SampleSense *FAST* UHT-S on the iCAP ICP-OES

11 Elements in 11 Seconds SampleSense *FAST* UHT-S for Thermo Scientific™ iCAP™ 6000/7000 Series ICP-OES

Introduction

Mehlich-3-ICP is a method for determining bioavailable concentrations of 11 extractable micronutrient elements in soil samples. Mehlich-3-ICP is invaluable for determining the amount of fertilizer to apply to farm fields. Because soil analyses must be completed in a narrow time window, ultra-high sample throughtput with high-reliability is required.

SampleSense *FAST* UHT-S* uses an inert injection valve with built-in optical sensors that automatically detect the liquid sample, inject the valve and trigger the ICP read in a tightly-timed analytical sequence. SampleSense *FAST* UHT-S eliminates wasted time from the ICP method and can more than double sample throughput on the iCAP ICP-OES while recording missing or empty tubes.

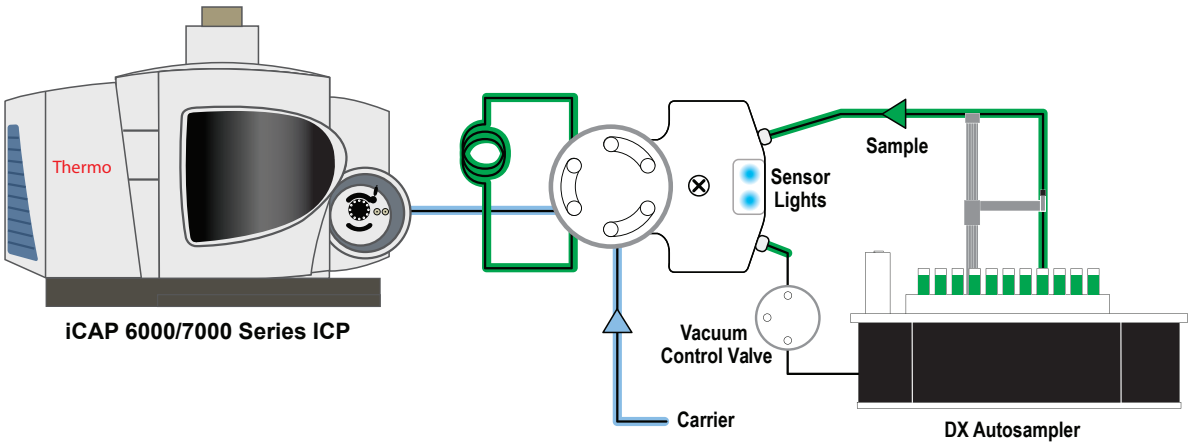
SampleSense *FAST* UHT-S Benefits

- 5+ samples per minute Mehlich-3-ICP
- Automatic sensing, injection, and triggering of the ICP analytical read
- Detection and reporting of missing or empty sample tubes as “unsensed” samples
- Adding SampleSense *FAST* UHT-S can more than double sample throughput

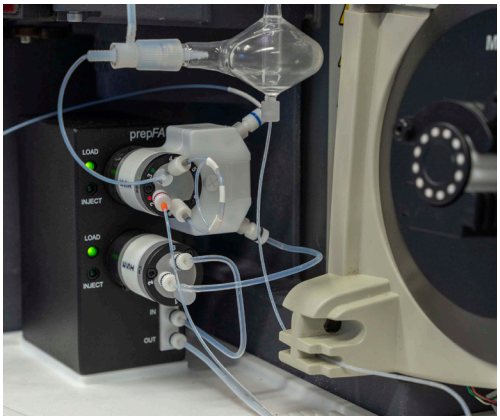
** Formerly SampleSense Soil*

SampleSense *FAST* UHT-S

SampleSense *FAST* UHT-S Flow Diagram

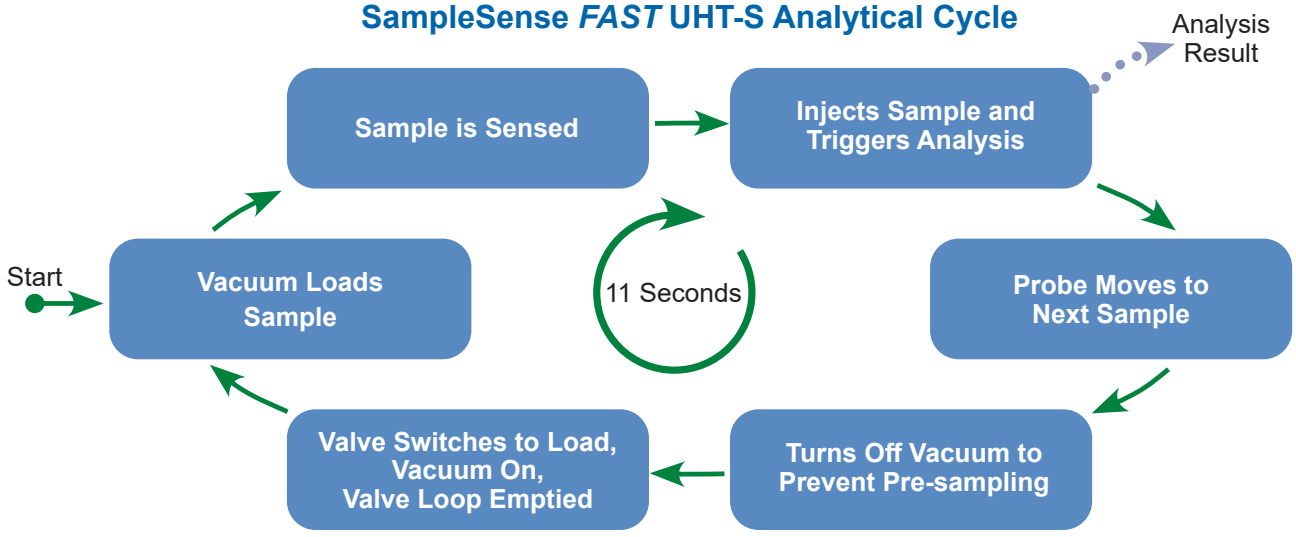


Sample not present, valve sensors not activated



Valve sensors activated, sample is sensed

SampleSense *FAST* UHT-S Analytical Cycle



Experimental

ICP Conditions

- Plasma Gas Flow: 12 L/min
- Aux Gas Flow: 0.5 L/min
- Nebulizer Gas Flow: 0.55 L/min
- Plasma Power: 1150 W
- Plasma Views: Radial and Duo
- Sample Loop Size: 250 µL

Table 1. Wavelengths and Calibration Results. Results displayed are from axial and radial (Duo) plasma view analysis.

Element	Wavelength (nm)	Plasma View	Bottom Std (PPM)	Low Mid Std (PPM)	High Mid Std (PPM)	Top Std (PPM)	Correlation Coefficient (r^2)
S	182.034	Axial	4	10	20	40	0.99989
Zn	206.200	Axial	0.4	1	2	4	0.99798
B	208.959	Axial	0.2	0.5	1	2	0.99808
P	213.618	Axial	8	20	40	80	0.99890
Cu	224.700	Axial	0.8	2	4	8	0.99792
Mn	257.610	Radial	2	5	10	20	0.99915
Fe	259.940	Radial	8	20	40	80	0.99902
Mg	279.806	Radial	24	60	120	240	0.99953
Ca	318.128	Radial	10	25	50	100	0.99972
Na	589.592	Radial	6	15	30	60	0.99913
K	769.896	Radial	40	100	200	400	0.99534

Table 2. SampleSense *FAST* UHT-S iCAP 6000/7000 Method Performance. SampleSense *FAST* UHT-S consumes <2.5 mL of sample pre-analysis. The image on the right shows the remaining 3.5 mL of sample post analysis – the black line indicates the original level of the 6 mL extract. Samples can be reanalyzed without re-extraction.

iCAP 7000 Duo Plasma View	Integration Time (s)	# of Replicates	Sample to Sample Time (s)	Sample Consumption (mL)
Radial Only	1	1	11	<2.5
	1	2	16	<2.5
High Wavelengths Radial and Low Wavelengths Axial	1	1	11	<2.5
	1	2	16	<2.5

Low Sample Consumption

Figure 1. Shows the remaining 3.5 mL of sample post analysis – the black line indicates the original level of the 6 mL extract. Samples can be reanalyzed without re-extraction.

Results

Missing Samples Detected

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Create

Log Messages

Logged at	Level	Message	Time
Line no. 6: Blank		Running 'Blank'	10/3/2019 18:50:17.44
Line no. 7: QC Sample		Running 'QC Sample'	10/3/2019 18:50:32.25
Line no. 8: Empty Tube		Running 'Empty Tube'	10/3/2019 18:50:47.05
Line no. 8: Empty Tube		Missed Sample: 8 - Rack: 3 Vial: 78	10/3/2019 18:50:53.13
Line no. 9: Low Volume Tube		Running 'Low Volume Tube'	10/3/2019 18:51:06.23
Line no. 9: Low Volume Tube		Missed Sample: 9 - Rack: 3 Vial: 79	10/3/2019 18:51:12.29
Line no. 10: Sample 001		Running 'Sample 001'	10/3/2019 18:51:25.41
Line no. 11: Sample 002		Running 'Sample 002'	10/3/2019 18:51:40.18

Figure 2. This view of the Thermo Scientific Qtegra™ Log within the LabBook displays the automatic logging capabilities provided by SampleSense. An empty vial and a low volume sample was placed in positions 78 and 79 within rack 3. SampleSense identified the missed samples that were not successfully loaded and provides this notification.

Rinseout

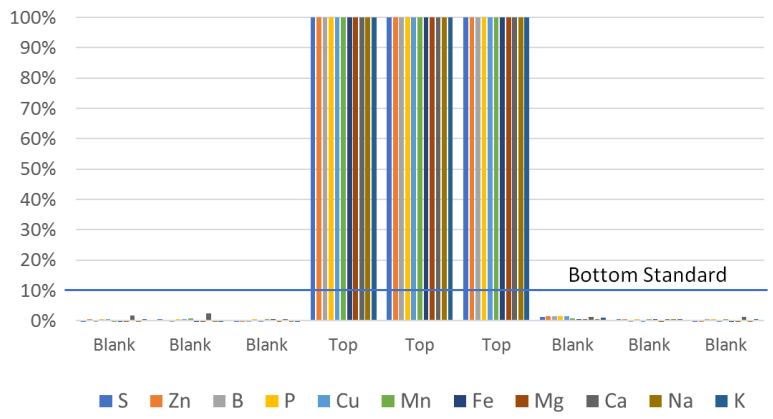

Figure 3. The SampleSense *FAST* UHT-S rinse-out immediately reduces all elements to concentrations well below the bottom standard when using the eleven second Mehlich-3-ICP procedure. Additional seconds can be added to the rinse-out to meet laboratory requirements. The system can deliver rinse-out factors of 1000x, 10,000x or more depending on how clear the spray chamber needs to be before the next sample is introduced.

Conclusion

At over 5+ samples per minute, SampleSense *FAST* UHT-S for Mehlich-3-ICP method can more than double the productivity of the ICP instrument. It delivers reliable and reproducible data, while providing quick and effective sample rinse out.

Description	iCAP Part Numbers
SampleSense *FAST* UHT-S 2DX	2F-SS6-UHT-88
SampleSense *FAST* UHT-S 4DX	4F-SS6-UHT-88
SampleSense *FAST* UHT-S 8DX	8F-SS6-UHT-88
SampleSense *FAST* UHT-S 14DX	14F-SS6-UHT-88

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