APPLICATION NOTE

MultiTek® Sulfur Analysis of Fertilizers by UVF Detection

- **Fully Automated Combustion System**
- **Rapid and Accurate Determination of Sulfur**
- **Sample Versatility**

Keywords:
MultiTek HS, fertilizers , ammonium thiosulfate, ATS, ammonium sulfate, ultra-violet fluorescence (UVF), sulfur

INTRODUCTION

Ammonium thiosulfate (ATS) and ammonium sulfate solutions are frequently used for source of sulfur in fluid fertilizer. Sulfur in fertilizer helps plants absorb nitrogen, which improves the quality of the fruit or vegetable produced by the plant. Sulfur deficient plants result in uniform yellowing of the plant and delayed growth rate. In addition to plant health, these compounds are particularly beneficial to alkaline soil due to its pH lowering properties.

The MultiTek can reliably detect ppb-percent level sulfur in fertilizers using combustion or ultra-violet fluorescence (UVF) detection. This application note focuses on percent level concentration.

REACTIONS

- **Sulfur Reaction by UVF**

$$SO_2 + hv' \longrightarrow SO_2^* \longrightarrow SO_2 + hv''$$

The oxidation products after combustion include CO_2, H_2O, NO, SO_2, and various other oxides. The SO_2 is exposed to ultraviolet radiation of a specific wavelength. This radiation is released in the form of sulfur fluorescence. This fluorescence is detected by a photomultiplier tube and is proportional to the amount of sulfur in the original sample.

EXPERIMENTAL CONDITIONS

- **Instrumentation**

Antek MultiTek HS
748 Autosampler
740 Multi-Matrix
735 Syringe Drive

- **Instrument Parameters**

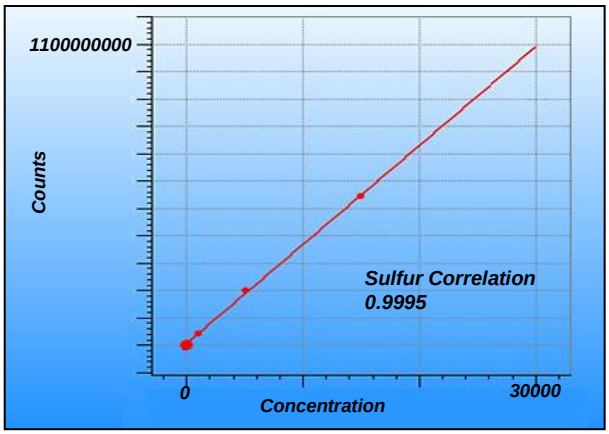
Injection volume (µL)	5
PMT Voltage (V)	400
GFC1- Ar/He (mL/min)	130
GFC2- Pyro O_2 (mL/min)	450
GFC4- Carrier O_2 (mL/min)	30
Furnace (ºC)	1050

- **Calibration (0 / 0.1% / 0.5% / 1.5% S)**

Dimethyl sulfoxide (DMSO) is used for sulfur source and diluted with pure 18.2 MΩ deionized water. The calibration range based on areas expected after 1:20 sample dilution.

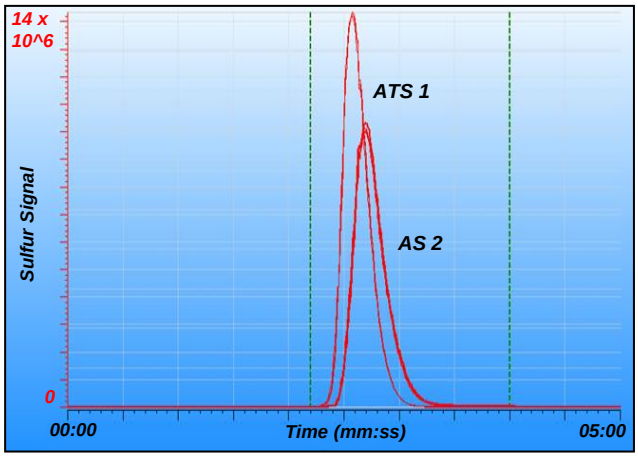
APPLICATION NOTE

CALIBRATION



S-concentration	S-area counts
0ppm	976598
1,000ppm	42347282
5,000ppm	200105158
15,000ppm	545843092

PEAK ANALYSIS



3 replicates of ATS 1 and AS 2

RESULTS

	Counts	Sulfur (%)	% RSD
ATS 1 (AVG)	**478999918**	**26.08**	**0.06**
Injection 1	479028056	26.08	
Injection 2	479277949	26.10	
Injection 3	478693748	26.07	
ATS 2 (AVG)	**485038642**	**26.42**	**0.23**
Injection 1	486149714	26.48	
Injection 2	485089572	26.42	
Injection 3	483876641	26.36	
AS 1 (AVG)	**397514223**	**21.58**	**0.11**
Injection 1	397804015	21.59	
Injection 2	397011211	21.55	
Injection 3	397727442	21.59	
AS 2 (AVG)	**402025368**	**21.83**	**0.11**
Injection 1	401548472	21.80	
Injection 2	402310411	21.84	
Injection 3	402217221	21.84	

Repeatability of three sample injections. PMT voltage has been reduced to 400V to help see high percent level sulfur without detector saturation.

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CONCLUSION

The results demonstrate that the MultiTek Analyzer provides an entirely automated and reliable sulfur analysis in fertilizers containing ammonium sulfate and ammonium thiosulfate.

Anteks MultiTek® is the only instrument on the market that combines testing sulfur, nitrogen, and halides all in one. Compact, powerful, automated, and multi-configurable, it's the perfect solution to today's increasing demand worldwide for fast, accurate detection and the analysis of unwanted chemicals, pollutants, contaminants, and corrosive elements. Because MultiTek® delivers precise results with high sensitivity and unmatched versatility, it's a valuable process optimization tool that will deliver faster ROI and a better bottom line.

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