Australian Standard®

Recommended practice for chemical analysis by ultraviolet/visible spectrophotometry

This Australian Standard was prepared by Committee CH/16, Spectroscopy. It was approved on behalf of the Council of Standards Australia on 13 November 1989 and published on 7 May 1990.

The following interests are represented on Committee CH/16:

Bureau of Steel Manufacturers of Australia
Confederation of Australian Industry
CSIRO, Division of Fuel Technology
CSIRO, Division of Materials Science and Technology
Department of Defence
Government Chemical Laboratories, Qld
National Association of Testing Authorities, Australia

Additional interests participating in the preparation of Standard:

Australian Government Analytical Laboratories
Department of Local Government, Qld
Instrument manufacturer
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PREFACE

This Standard was prepared by the Standards Australia Committee on Spectroscopy under the direction of the Chemical Standards Board to supersede AS CK19—1970, *The chemical analysis of materials by ultraviolet/visible spectrophotometry*.

In the preparation of this Standard, cognizance was taken of the following Standards:

ISO

6286 *Molecular absorption spectrophotometry—Vocabulary—General—Apparatus*

ASTM

E131 *Standard definitions of terms and symbols relating to molecular spectroscopy*

E169 *Recommended practices for general techniques of ultraviolet quantitative analysis*

E275 *Practice for describing and measuring performance of ultraviolet, visible and near infrared spectrophotometers*

E925 *Standard practice for periodic calibration of narrow band-pass spectrophotometers*

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE. This Standard sets out recommendations for instrumentation and operating techniques suitable for chemical analysis of solutions by ultraviolet/visible spectrophotometry, and includes a summary of testing procedures, calibration procedures and requirements for safe operation. Although most sections of this Standard refer to the analysis of solutions, sections on instrumentation and instrument optimization are relevant to instruments used for gas analysis.

1.2 APPLICATION. This Standard is intended to be read in conjunction with the instrument manufacturer's recommendations.

1.3 PRINCIPLE. Ultraviolet/visible spectrophotometry relies upon —

(a) the absorption of radiation by a substance when the frequency of the radiation corresponds to the energy required to raise the substance to a state of higher energy in an allowed electronic transition. Absorption may be highly wavelength specific or may occur over a wider range of frequencies;

(b) the excited state of the substance being unstable and reverting rapidly to the normal state without emission of radiation; and

(c) the amount of energy absorbed being a function of the number of absorbing molecules in the light path (see Appendix B, Bouguer's (Lambert's) Law and Beer's Law).

The technique described in this Standard involves passing radiation of known wavelength through a solution of a sample, and measuring the absorption of energy as a function of radiation transmitted at that wavelength.

1.4 REFERENCED DOCUMENTS. The following document is referred to in this Standard:

AS
2850 Chemical analysis—Interlaboratory test programs—For determining precision of analytical method(s)— Guide to the planning and conduct

1.5 DEFINITIONS. For the purpose of this Standard, the definitions given in Appendix B apply.

1.6 SAFETY PRECAUTIONS.

1.6.1 UV sources. UV sources, such as deuterium lamps, can cause eye damage if observed directly. Where exposure is unavoidable, suitable protective glasses should be worn.

1.6.2. Strong acids. In some cases, analyses may involve the use of strong acids for the development of colour in the sample. A typical example is the determination of boron with carminic acid in a medium of concentrated sulfuric acid. Care should be exercised to avoid skin contact and spillages of acids within the sample cell compartment, and capping of cells is recommended to minimize acid fume damage in the cell compartment.

1.6.3 Flow-through cells. Some instruments are equipped with flow-through cells, which effectively reduce the time required to change sample solutions. Attached to the flow-through cell are flexible plastics connecting hoses, to deliver reagents to, and drain them from the cell. The connecting hoses are susceptible to attack by strong oxidizing agents (e.g. $KMnO_4$, $K_2Cr_2O_7$) and aggressive solvents (e.g. halogenated hydrocarbons, acetone), therefore it is recommended that such reagents not be used in flow-through cells.

1.6.4 Flammable solvents. In view of the possibility of accidental ignition, it is recommended that cells be capped after filling with solutions of materials in flammable solvents.