BUCK Scientific

Application Note #AA3011

Evaluation of Mineral Supplements for Content and Purity by Flame / Graphite Furnace AAS

Doctors, dieticians and health officials recommend a balanced diet that provides essential minerals for proper nutrition in the human body. The accurate analysis of metals in vitamin / mineral preparations and food supplements is very important. These metals can be classified into several groups – the major electrolytes (Na, K, Ca, Mg), crucial to normal primary physiological processes like cellular activity and metabolism; the minor minerals (Fe, Mn, Zn, Cu), present in lower levels to act as metabolic agents and enzyme catalysts; and the micro (trace) minerals, in low levels (Se, Cr, Mo), for less defined reactions. There is a need for an analytical tool to quantitate these elements easily and reproducibly. Ferrous gluconate is a source of iron, but can be contaminated with manganese, titanium and vanadium. Dolomite is an excellent source of calcium and magnesium, but is often contaminated with lead and silver. Zinc oxide provides an essential form of easily absorbed zinc, though the amount of cadmium and arsenic found can be a problem.

Examining some of the common over-the-counter and prescription formulations, one can see that the potential contaminants present in some of these higher concentration minerals is as important as the accurate determination of these essential minerals themselves. For this type of low-level analysis in such a complex matrix (high organics and alkali elements), graphite furnace atomic absorption spectroscopy (GFAAS) with deuterium background correction (D2) is one of the few acceptable techniques for error-free determination of trace metals. GFAAS is also the preferred technique for measuring the desired micro-minerals. The electrolyte metals and minor minerals are best done by simple flame AA (FAAS).

Both flame and furnace techniques can suffer from tremendous interferences when low level elements are determined in “dirty” or complex matrices. The alkali elements (Na, K, Mg, Ca) and the refractory metals (Al, Si) can create background effects that will add signficant inaccuracies to an analysis. The presence of organic materials in the sample matrix can cause the formation of smoke particulates in a graphite furnace analysis and cyanogen bands in a flame method; which also contribute to analytical errors. The nature of these interferences can be compensated for by the use of an efficient D2 Background Correction system; and the unique design of the Buck 210VGP AA system provides the maximum energy throughput for maximum sensitivity and accuracy.

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Samples: 1) An enriched Wheat Flour; 2) A Multi-Vitamin & Mineral Capsule; 3) A Dolomitic Limestone [a natural Calcium and Magnesium source]; and 4) A Mineral Supplement Concentrate

Preparation: Dissolve 1gram of sample or 1 capsule in 100ml 5% Nitric Acid.
Filter and dilute to 50ml to make a 1:50 dilution, or a 2% solution to be used for **trace** elements.
Dilute 1ml of this to 100ml for a 1:5,000 sample dilution for the **electrolytes** and **major** metals.

Calibration: Buck Certified standards at 5 ppm [Flame] and 0.1 ppm with modifiers for [Furnace].

Instrument: Buck 210VGP AA with the 220 Graphite Furnace and 420 Hydride accessories as noted.

Conditions: Flame for Na, K, Mg, Ca, Cu, Zn, Fe, Mn
Hydride for Se and As
Furnace for Cr, Mo, Ag, Pb, and Cd
Values are noted as Percent, ppm, or ppb in the **original** sample; or mcg in the capsule.

Element	Wavelength	Detection Limit	Flour	Capsule	Lime	Conc
Sodium	589 nm	0.5 ppm	2,575 ppm	<10 mg	0.83%	255 ppm
Potassium	766	2.0 ppm	4,150 ppm	15 mg	0.24%	810 ppm
Magnesium	285	0.05 ppm	375 ppm	20 mg	9.82%	175 ppm
Calcium	422	1.0 ppm	1,500 ppm	100 mg	17.2%	75 ppm
Copper	324 nm	0.05 ppm	21 ppm	120 mcg	0.09%	550 ppb
Iron	248	0.10 ppm	315 ppm	100 mg	0.35%	1070 ppm
Manganese	257	0.10 ppm	46 ppm	1.5 mg	0.18%	58 ppm
Zinc	214	0.05 ppm	185 ppm	5 mg	1.04%	245 ppm
* Arsenic	194 nm	10 ppb	<10 ppb	<5 mcg	47.5 ppm	<10 ppb
Selenium	196	25 ppb	69 ppb	7.9 mcg	16.3 ppm	78 ppb
Chromium	357 nm	50 ppb	3.8 ppm	12.5 mcg	0.33%	155 ppb
* Lead	283	25 ppb	<25 ppb	<10 mcg	0.29%	<25 ppb
* Silver	328	10 ppb	1.7 ppm	<5 mcg	0.12%	<10 ppb
* Cadmium	228	5.0 ppb	<5 ppb	<2 mcg	665 ppm	<5 ppb
Molybdenum	313	50 ppb	2.4 ppm	9.3 mcg	0.09%	165 ppb

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