Nitrogen accuracy is on the order of 1 or 2%. Phosphorus and potassium usually are determined to about 5 to 10%, depending on the interference levels.

The precision achievable is a function primarily of the number of counts in each band; higher precision can be achieved at the cost of analysis rate, and higher sample throughput rates can be achieved with somewhat degraded precision.

Multielement systems of this type now are a production reality in the Soviet Union. The systems analyze large numbers of grain samples in support of the Soviet agricultural program (2). In addition to analysis, the computer system in the Soviet installation is used for related agricultural tasks, such as massive storage of plant genetic data to enable optimum species selection.

Neutron activation analysis systems of this sophistication are versatile instruments. With minor software modification, calcium analysis probably can be added to the basic six elements. But this analysis may require operation at a lower sample throughput rate.

Operation with short radiation and delay times permits measurement of oxygen and some other elements producing short-lived products, such as sodium.

Similarly, longer times and lower sample throughput rates permit analysis for some longer-lived trace elements. This flexibility adds to the appeal of neutron activation analysis both to agricultural researchers and to the food processing industry.

Neutron detectability using 14-MeV source

Less than 5 μg	10 to 29 μg	30 to 100 μg
Dysprosium	Europium	Cesium
Hafnium	Iodine	Gold
Manganese	Krypton	Holmium
Rhodium		Iridium
Silver		Lutecium
		Rhenium
		Samarium

Prediction of the future is as necessary as it is risky. It is the author's belief that the next decade will witness substantial innovation in the application of neutron activation analysis and in auxiliary equipment. But there will be comparatively little change in the fundamental technology.

A constantly increasing demand for analysis of food and feed materials is inevitable, both for label compliance and for economic reasons. And the analytical requirements will grow more sophisticated.

NAA systems will be used in many installations for reasons of simplicity, economy, and safety. To expedite this goal, even sample preparation is becoming automated. Machines are in development to automate the task of weighing the sample, entering the weight data into the computer, and placing the sample in its carrier for loading.

With a little delay, other industries will follow the food industry. The metals industries will expand their use of NAA for oxygen determination and will add the ability to determine alloying elements. The mineral industry will institute routine NAA assay of ore and process stream samples. Many applications will develop in the chemical industry and related fields.

In each new application, the early installations probably will be flexible, multipurpose systems. As specific industrial applications become popular, the systems will tend to become simpler, dedicated instruments of somewhat lower cost.

Microcomputers with limited peripherals may replace the powerful minicomputers in some special-purpose systems. These innovations will lead to marginal economic improvements, but neutron activation analysis is ready for industrial applications now. ■

References

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