

analytical chemistry

Gathered at the 1968 International Conference on Activation Analysis at Gaithersburg, Md.

PHOTOGRAPHY

Speedier film-emulsion analysis

Industry needs accurate and rapid methods of analyzing components which determine light-sensitive properties of photographic emulsions. In response to this need, National Bureau of Standards scientists have been using activation analysis to develop calibration data for nondestructive measurement of chloride and iodide in these emulsions.

Activation analysis is a way of identifying and measuring small amounts of materials without destroying the sample. Bombarding substances with neutrons, photons or charged particles make them slightly radioactive, and the kind and intensity of radiation reflects the composition of the substance.

In testing emulsions, activation analysis "offers an attractive alternative for the determination of iodide and chloride in silver halide mixtures since it has the potential for providing rapid analyses with reasonably good precision and accuracy," report Eastman Kodak's E. P. Przybylowicz and NBS staff members Gilbert W. Smith, J. E. Suddueth and S.S. Nargolwalla. "With an order of magnitude increase in neutron flux, the method would be unquestionably superior to other instrumental methods for the halides," they say.

FORENSICS

Comparing soil samples

Laboratories engaged in the examination of physical evidence are frequently required to determine whether questioned and known soil specimens come from the same location. Currently, this comparison is carried out by measuring density and microscopic investigation. Considerable physical variation can occur between soils taken only a few feet apart, and samples from the same general location may appear different when examined by these methods.

In most criminal examination it is only necessary to establish that questioned and known soils come from the same localized areas. An activation analysis method for accomplishing this was described by C. M. Hoffman, R. L. Brunelle, K. B. Snow and M. J. Pro of the Alcohol and Tobacco Tax Division of the Internal Revenue Service.

A study was made of the trace element distribution in soils using neutron activation analysis. An evaluation of the data was made to determine the individuality of soils having a particular elemental composition. Using this method soils from different locations can be easily individualized and distinguished.

POLLUTION

Assay of aquatic and terrestrial trace substances

Analytical methods for the determination of trace substances in concentrations of parts per million or less are somewhat limited. Activation analysis is generally con-

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sidered to be a useful method for trace inorganic species in such low concentrations.

In investigations of pollutants by G. W. Leddicotte, Nuclear Engineering and Radiological Sciences Department, University of Missouri at Columbia, neutron activation analysis was used.

Leddicotte assayed samples of water, soil, stream sediments, dusts, vegetation and similar materials from aquatic and terrestrial environments for unusual, as well as common, elements.

COSMOCHEMISTRY

Trace elements in meteorites

Meteoritic research has gained considerable importance in helping to determine the origin of the solar system and the cosmic abundance of the elements.

Dr. Wolfgang Kiesel of the Analytical Institute of the University of Vienna, Austria, is investigating the quantitative determination of about 47 elements in meteorites. About 15 of these elements are determined by wet-chemical means; the assay of the others is performed by activation analysis and mass spectrometry. For isotopes with half-lives exceeding 24 hours, an analytical activation analysis technique has been developed for the quantitative determination of selenium, arsenic, antimony, tin, rhenium, mercury, osmium, ruthenium, zinc, scandium, gold, iridium, indium, molybdenum, cesium and rubidium.

From such studies, Dr. Kiesel says, it may be possible to postulate a high temperature origin for the terrestrial planets and a low temperature formation for the giant planets and the carbonaceous chondrites.

IDENTIFICATION

Murder suspect freed

Neutron activation analysis was used in a recent murder trial to determine if human hairs found in the suspect's car could have come from the head of the murder victim.

Laboratory procedures which made possible the introduction of the evidence in the case were described by H. L. Schlesinger, H. R. Lukens and D. M. Settle of Gulf General Atomic Inc., San Diego, Calif.

Hair samples from the car and from the victim were irradiated in a nuclear reactor for 125 minutes under terms of a court order "requiring that the hairs be physically unaltered by the analytical procedure." Radioactivity measurements identified traces of various elements in the hair—iodine, copper, manganese, zinc, sodium, chlorine and bromine—and comparisons were made. The evidence failed to support a conclusion that even one of the hairs found in the car originated from the victim's head, and the defendant was found not guilty.

This was the first court case in which neutron activation analysis results were successfully introduced by the defense.

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