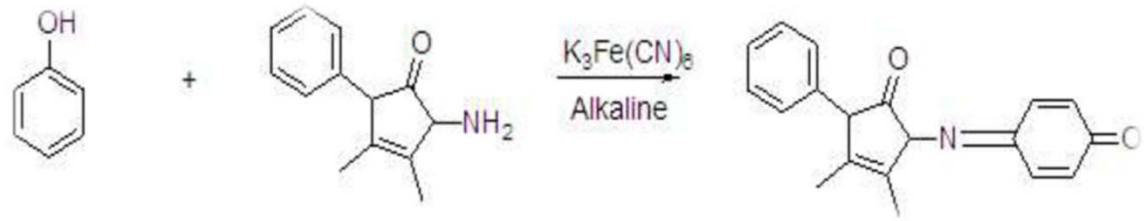
- Discrete Analyzer
- Hold Reagents at Room Temperature
- Software Capability

Phenol

Phenol

Method Principle

- 4-Aminoantipyrine
- Potassium Ferricyanide
  - Alkaline Conditions



Phenol

Reagents

- 4-Aminoantipyrine
  - Remake Daily
  - Dry Chemical White in Appearance
  - Prepared Solution is Colorless
  - Store in a Glass Container

Phenol

Reagents

- Potassium Ferricyanide
  - Remake Weekly
  - pH Requirements
  - Store in the Refrigerator
  - Store in a Dark Container
  - Store in a Glass Container

Phenol

Interferences

- Sulfur Compounds
  - pH Sample < 4
  - Aerate Sample
- Oxidizing Agents
  - Negative Interference
  - Ferrous Ammonium Sulfate
- Background Contamination
  - Store Reagents and Standards in Glass

Phenol

Hardware Requirements

- Discrete Analyzer
  - Method Added in Software
  - Distillation Required

- Segmented Flow Analyzer
  - Multi-Test Manifold
  - 505 or 520 nm Filter
  - Distillation Required

Ortho-Phosphate

Ortho-Phosphate

Method Principle

- Ammonium Molybdate
  - Orthophosphate + Molybdate → Phosphomolybdic Acid
- Antimony Potassium Tartrate
  - Catalyst for Phosphomolybdic Acid
- Ascorbic Acid
  - Phosphomolybdic Acid + Ascorbic Acid → Blue Phosphomolybdic Complex

Ortho-Phosphate

Reagents

- Ammonium Molybdate
  - Remake Monthly
  - Stored in Plastic Bottle
  - Store in the Refrigerator
  - Prone to Precipitate and Turbidity
  - Dry Chemical White in Appearance

Ortho-Phosphate

Reagents

- Sulfuric Acid
  - Stored Indefinitely at Room Temperature
  - Cool Prior to Final Dilution

- Antimony Potassium Tartrate
  - Remake Monthly for Best Results
  - Stored in Glass Container
  - Store in the Refrigerator

Ortho-Phosphate

Reagents

- Prepared Color Reagent
  - Add Reagents in Specific Order
    - Sulfuric Acid
    - Antimony Potassium Tartrate
    - Ammonium Molybdate
  - 1 – 3 Week Stability
  - Store in Refrigerator in Plastic Bottle
  - 4 Hour Stability if Ascorbic Acid Added

Ortho-Phosphate

Reagents

- Ascorbic Acid Reagent
  - Stable 1 Week
  - Prepare Daily for Best Results
  - Discard if Yellow
  - Expired Reagent Concerns

Ortho-Phosphate

Interferences

- Nitrite and Hexavalent Chromium
  - Low Concentration Readings
- Arsenate
  - Positive Interference
  - Similar Colorimetric Reaction
- Salt Concentrations
  - Less Than 1% Error for Salt Concentrations up to 20%(w/v)

Ortho-Phosphate

Interferences

- Iron, Copper, and Silica
  - High Silica Concentrations May Cause Positive Interference
  - 50 mg Fe^{3+}/L, 10 mg Cu/L and 10 mg SiO_2/L Tolerated
  - High Iron Concentrations May Cause Precipitation of Phosphorous

- Turbidity
  - Filtration if Applicable

Ortho-Phosphate

Hardware Requirements

- Discrete Analyzer
  - Method Added in Software
- Segmented Flow Analyzer
  - Multi-Test Manifold
  - 880 or 660 nm Filter

Additional Methods

Anions

- Bromide
- Fluoride
- Nitrite
- Sulfide
- Cyanide
- Iodide
- Nitrate + Nitrite
  - Vanadium Reduction
  - Cadmium Reduction
  - Hydrazine Reduction
  - Enzymatic Reduction

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