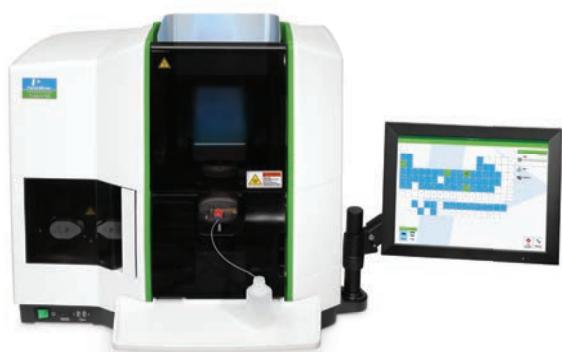


HUMAN HEALTH

ENVIRONMENTAL HEALTH



IMPROVES BOTH  
WORKFLOWS  
& CASHFLOWS



### PinAAcle 500

Flame Atomic Absorption Spectrometer



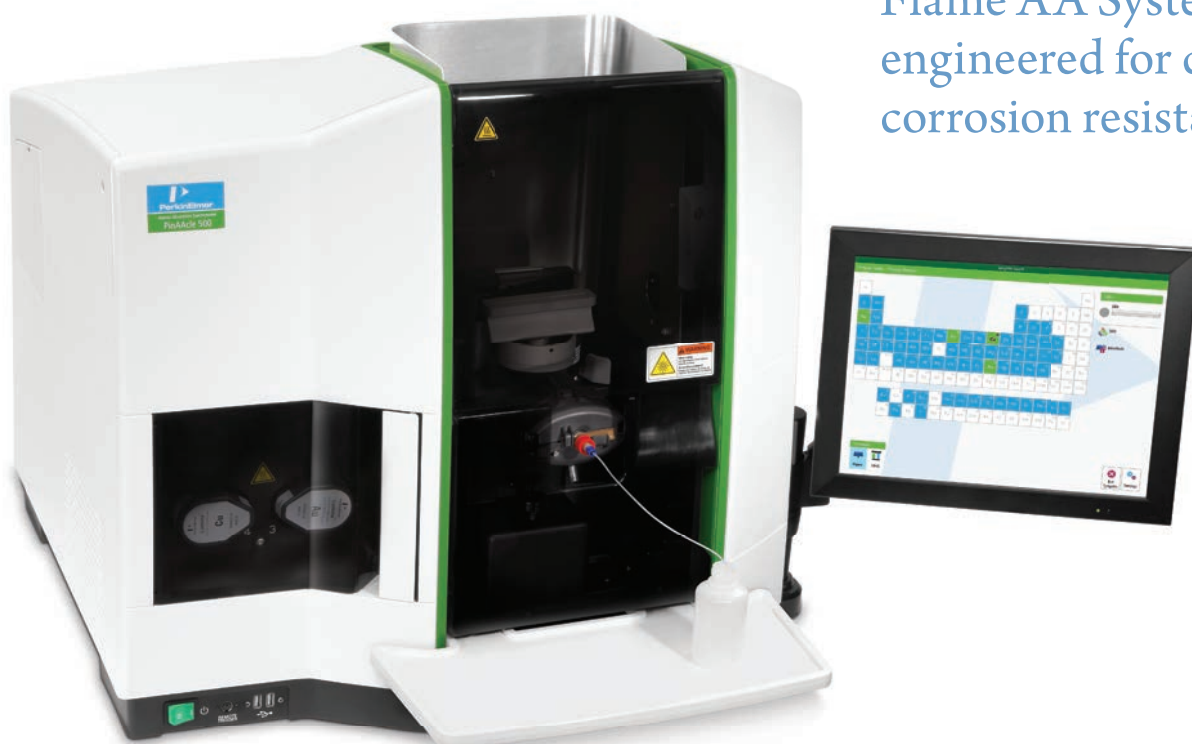
# RELIABILITY SENSITIVITY AFFORDABILITY

Engineered to deliver an uncompromising level of performance at an unbeatable price, the PinAAcle™ 500 puts the industry's most robust, reliable Flame AA within reach of even the most budget-conscious laboratories.

The PinAAcle 500 offers superior durability, longer life, lower maintenance costs, and the fastest return on investment of any Flame AA.

Discover an instrument engineered to outlast and outperform. And take your laboratory to a new PinAAcle of productivity and profitability.

The world's first  
Flame AA System  
engineered for complete  
corrosion resistance.



# DESIGNED FOR...

## EXCEPTIONAL SENSITIVITY AND PRECISION

- Analyze lower concentrations with the accuracy of higher-end AA systems
- Achieve precision of less than 0.3%, consistently better than competitive instruments
- Increase throughput without sacrificing accuracy or precision with an optional FAST Flame sample automation system

## FAST, SIMPLE, REPRODUCIBLE OPERATION

- Speed through every analysis with the intuitive, icon-based interface of Syngistix Touch™ or Syngistix™ for AA Software
- Minimize downtime with the quick-change, modular sample introduction system
- Proven precision with a FAST Flame-enabled system, providing high accuracy and reproducible results

# PINAACLE 500 FLAME AA

## THE HARSHTEST ENVIRONMENTS AND CORROSIVE SAMPLES

- Enjoy the confidence and sample flexibility of working with the world's first Flame AA System engineered for complete corrosion resistance
- Discover the new benchmark for durability and reliability
- Peace of mind with fast return on investment

## MINIMUM MAINTENANCE AND MAXIMUM SPEED

- Reduce operating costs with a rugged design that virtually eliminates maintenance
- Boost profitability with the lowest cost-per-element Flame AA analysis using a FAST Flame-enhanced system
- Optimize your investment with a longer-lasting, corrosion-resistant platform

COMPLETE  
CORROSION RESISTANCE  
**TOTAL**  
PEACE OF MIND



Harsh environments and corrosive samples have finally met their match in a Flame AA. Run your PinAAcle 500 with complete confidence knowing that every circuit board is conformal coated for unparalleled durability, corrosion resistance, and long life.

Isn't it time for a tool that works with everything in your lab while working within your budget?





# ENGINEERED TO PERFORM BUILT TO LAST

## Real-time, true double-beam optics

- High light throughput for best detection limits available
- Fully contained, maintenance-free fiber optic technology
- Automatically adjusts to changes in lamp intensity for stable baselines and compensates for drift multiple times per second
- Fast start-up and exceptional long-term stability without recalibration

## Solid-state detector

- Accurately measures even the most difficult elements (including arsenic and barium)
- Excellent signal-to-noise ratios
- No need for expensive photomultiplier tubes

## Syngistix Touch software

- Quickly and easily save and share all methods and results
- Large, easy-to-use, full-color touchscreen
- Flexibility to mount touchscreen on either side of instrument

## Corrosion-resistant design

- Industry's most completely corrosion-resistant system featuring:
  - Conformal-coated circuit boards
  - Polymer-coated flame shield
  - Polymeric sample introduction module

## Small footprint

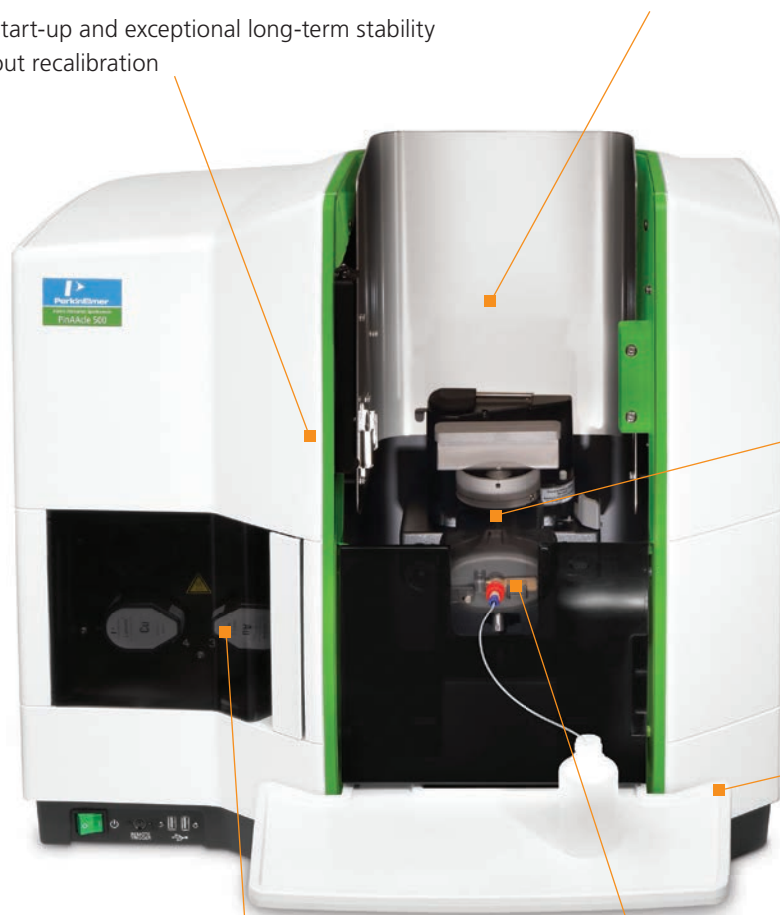
- 26" (w) x 25" (d) x 25" (h)
- Saves valuable bench space
- Upgradable on-board computer

## Genuine PerkinElmer lamps

- Coded 2-inch Lumina™ cableless Hollow Cathode Lamps (HCLs) provide exceptional performance and stability
- Electrodeless Discharge Lamps (EDLs) ensure improved sensitivity and extended lamp life

## Quick-change modular sample introduction

- Simplifies routine maintenance/cleaning
- Corrosion-resistant, durable design



# SOFTWARE OPTIONS THAT LET YOU WORK THE WAY YOU WANT



Depending on the needs of your laboratory, the PinAAcle 500 can be run using your choice of Syngistix software options. Whether you select the innovative and easy-to-use Syngistix Touch or the more comprehensive Syngistix for AA package, you'll enjoy a full suite of powerful tools and a remarkably simple user experience.

- Intuitive software interface features a left-to-right, icon-based design that mirrors your workflow
- Go from setup to analysis in just three clicks
- World's first cross-platform atomic spectroscopy software offers a simpler, more efficient user experience across AA, ICP and ICP-MS instruments

PLATFORM	Syngistix Touch	Syngistix for AA Software
<b>OVERVIEW</b>	<p>Speed and simplify every step from setup and method development to sample analysis and report generation:</p> <ul style="list-style-type: none"> <li>• Easy-to-use touchscreen interface</li> <li>• On-board PC allows all methods and results to be saved</li> <li>• Multi-language capability</li> <li>• Built-in cookbook with recommended conditions for each element</li> </ul>	<ul style="list-style-type: none"> <li>• Easy creation and storage of new methods</li> <li>• Simple entering of sample ID and dilution factors</li> <li>• System monitoring for real-time instrument status and enhanced safety</li> <li>• Output results on any printer</li> </ul>
<b>KEY BENEFIT</b>	Fingertip control for fast, easy setup and analysis	Powerful, feature-rich platform capable of adapting to the unique needs of a specific laboratory, application or user
<b>IDEAL FOR</b>	Laboratories working with limited sample types looking for a fast, simple, highly efficient interface and operating system	Laboratories requiring a robust, flexible, comprehensive package capable of adapting to any application

# TAILOR YOUR SYSTEM FOR THE PERFECT FIT



Optimizing the performance of your PinAAcle 500 Flame AA spectrometer is as easy as customizing it to your specific needs. And there's no better way to do that than with the following array of specialized accessories and consumables.

## Sample Automation Solutions

### FAST Flame Sample Automation Platform

- Eliminates the variability of manual sample preparation for more accurate and precise results
- Enhances the speed, consistency and precision of daily workflows
- Delivers the lowest cost-per-element analysis on the market
- Offers a fast, automated, error-free way to:
  - Prepare calibration standards
  - Dilute over-range sample solutions
  - Add chemicals and other flame sampling needs

### AutoPrep 50 Automatic Dilution System

- Precise, intelligent online dilution for faster, more accurate analyses
- Provides fully automated sample introduction when paired with a PerkinElmer autosampler
- Lower-cost automation solution

### S10 Autosampler

- Creates an efficient, flexible, fully-automated analytical workstation
- Rugged design and corrosion-resistant components ensure long-term reliability and reproducible, precise results

## Additional Sample Preparation Solutions

### Flow Injection for Atomic Spectroscopy (FIAS)

- Automates and accelerates the measurement of mercury and hydride-generating elements with exceptional detection limits

### PerkinElmer Sample Preparation Blocks (SPB)

- Ensure reliable, reproducible results for any digestion/heating method requiring a temperature below 180 °C fully controlled by the user

### Titan MPS™ Microwave Sample Preparation System

- Complete control of real-time temperature and pressure for the mineralization of a broad range of sample types
- Choice of contaminant-free rotors and vessels for specific digestion needs
- Saves time and aggravation with easy loading and simple operation

## PerkinElmer AA Consumables

Our complete portfolio of consumables, parts, supplies, training and service helps you meet both routine and demanding measurement challenges. We invest heavily in testing and validating our products to ensure you receive guaranteed compatibility and performance. For a complete listing of PinAAcle consumables, please visit [www.perkinelmer.com/AAsupplies](http://www.perkinelmer.com/AAsupplies)



Discover the new PinAAcle of performance in Flame AA and take your laboratory to a whole new level of productivity and profitability.

See what the PinAAcle 500 can do for you at [www.perkinelmer.com/PinAAcle500](http://www.perkinelmer.com/PinAAcle500)

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## Atomic Absorption

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# Analysis of Minerals in Drinking Water with the PinAAcle 500 Atomic Absorption Spectrometer

### Introduction

With water quality varying widely with geography and geology, as well as pollution considerations, it is important to know the metal content of waters, both for consumption and industrial use. Although a variety of techniques can measure minerals in water, one of the simplest, least

expensive, and fastest is flame atomic absorption (AA) spectrometry. As a result, the technique continues to enjoy widespread use, despite the increasing popularity of ICP-OES and ICP-MS.

This work focuses on the determination of seven non-toxic elements usually found in drinking waters with the PerkinElmer PinAAcle™ 500 flame atomic absorption spectrometer. Although other lower-level elements can also be measured by flame AA, these are most commonly analyzed by either graphite furnace AA, ICP-OES, or ICP-MS.

## Experimental

Samples consisted of municipal and well waters collected locally, spring waters purchased from a local grocery store, and a certified drinking water standard (Trace Metals in Drinking Water – High-Purity Standards™, Charleston, South Carolina, USA). Sample preparation consisted only of acidifying each water with 1% HNO<sub>3</sub> (v/v) and adding 0.1% lanthanum chloride as a releasing reagent for calcium (Ca) and magnesium (Mg) and as an ionization suppressant for sodium (Na) and potassium (K).

All analyses were carried out with the PinAAcle 500 flame AA spectrometer using the conditions in Tables 1 and 2. Due to the high mineral content, the burner was rotated 30 degrees to decrease the signal intensity for the analysis of the minerals. In addition, K and Na were analyzed in emission mode, which allowed the PinAAcle 500 to be auto-configured in such a way to extend the analytical range so that even higher concentrations could be measured. This allowed minimal dilution for K and elimination of dilution for Na.

Samples were introduced via self-aspiration with a high-sensitivity nebulizer, which is standard on the PinAAcle 500 spectrometer. The nebulizer was used without the spacer (providing maximum sensitivity) for the determinations of copper (Cu), iron (Fe), and zinc (Zn). The spacer was inserted for the determinations of Na, K, Mg and Ca.

Table 1. PinAAcle 500 instrument and analytical conditions common to all elements.

Parameter	Value
Air Flow (L/min)	2.5
Acetylene Flow (L/min)	10
Read Time (sec)	3
Replicates	3

Table 2. PinAAcle 500 instrument and analytical conditions specific to each element.

Element	Wavelength (nm)	Slit (nm)	Mode	Burner Angle (degrees)	Calibration Standards (mg/L)	Calibration Curve
Ca	422.67	0.7	Absorption	30	0.5, 1.0, 2.0, 5.0, 10, 20, 40	Non-Linear through Zero
Cu	324.75	0.7	Absorption	0	0.05, 0.10, 0.25, 0.50	Linear Through Zero
Fe	248.33	0.2	Absorption	0	0.05, 0.10, 0.25, 0.50, 1.0	Linear Through Zero
Mg	285.21	0.7	Absorption	30	0.5, 1.0, 2.0, 5.0, 10	Non-Linear Through Zero
K	766.49	0.7	Emission	30	2, 5, 10, 20, 30, 40, 50	Non-Linear Through Zero
Na	589.00	0.2	Emission	30	2, 5, 10, 20, 30, 40, 50	Non-Linear Through Zero
Zn	213.86	0.7	Absorption	0	0.05, 0.10, 0.25, 0.50	Linear Through Zero

## Results and Discussion

All calibrations yielded correlation coefficients of 0.999 or greater. The accuracy of the calibrations was assessed with an independent calibration verification (ICV) solution, which was diluted 100 times to fall within the range of the calibration curve. The results of the ICV appear in Table 3 and demonstrate the accuracy of the calibration curves.

Table 3. Results for independent calibration verification (ICV).

Element	Concentration (mg/L)	Experimental (mg/L)	% Recovery
Ca	5.00	4.86	97
Cu	0.25	0.26	104
Fe	1.00	1.00	100
Mg	5.00	4.88	98
K	5.00	4.78	96
Na	5.00	5.12	102
Zn	0.20	0.21	105

To validate the methodology, a reference material was first analyzed, with the results shown in Table 4. All recoveries are within 10% of the certified value, demonstrating the accuracy of the methodology.

Table 4. Results for reference material (all units in mg/L).

Element	Experimental (mg/L)	Certified (mg/L)	% Recovery
Ca	33.4	35.0	95
Cu	0.022	0.020	110
Fe	0.095	0.100	95
Mg	8.69	9.00	97
K	2.28	2.50	91
Na	5.90	6.0	98
Zn	0.070	0.070	100

Table 5. Results for samples (all units in mg/L).

Element	Municipal Water (mg/L)	Well Water-1 (mg/L)	Well Water-2 (mg/L)	Well Water-3 (mg/L)	Spring Water-1 (mg/L)	Spring Water-2 (mg/L)
Ca	17.7	0.148	35.3	32.4	3.43	19.2
Cu	0.048	< DL	0.052	0.017	< DL	< DL
Fe	< DL	< DL	0.019	< DL	< DL	< DL
Mg	6.43	0.026	4.90	5.12	0.799	6.09
K	< 0	233*	4.89	4.10	0.73	0.69
Na	38.4	3.63	10.9	42.9	6.60	7.25
Zn	0.008	0.043	0.010	0.023	< DL	< DL

\* Sample required a 10x dilution

With the accuracy of the method established, several drinking water samples from various sources were analyzed. The municipal and well water samples were collected directly from a faucet, while the spring water samples were poured from the bottles in which they were purchased. The results appear in Table 5.

The presence of Cu and Zn in the four samples collected from the faucet is most likely due to leaching from copper pipes, fittings, and solder. Well Water-1 is interesting as it contains the lowest levels of all samples, except for an extraordinarily high level of K. Further investigation determined that this residence has a water softener installed which utilizes K as the counter-ion to remove high levels of Ca and Mg from the well water.

As expected, Cu and Zn are not detected in the spring waters; only the minerals are present. The variation in mineral concentration is indicative of the different geologies of the areas where these waters originate.

Finally, detection limits were determined for Cu, Fe, and Zn as three times the standard deviation of ten blank measurements (i.e. 1% HNO<sub>3</sub>), as shown in Table 6. Because of their elevated levels, detection limits were not determined for the mineral elements (i.e. Ca, K, Mg, Na). In addition, since these elements are usually present at high concentrations, the instrument was detuned for their analysis. Therefore, detection limits would be meaningless.

Table 6. Detection limits.

Element	Detection Limit (mg/L)
Cu	0.002
Fe	0.006
Zn	0.004

## Conclusion

This work has demonstrated the ability of the PinAAcle 500 to successfully measure mineral elements in drinking water samples, including municipal, well, and spring waters. By taking advantage of the ability to rotate the burner and measure in emission mode, both trace and mineral elements could be measured. With Syngistix Touch™ software, the PinAAcle 500 AA spectrometer can be operated exclusively from a touchscreen interface. For greater flexibility, the ability to run Syngistix™ for AA software from an on-board computer is also available. This flexibility makes the PinAAcle 500 flame AA spectrometer an excellent choice for the analysis of drinking waters.

## Consumables Used

Component	Part Number
High Sensitivity Nebulizer	N3160144
Autosampler Tubes	B0193233 (15 mL) B0193234 (50 mL)
Ca Hollow Cathode Lamp	N3050114
Cu Hollow Cathode Lamp	N3050121
Fe Hollow Cathode Lamp	N3050126
Mg Hollow Cathode Lamp	N3050144
Zn Hollow Cathode Lamp	N3050191
Quality Control Standard, 21 Elements	N9300281
Initial Calibration Verification Standard	N9300224
Pure-Grade Ca Standard (1000 mg/L)	N9303763 (125 mL) N9300108 (500 mL)
Pure-Grade K Standard (1000 mg/L)	N9303779 (125 mL) N9300141 (500 mL)
Pure-Grade Mg Standard (1000 mg/L)	N9300179 (125 mL) N9300131 (500 mL)
Pure-Grade Na Standard (1000 mg/L)	N9303785 (125 mL) N9300152 (500 mL)