

CASE STUDY: PHOSPHATE ROCK AND PRODUCTS USING TSI® LIBS DESKTOP ANALYZER

APPLICATION NOTE LIBS-006

Introduction

Phosphate rock is the fundamental ingredient of phosphate fertilizers used in agriculture. Many soil types are inherently phosphorus-deficient, thus there is a constant demand from the agricultural sector for phosphate fertilizers.

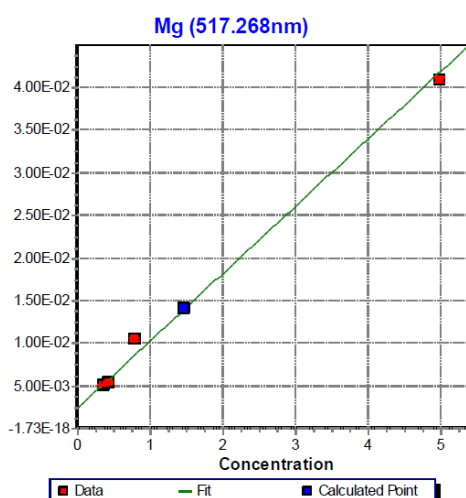
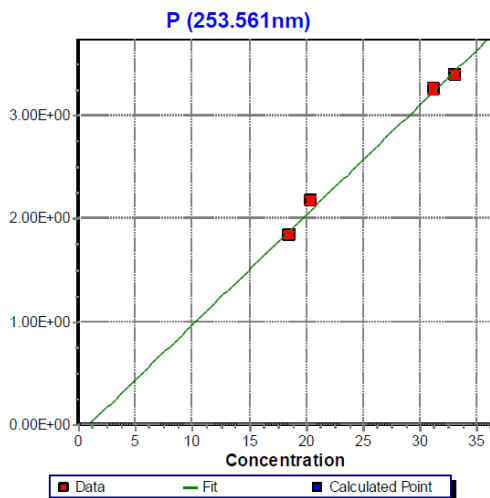
Although 90% of mined phosphate rock is used to produce fertilizers, other end uses include food preservatives, animal feed supplements, anti-corrosion agents, fungicides, cosmetics, and ceramics.

With its extensive elemental range and rapid analysis times, the TSI® LIBS Desktop Analyzer is a useful tool in the analysis of phosphate rock and fertilizer products.

At the Mine

Elemental analysis of phosphate rock during mining includes analysis of both major (P, Ca) and minor components such as mineral inclusions SiO_2 , Al_2O_3 , Fe_2O_3 ...

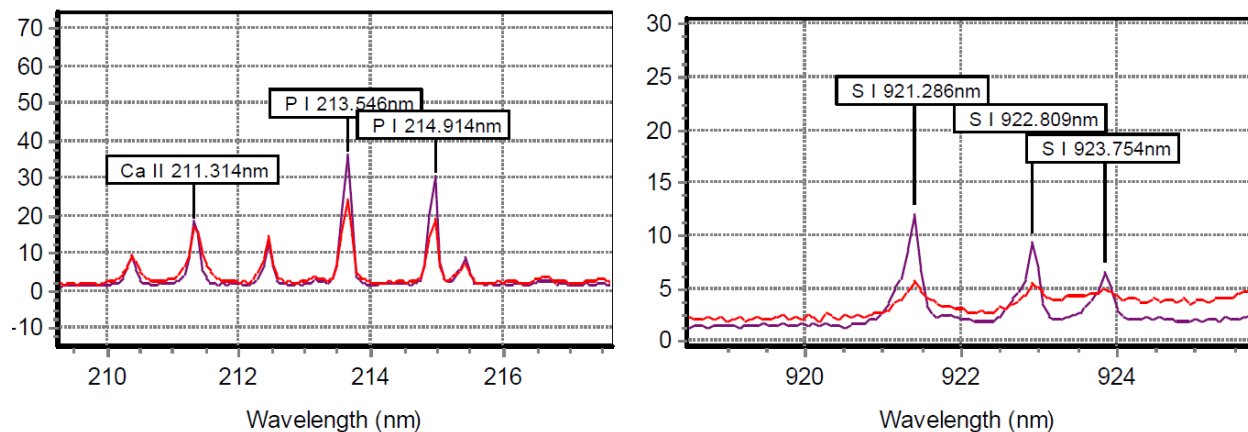
The TSI LIBS Desktop Analyzer's wide spectral coverage enables use of multiple emission lines in any calibration. Virtually all elements fluoresce at multiple emission wavelengths with different emission intensities—i.e. they have multiple strong and weak emission lines—thus calibrations can be constructed at both low and high concentration ranges. Example analyses are shown below for P and Mg in four phosphate rock samples.



Phosphate Products

There are numerous applications in maintaining product quality and integrity via rapid component analysis using the TSI LIBS Desktop Analyzer. Quality control of super-phosphate fertilizer, for example, requires precise measurement of the phosphorous and sulfur contents in the material.

The TSI LIBS Desktop Analyzer in this application can be used with air, or a buffer gas such as argon or helium can be used. In general, halogens and sulfur are more accurately determined using a buffer gas while most metallic elements and their oxides can simply be measured without external services.



Legend

— Air — Helium buffer gas

Spectra of P and S

Repeat analysis using a TSI LIBS Desktop Analyzer shows quite acceptable repeatability and accuracy in direct measurement of sulfur and phosphorous in fertilizers. The analysis time in these measurements is less than 20 seconds offering the user substantial benefits in using the TSI LIBS Desktop Analyzer as a process control and optimization tool.

Measurement	Total P %	SO ₄ %
1	9.80	11.23
2	9.89	10.56
3	9.89	10.59
4	10.01	10.34
5	10.03	10.55
6	9.66	10.51
Average	9.88	10.63
Std. Deviation	0.14	0.31
RSD	1.39	2.88



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